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AND DEVELOPMENT

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MIGRATION, HUMAN CAPITAL  
AND DEVELOPMENT

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## FOREWORD

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The role of human capital in the process of socio-economic development is one of the most important and sensitive issues facing development planners and policy makers in recent years. It needs no emphasis that for many countries, the availability of human capital in the desired amount and mix, in the right time and place, could be a major constraint in achieving developmental targets. The achievement of such optimal allocation depends on the pattern of private and social investment in health, education, and migration; and on the presence of a social structure that provides an acceptable standard of equity and an efficient labor market.

Particularly timely, therefore, is this collection of studies on migration, human capital and development edited by Professor Oded Stark, Director, Migration and Development Program at Harvard University, who himself has made significant contribution to the conceptual understanding of the process of migration.



We welcome this volume in the Research in Human Capital and Development (RCHD) series. It provides both the empirical depth and conceptual complementarity to previous and future volumes of the series devoted to examining the role of various social issues in the process of human capital formation and development, e.g., the role of equity analyzed in the second volume (1981), manpower planning (supplement, 1982), health (Vol. 3, 1983), and public health (Vol. 5, 1987) and forthcoming issues on education, rural development and food and nutrition.

Ismail A. Sirageldin  
*Series Editor*

## INTRODUCTION: MIGRATION, MARKETS, CLUSTERS AND COOPERATION

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There are obvious dangers in making broad generalizations pertaining to social science phenomena. But the temptation is there and, at times, the cumulative weight of the stylized facts does not help in resisting the temptation. Consider recent migration to the United States. In spite of discernible variance with regard to many variables, several features stand out. First, migrants from a given origin are not randomly or evenly spread across the absorbing economy nor are they all concentrated in one single labor market or location. Migrants tend to form clusters. Second, in comparison with the absorbing population, migrants constitute a relatively small group. Third, recent migrants are assisted by established migrants; there is heavy reliance upon and usage by the

new migrants of "network and kinship capital." Fourth, migrants have traits distinguishing them from members of the economy they join. Quite often this is concurrent with a statistical or economic discrimination against the migrants. Fifth, some time after their arrival at the receiving economy, migrants out-perform the native born. This is manifested when the wage curve of migrants intersects that of the non-migrants—a relation that tends to hold even after allowance is made for the standard controls.

Although with greater or lesser ease each of these stylized facts may be explained separately, no explanation which causally links all of them appears to exist. It might be useful to attempt to sketch the outline of a possible explanation. We begin by explaining the clustering of migrants through an application of a random walk rule in conjunction with scale economies to trade. Suppose that initially migrants choose the labor markets they join randomly. Successive migrants arrive and each chooses a labor market, taking into consideration several factors one of which may be the presence of migrants who have arrived in the preceding period(s). Even if each new migrant were to choose randomly among the labor markets, after several waves of migration, say at time  $t$ , a specific market will likely have more migrants than others. When each of several players repeatedly tosses a die, at some point one player will have scored more odd numbers than the other players even though after many rounds all would score odd numbers exactly the same number of times.

Suppose the concentration of migrants is subject to scale economies which are quite sensitive to changes in the number of migrants when the number of migrants is small. The scale economies (and diseconomies) arise from the trade considerations as explained below. Consequently, from some point in time, a particular market will become more attractive to all subsequent migrants, and clustering will evolve. Suppose that in contrast, the native population which is much larger in numbers is subject to decreasing returns to scale. Then, from some point in time, the migrants may obtain an edge and outperform the natives. To the extent that migrants of an early vintage are aware of the sensitivity of the onslaught of scale economies to the overall number of migrants in their particular location they may well undertake steps to support and induce new migrants to join them. Consequently, the choice of destination by the new migrants is less likely then to be random. This process will not continue if increasing returns at a specific

location prevail no more while they do in another location. The intensity of the pull exerted by that other location will then transform it into the more attractive destination and hence the pattern of clusters. So long as migrants constitute a distinct group from the natives in the sense that there is no cross over between "their" increasing returns and "the natives'" decreasing returns, the explanation as outlined above can account for all five stylized facts.

Scale economies leading to differences in the returns to trade (exchange activities) may arise from differences in the structure of interactions viz., in the manner in which trades are being conducted. This manner, in turn, is largely determined by the likelihood of trades being repeated. This likelihood affects the incentive to invest in reputation and the choice whether to execute trade cooperatively or not. When the number of migrants is very small the likelihood of repeated trades with fellow migrants is low since by necessity many trades will be conducted with members of the host community. When the number of migrants becomes very large, the need for a repeated trade with any given agent or sub-set of agents dwindles and even among migrants trades are conducted in an environment of anonymity. With a negligible likelihood of trades being repeated, tomorrow's reaction by a partner to today's trade will not matter and hence there will be no inducement to undertake steps either to build and sustain reputation or to protect against retaliation. If, however, the number of migrants is neither too small nor too large and the likelihood of repeated trades amongst them is reasonably high, short term gains from non-cooperation will be more than offset by losses from adverse reputational effects and a pattern of cooperative trades could ensue. Variables tending to raise the likelihood of a repeat meeting among migrants, e.g., barriers of various types to trades with outsiders, somewhat paradoxically, may be to the migrants' advantage in inducing a pattern of cooperative trade amongst them which accounts for or contributes to migrants' superior performance. Whereas for a relatively small migrant population being distinct from the absorbing population is cost-free, forming a distinct group might be quite costly for a sub-group of agents of the absorbing population who recognize the advantages associated with cooperative trades. This is so especially because of the incentive for members of the complementary portion of the absorbing population to "raid" the sub-group with non-cooperative trades, hoping not to be recognized for what they are.

Clearly, for an approach of this type to become credible a systematic and formal development of a theory is required; this task will be pursued at a later point in time. But even in its rudimentary form the approach seems to lead to several interesting hypotheses and explanations. By undermining the incentive for cooperative trades, efforts to hasten the integration of migrants into the absorbing economy and render the integration more complete (along with similar acculturation and socialization efforts) may not be in the migrants' best interest. Efforts to disperse migrants across a large number of receiving communities will fail in as much as migrants recognize the advantage associated with regrouping and the formation of optimal size clusters. And new migrants may not necessarily receive the greatest degree of help from an established community of migrants when such a community is large since the advantage accruing to the latter from a marginal increase in its size might be much smaller than the advantage accruing to a smaller community from a similar increase.

The contributors to this volume share several common attributes. First, papers they have prepared neatly fit the above tale. Thus, for example, Taylor's study addresses the utilization of network capital and Chiswick's study deals with the change in the relative performance of migrants over time. Second, all authors have more than a transitory interest in labor migration. Nearly all have written on the subject prior to contributing to this volume and all have continued working on migration issues subsequent to making the current contributions. This provides the papers assembled here with a special depth. Third, authors of papers included in this volume have been associated with the Migration and Development Program at Harvard University either by spending periods of residence here and/or by presenting papers in the Research Seminar on Migration and Development. Finally, all authors share the common attribute of extraordinary patience with the lengthy process of transforming their contributions into volume papers. To them as well as to several colleagues who graciously refereed papers for this volume I am most grateful.

Oded Stark  
*Guest Editor*

# HUMAN CAPITAL AND THE LABOR MARKET ADJUSTMENT OF IMMIGRANTS: TESTING ALTERNATIVE HYPOTHESES

Barry R. Chiswick

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## ABSTRACT

In previous research on the economic adjustment of immigrants, hypotheses were generated based on the degree of the transferability of skill and the self-selection of immigrants for labor market ability. These hypotheses were found to be consistent with cross-sectional data for the United States and other countries. This paper considers two alternative hypotheses that have been suggested—selective return migration of immigrants and the migration of those who anticipate high earnings for reasons other than ability. To compare the original and alternative models, a variety of new tests are made using cross-

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sectional and longitudinal data on earnings, occupation, and schooling from the censuses of population and the National Longitudinal Survey. The model of immigrant adjustment based on skill transferability and immigrant self-selection is shown to be consistent with these new tests, while the alternative hypotheses are not.

## I. INTRODUCTION

In the last few years there has been considerable research on the economic adjustment of immigrants in the United States and other countries, as measured by their earnings, occupational status, and employment. The theoretical underpinning of these analyses has been human capital theory and, in particular, the extent of the transferability of skills and the self-selection of migrants.<sup>1</sup> The model has been tested with cross-sectional data, primarily from the censuses of population, but also for other data files for the United States and other countries.<sup>2</sup>

The following hypotheses have been found to be consistent with the data:

1. The economic status of immigrants improves with duration of residence.
2. Refugees experience greater difficulty initially, but because of a steeper improvement in economic position with duration of residence, the differential between refugees and economic migrants narrows with duration of residence.
3. Pre-immigration years of schooling and labor market experience have a smaller effect on economic status in the destination than the schooling and experience of the native born, and the differential is larger for refugees than for economic migrants.
4. The earnings of economic migrants may reach parity with the native born, *ceteris paribus*, after which the foreign born would have higher earnings. This crossover would come later, if at all, for refugees. (Empirically, for white economic migrants in the United States, the crossover occurs at about fifteen years of residence.)

Although these patterns are extremely robust, it is not sufficient to show that the data are consistent with a set of hypotheses. Are there other hypotheses that are also consistent with some or all of the observed patterns? The purpose of this paper is to indicate some plausible

alternative hypotheses and to test them with the same data. Two alternative models to the approach outlined above that have been suggested at various seminars and in the literature (for example, Bronfenbrenner 1982; Jasso and Rosenweig 1982) are:

1. *Selective Return Migration* (attrition bias). The rise in economic status with duration of residence is due to the selective return migration (emigration) of the less successful immigrants.
2. *"Luck" as a Determinant of High Earnings*. Immigrants eventually have higher earnings than the native born, not because of greater "ability" but because only those with the good fortune to draw a high earnings profile will move. Either pure luck or some other unobserved component unrelated to ability accounts for the high earnings.

This paper develops additional tests that can be used to differentiate the original and the alternative hypotheses. The new tests indicate that the data are consistent with the original hypotheses but not the alternative hypotheses. The failure of the alternatives increases confidence in the robustness of the human capital model of immigrant adjustment based on transferability of skills and self-selection for explaining the economic status of immigrants across demographic groups, across geographic areas, and over time.

Section II is a review of the human capital model of immigrant adjustment and the major hypotheses derived from this approach. The model is based on the self-selection of immigrants and the international transferability of skills. Section III introduces an alternative hypothesis—that the selective emigration from the United States of less successful immigrants is responsible for the observed rise in earnings, employment, and occupational status with duration of residence of the remaining foreign-born population. This alternative hypothesis is tested with data on the effect of duration of residence for immigrants from countries that differ in the degree of return migration. It is also tested by an examination of the growth in earnings over time among adult men in the National Longitudinal Survey. An additional test uses longitudinal data on the occupational status of immigrants in the 1970 census. The analyses in Section III are "ceteris paribus"; that is, earnings, employment, and occupational profiles are examined when other variables, including schooling, are the same.

Section IV uses data from the 1960 and 1970 censuses of population



to test for the selective emigration of the foreign born by level of schooling and country of origin. The self-selection model has implications for earnings patterns by immigrant generation, that is, for the earnings of the children and grandchildren of immigrants. These implications do not exist in alternative models. The implications of the self-selection model for earnings by immigrant generation are tested in Section V. The final section is a summary and conclusion.

## II. THE MODEL AND ITS IMPLICATIONS

The model of immigrant adjustment is based on the international transferability of skills and the self-selection of immigrants.<sup>3</sup> The model generates implications regarding differences in economic status by nativity, schooling, labor market experience in the countries of origin and destination, and motive for migrating, among other variables.

### A. Transferability of Skills

The extent of the transferability of skills differs by the type of skill and the setting in which it is to be applied. Immigrants whose skills have little transferability will undergo a sharper decline in occupational status at immigration and have lower earnings and higher unemployment (less employment) in the destination. With continued residence in the destination, however, their skills will gradually be modified to increase the transferability of previous investments, and new skills that are more specific to the destination are acquired. Also, the extent of experimental job changes and involuntary layoffs (from low seniority, little firm-specific training, and employer hiring errors) will diminish. As a result, the occupational status, earnings, and employment (weeks worked, or the complement of unemployment) of immigrants will rise with duration of residence.

The labor market disadvantages shortly after immigration are most intense, and the subsequent improvement is strongest, the weaker the transferability of skills. In addition, the effects of pre-immigration schooling and pre-immigration labor market experience on occupational status, earnings, and employment are expected to be weaker for workers with skills that are less readily transferable.

Immigrants may be classified by the similarity of the labor markets in their country of origin to the United States in terms of language,

labor market structure, and institutional arrangements. The greater the similarity, the greater the transferability of skill. Thus, English-speaking migrants from developed countries to the United States or Britain would be expected to have more highly transferable skills than otherwise-identical immigrants from other countries.

Motive for migrating is also an important determinant of the transferability of skills of a cohort of immigrants. "Economic migrants" are persons who move primarily because of the attractiveness of the labor market in the destination relative to that in the origin. "Refugees" are those who move largely because of actual or feared persecution for religious, racial, ethnic, political, or social class reasons. Refugees presumably have skills that are less transferable than economic migrants. Economic migrants moved because of the transferability of their skills, and they are more likely to have planned for the move by investments to increase this transferability. For refugees, migration is often an unexpected and unwanted occurrence undertaken to protect their freedom or their lives.

A second category of noneconomic migrant is the "tied-mover." Tied-movers are persons whose migration is determined largely by the migratory behavior of another person, usually a relative (for example, a spouse). Again, since the person's own labor market opportunities are not the primary determinant of the migration decision, tied-movers are likely to have skills that are less readily transferable than those of economic migrants, and they have lower earnings in the destination than economic migrants.<sup>4</sup>

A third category of noneconomic migrants is the "ideological migrant." An ideological consideration (for example, nationalism) rather than conventional economic forces or the persecution associated with refugee migration is the primary migration determinant.<sup>5</sup> Ideological migrants would experience many of the same labor market disadvantages as other noneconomic migrants, although they may have a longer period of preparation.

While the classification of economic migrant, refugee, tied-mover, and ideological migrant is convenient for analytical purposes, empirically it is difficult to identify the motive or motives of particular individuals. Perhaps most Cuban and South Vietnamese "refugees" are truly refugees, but many others may be economic migrants who are using a refugee status as a mechanism to enter the United States. Although many married couples make a joint decision regarding migration, if the husband has more skills and expects greater labor force attachment

than the wife, he may be the economic migrant and she may be a tied-mover; yet both elements enter the decision making of each spouse. It seems reasonable to assume, however, that for migration to the United States over the past two to three decades, a greater proportion of the Cubans than the Mexicans and a greater proportion of the Chinese than the Filipinos or Japanese are refugees. Similarly, married female immigrants are more likely to be tied-movers than those who are single at the time of migration.

### B. Self-Selection of Immigrants

As with other forms of investment in human capital, international migration tends to be more profitable for those with higher levels of "ability."<sup>6</sup> Assuming that earnings do not vary with experience, the work life is very long, and migration costs are incurred only in the initial period, then the rate of return on the investment in migration for a low-ability person is approximately

$$r = \frac{W_A - W_B}{C_o + C_d},$$

where  $W_A$  and  $W_B$  are earnings in the destination and origin of a low-ability worker,  $C_o$  is the opportunity (time) cost, and  $C_d$  is the direct (out-of-pocket) cost. If the more able have  $k$  percent higher earnings in the destination and origin ( $k > 0$ ) but ability does not affect the units of time for making the investment or the direct cost component, the rate of return for the high-ability migrant is:

$$r^* = \frac{(1+k)W_A - (1+k)W_B}{(1+k)C_o + C_d} = \frac{W_A - W_B}{C_o + C_d/(1+k)},$$

and  $r^* > r$  as long as  $k > 0$  and  $C_d > 0$ . Thus, the rate of return from migration is higher for the more able. The intensity of the favorable self-selection is greater the larger the out-of-pocket costs ( $C_d$ ) of migration.

The incentive for migration by the more able is even greater if high ability makes a person more efficient in the myriad activities involved in migration, thereby reducing the time cost (units of time) and direct

costs. For the same percentage reduction in costs, the favorable self-selection is greater the larger the time and direct costs of migration.

If distributions of ability are similar across countries and if immigrants are favorably self-selected on the basis of ability, then immigrants will, on average, have a higher level of ability than does the population in the destination. The favorable self-selection is more intense the larger the costs (particularly out-of-pocket costs) of migration. The ability in question relates to labor market success and may be variously described as entrepreneurial skill, ambition, aggressiveness, allocative decision making, and so forth.

It is the economic migrants who view the migration decision as a conventional human capital investment. For refugees and tied-movers, different incentives are operative. It is therefore expected that economic migrants have greater relevant ability for the labor market than do refugees or tied-movers, other readily measured variables being the same, and that among economic migrants the intensity of the ability differential would be larger the greater the costs of migration.

If economic migrants have greater ability than the native population, they would be expected to have higher earnings once the disadvantages of a foreign origin becomes sufficiently small. Among refugees, however, the combined effects of the lesser transferability of skills (which may not be fully dissipated with a long duration of residence) and the less-intense favorable self-selection implies that they may not reach earnings parity with the native born, but if they do it will be at a longer duration of residence than for economic migrants.

The testing of the model for adult male immigrants in the United States using the 1970 census of population reveals that the data are consistent with the hypotheses. In particular, controlling for total experience, the occupational status, earnings, and employment of the foreign born rise with the duration of residence; the rise is least intense for English-speaking economic migrants and most intense for refugees. Earnings at arrival and the effects of schooling and pre-immigration labor market experience also vary with the transferability of skills; they are highest for English-speaking economic migrants and lowest for refugees. The regression equations reveal that white economic migrants reach earnings parity with their native-born counterparts at about fifteen years of residence, but the crossover is later or nonexistent for refugees. The employment (weeks worked) disadvantage of immi-

grants disappears at about five to ten years of residence, and it is more intense for refugees than for economic migrants. Analyses of the earnings of immigrants in other countries (Australia, Canada, Britain, and Israel) and the United States at the turn of the century using cross-sectional household survey data are consistent with the model and with the patterns found in the contemporary United States.

### III. SELECTIVE EMIGRATION OF THE FOREIGN BORN

A caveat regarding the empirical testing of the model outlined in Section II is that longitudinal hypotheses are being tested with cross-sectional data. Because of cohort differences, cross-sectional and longitudinal data can generate quite different interpretations.<sup>7</sup> An alternative hypothesis is that, other things the same, the less-successful members of an immigrant cohort reemigrate, either to their country of origin or to a third country. That is, the longer a cohort is in the destination, the smaller its size, but more important for our purposes, the higher its level of ability and economic status (earnings, occupation, and employment). Thus, selective emigration among the foreign born may be responsible for the rise in economic status with duration of residence (Bronfrenbrenner 1982; Jasso and Rosensweig 1982).

The Immigration and Naturalization Service collected data on the emigration of the foreign born from 1908 to 1957, but this activity was suspended because of the poor quality of the data. Indirect techniques have been used to study the issue. The emigration of the foreign born appears to be substantial. It is estimated that during the 1960s, 1.1 million foreign-born persons emigrated, of whom one-quarter (284,000) were men aged twenty-five to sixty-four in 1970. This can be compared with the 9.6 million foreign-born persons in the United States in 1970, of whom one-quarter (2.3 million) were men aged twenty-five to sixty-four. Because the number of foreign-born emigrants was estimated as a residual, it is subject to substantial measurement error (Warren 1979; Warren and Peck 1980).

The rate of foreign-born emigration increases in a recession, is high for new immigrants and then falls sharply until retirement when there is a second mode, and varies by country of origin. It is greatest for immigrants from Mexico and Canada, lower for Western Europe, and smallest for Cuba and Eastern Europe. Thus, geographic and cultural

proximity to the United States and motive for migrating (economic or refugee) influence foreign-born emigration. (See Axelrod 1972; Hansen 1940; Jasso and Rosensweig 1982; Warren 1979; Warren and Peck 1980; United States Bureau of the Census 1960; Series C88-114 and C156-157.)

Information on the self-selection of return migrants is even more scarce and offers ambiguous implications. Vanderkamp's (1972) analysis of short-term interprovincial return migrants in Canada suggests that they were the less-successful migrants. Long and Hansen's (1977) study of black return migrants to the South suggests that both the original migration and the return migration were selective in favor of those with more schooling. DaVanzo (1976) finds that for internal U.S. migration, the return migrants respond to many of the same economic incentives as did the original migrants. Rogers (1982) cites data indicating a variety of motives for return migration, including an original intention that the initial migration is only temporary. She concludes that it is not obvious that return migration reflects negative self-selection.

There are several tests for the selective emigration hypothesis, including comparisons among countries of origin that differ in the extent of re-emigration, and analyses of longitudinal data.

### A. Country Differences in Emigration

In spite of the poor quality of the data on foreign-born emigrants, there is reason to believe that emigration varies by country of origin. For example, it is believed that there has been little emigration of the Cuban refugees—few have sought to return to Cuba or to go elsewhere. On the other hand, there is substantial return migration for Canadian, British, and Mexican immigrants.<sup>8</sup> If the return migrants are disproportionately those who have been less successful in the United States, the return migration hypothesis would predict a steeper rise of earnings, occupation, and employment with duration of residence in the United States for Canadian, British, and Mexican immigrants, and a flatter rise for Cuban immigrants. On the other hand, the skill transferability model predicts the smallest rise for the Canadian and British immigrants (English-speaking developed countries), a steeper rise for the Mexican immigrants, and the steepest rise for the Cubans (non-English-speaking refugees).

The empirical evidence supports the skill transferability model. Among adult foreign-born men, other things the same, the partial effect of duration of U.S. residence (entered as a quadratic variable) on annual earnings (expressed in natural logarithms) can serve as the test parameter (Chiswick 1979).<sup>9</sup> The partial effect for adult (age twenty-five to sixty-four) white men, when evaluated at ten years, are:

<i>Country of Origin</i>	<i>Percent</i>
All countries	1.12*
English-speaking developed countries <sup>10</sup>	0.12*
Other countries	1.71*
Mexico	1.34*
Cuba	2.37*

\*Duration of residence and its square are statistically significant at 2.5 percent level, one tailed test.

That is, the partial effect of duration in the United States is related to skill transferability rather than the degree of return migration.

For an analysis of weeks worked in 1969, immigrants who entered the United States between 1955 and 1959 can serve as the benchmark. The employment "disadvantage" of the 1965 to 1970 immigrant cohort is instructive. The recent Cuban immigrants worked a highly significant 4.6 fewer weeks ( $t = -4.76$ ) than the Cubans who entered during the benchmark period; recent Mexican immigrants worked a significant 1.8 fewer weeks ( $t = -2.2$ ) than their benchmark; for all-white recent immigrants, the disadvantage was 2.7 weeks ( $t = -11.5$ ) (Chiswick 1982).

A similar test can be performed for nonwhite immigrants. Black immigrants in the United States are primarily from the Caribbean, but they differ in the extent of the transferability of their skills depending on their country of origin. The partial effect of duration of United States residence (evaluated at ten years) on earnings among foreign-born blacks is 1.60 percent overall, but 1.00 percent for those from English-speaking countries and 1.78 percent for those from other (non-English-speaking) countries (Chiswick 1980a: ch. 7). This is consistent with the pattern found among whites.

Among Asian-origin immigrants, the three most numerous groups in the 1970 census were the Japanese, the Chinese, and the Filipinos. There are no refugees among the Japanese and Filipinos and there are no barriers to their return migration. Among the foreign-born Chinese,

however, many are refugees from the mainland—individuals who fled during the communist revolution and the periodic persecutions and anarchies since 1949. For many, returning to the mainland is unthinkable, and Hong Kong and Taiwan are “third countries” rather than their origin. When evaluated at ten years, the partial effect of the duration-of-residence variable is 2.7 percent for the Chinese, 2.4 percent for the Japanese, and 1.9 percent for the Filipinos (Chiswick 1979, 1980a: ch. 8). The earnings profile is steeper among Asian-origin immigrants than among white immigrants, presumably because their adjustment is more difficult. As was found among white men, however, the profile is steepest for the Asian-origin group with the largest proportion of refugees.

Return migration of the less able is not a compelling interpretation for country-of-origin differences in the slope of the earnings-duration profile. If there were selective emigration of the less-successful immigrants, the slope of cross-sectional profiles relating earnings and employment to duration of residence would be biased upward. The finding that these profiles are flatter where re-emigration is most pronounced is inconsistent with the model regarding the transferability of skills and motive for migrating.

### B. Longitudinal Data on Earnings

Longitudinal data can provide a test of the hypothesis that earnings rise with duration of residence among the foreign born when total labor market experience is held constant. By following a cohort of native-born and foreign-born workers over time, earnings ratios would not be confounded by selective emigration.

Longitudinal files with the appropriate data are scarce. Because of the substantial cost of conducting longitudinal surveys, the sample sizes are relatively small. Since the foreign born are about 5 percent of the adult population, the sample size for immigrants is usually very small. Many longitudinal samples do not permit an identification of the foreign born or the year of immigration.

Although it has several deficiencies, the National Longitudinal Survey (NLS) of adult men may be the best longitudinal data file for analyses of the foreign-origin population (Chiswick 1980a:App. D). The NLS sample of adult men is a cohort of men aged forty-five to fifty-nine in 1966. There are approximately 3,500 white men in the data,



but the sample size is reduced when men with missing values for one or more of the relevant variables or who did not work are deleted from the data. In addition, the sample was limited to men aged sixty-four or less in 1973 (that is, men aged forty-five to fifty-seven in 1966). Analyses of earnings (wage, salary, and self-employment income) in 1965 and 1973 were computed for a cohort of 1,338 men, of whom 98 were foreign born. The NLS includes information on nativity, but not year of immigration for the foreign born. However, all of the foreign-born men had immigrated to the United States before 1965.

The average earnings of the foreign born were below that of the native born in 1965 (\$8,244 compared with \$8,521), but they exceeded those of the native born in 1973 (\$11,783 compared with \$11,445) (Chiswick 1980a:App. D). Controlling for schooling, experience, marital status, weeks worked, and area of residence, the foreign born earned 3.2 percent more than the native born in 1965, although the difference was not statistically significant ( $t = 0.52$ ). In 1973, however, the foreign born had 12.1 percent higher earnings, and the difference was statistically significant ( $t = 1.8$ ). Thus, tracing a cohort of men as it aged suggests that earnings grew more rapidly for the foreign born than for the native born.

The increase in the foreign-born/native-born earnings differential by 8.9 percent over the period of eight years implies a partial effect of duration of residence of 1.1 percent per year. It is quite striking that this same 1.1 percent increase per year of U.S. residence (evaluated at ten years in the United States) was found for white men in the 1970 census. Indeed, since international migration is generally undertaken when men are young adults, since there is a nonlinear effect of duration of residence on earnings, and since the NLS sample is relatively old, a smaller partial effect of duration of residence on earnings would have been expected in the NLS data.

### C. Longitudinal Data on Occupation

The largest sample with longitudinal data<sup>11</sup> on a dimension of economic status is the 1970 census of population (5 percent questionnaire) which asked occupation in 1965 and in 1970. Although the data on occupation in 1965 are based on a retrospective question and although the time span is short, the data can be used to analyze the occupational change of immigrants.

The change in occupational status from 1965 to 1970 can be related to the immigrant's year of immigration and country of origin. The skill-transferability model predicts a decline in occupational status from 1965 to 1970 for immigrants who were in their country of origin in 1965. The decline would vary with the transferability of skill; it would be least intense for economic migrants from English-speaking developed countries and most intense for non-English-speaking refugees. Among immigrants in the United States in 1965, relative to the native born, there would be greater occupational change and a steeper rise in occupational status the more recent the immigration and the less transferable the skills at immigration. Thus, the intensity of this rise would be least for economic migrants from English-speaking developed countries and most intense for refugees. The alternative hypothesis—that the rise in economic status with duration of residence in cross-sectional data arises from the emigration of the less successful—offers no prediction regarding longitudinal changes in occupational status by country of origin.

The empirical analysis focuses on adult white men and the ten broad occupational categories. Other things the same, the foreign born were significantly more likely to experience a change in occupation, particularly those who had been in the United States for fewer than five years and to a lesser extent five to ten years. Among white male immigrants in the United States less than five years, the Cubans experienced the steepest decline in occupational status. This decline is attributable to their refugee-motivated migration rather than to their high level of skill in Cuba. Immigrants from the English-speaking developed countries (mainly Canada and Britain) are also highly skilled, but they experience the least decline in occupational status. Among immigrants in the United States for more than five years, holding period of immigration constant, the Cubans experienced the steepest rise in occupational status, while immigrants from the English-speaking developed countries experienced a relatively small rise.<sup>12</sup> Mexican immigrants are relatively low skilled and they experienced little downward mobility on arrival and little upward mobility in subsequent years.<sup>11</sup> Indeed, small investments in human capital appear to be a characteristic of Mexican-Americans, whether native or foreign born.

Thus, the longitudinal analyses of occupational change in the 1970 census are consistent with the implications of the skill-transferability model and hypotheses.

#### IV. THE SCHOOLING OF FOREIGN-BORN EMIGRANTS

There are no direct data on the characteristics of foreign-born emigrants. There is an indirect test, however, of whether foreign-born emigrants are self-selected in favor of high (or low) levels of schooling. The test suggests that the schooling distribution of the emigrants is not likely to be substantially different from that of foreign-born persons who did not emigrate.

The 1960 and 1970 censuses of population asked country of birth, but only the 1970 census asked year of immigration for the foreign born. It is, therefore, possible to compare the schooling distribution in 1960 of an age cohort of immigrants from a country with the "survivors" in the 1970 census. That is, persons from a particular country in the 1960 census are compared with those in the 1970 census who are from the same country, have been in the United States at least ten years, and are ten years older. This is done for men from Europe, Canada, and Mexico. The changes in these schooling distributions over the decade are compared with the change in the distribution for all adult white men in the same age cohorts.

The distributions of schooling for all white men (Table 1), 95 percent of whom are native born, shows a small increase in schooling attainment over the decade. This may be due to several factors, such as lower mortality rates for those with higher levels of schooling, the acquisition of more schooling as a cohort ages, or an increase in the over-reporting of schooling level as a cohort ages.<sup>14</sup> If these factors are the same for the native and foreign born, a sharper increase in the level of schooling of the foreign born from 1960 to 1970 would be consistent with a higher rate of emigration for the foreign born with less schooling.<sup>15</sup>

The change in the distribution of schooling for white men and for those born in Europe and Canada are compared in Tables 1 through 3. There is a tendency for the proportion of men who report the completion of twelve years of schooling to increase over the decade, largely at the expense of the nine-to-eleven-year category. This tendency is somewhat larger for the European- and Canadian-born men than it is for all white men. Otherwise, there do not appear to be important differences over the decade in the changes in the schooling distribution by country of origin.

Table 1. Frequency Distribution of Schooling in 1960 and 1970 by Age Cohorts for White Men

Years of Schooling Completed	Age in 1960							
	25 to 34		25 to 34		35 to 44		45 to 54	
	1960	1970	1960	1970	1960	1970	1960	1970
0-4	3.5	3.3	2.6	2.4	3.3	3.1	4.9	4.8
5-7	9.9	8.6	6.9	5.9	8.8	7.7	14.4	13.2
8	14.0	12.9	9.5	8.5	13.0	12.0	20.6	19.7
9-11	21.5	20.4	21.4	19.2	21.6	21.0	21.5	21.1
12	28.2	26.7	31.7	33.4	30.8	31.5	21.0	22.6
13-15	10.5	10.7	12.3	12.0	10.2	10.8	8.6	8.9
≥16	12.4	14.4	15.6	18.6	12.3	13.9	9.0	9.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The published tables do not identify nativity; however, 95 percent are native born.

Sources: U.S. Bureau of the Census, *Census of Population: 1960, Subject Reports, Educational Attainment* (Washington, D.C., 1963), Table 1, based on a 5 percent sample of the population.

U.S. Bureau of the Census, *Census of Population, 1970, Subject Reports, Educational Attainment* (Washington, D.C., 1973), Table 1, based on a 15 percent sample of the population.

Table 2. Frequency Distributions of Schooling in 1960 and 1970 by Age Cohorts for Men Born in Europe

Years of Schooling Completed	Age in 1960							
	25 to 34		25 to 34		35 to 44		45 to 54	
	1960	1970*	1960	1970*	1960	1970*	1960	1970*
0-4	6.9	6.0	4.7	3.8	5.9	4.8	8.4	7.5
5-7	14.5	13.7	11.2	11.5	12.7	12.8	16.6	15.1
8	21.4	19.5	16.4	14.1	16.4	15.5	25.8	24.2
9-11	16.5	14.4	16.3	12.2	16.5	14.2	16.5	15.4
12	19.3	23.0	21.2	24.9	23.3	28.1	16.4	19.1
13-15	9.6	9.6	13.5	13.5	11.3	10.1	7.3	7.6
≥16	11.8	13.9	16.7	19.9	14.2	14.5	8.9	11.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Size	216,018	7,568	40,127	1,560	61,298	2,241	114,594	3,767

\*Immigrated prior to 1960.

Note: The countries included in the table are United Kingdom, Norway, Sweden, Germany, Austria, Poland, Czechoslovakia, Hungary, Yugoslavia, Lithuania, Finland, the USSR, and Italy.

Sources: U.S. Bureau of the Census, *Census of Population: 1960, Subject Reports, Nativity and Parentage* (Washington, DC., 1965), Table 2, based on a 25 percent sample of the population.

U.S. Bureau of the Census, *Census of Population, 1970, Public Use Sample, Microdata, State File* (Washington, D.C., 1970), 1/100 sample, 5 percent questionnaire.

Table 3. Frequency Distributions of Schooling in 1960 and 1970 by Age Cohorts for Men Born in Canada

Years of Schooling Completed	Age in 1960							
	25 to 34		25 to 34		35 to 44		45 to 54	
	1960	1970*	1960	1970*	1960	1970*	1960	1970*
0-4	2.5	2.2	1.7	1.8	1.6	1.1	3.5	3.4
5-7	10.9	8.0	8.6	5.8	7.8	6.6	14.9	10.3
8	15.7	15.0	11.3	10.0	12.6	12.3	20.6	19.7
9-11	24.5	20.2	24.0	21.9	24.9	20.4	24.3	19.3
12	22.0	25.9	20.3	25.2	26.5	28.2	18.8	24.0
13-15	11.1	13.0	14.1	13.7	11.7	14.8	9.2	11.1
≥16	13.3	15.7	20.0	21.6	14.9	16.6	8.7	12.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Size	46,656	1,826	8,953	329	17,865	730	19,838	767

\*Immigrated prior to 1960.

Sources: U.S. Bureau of the Census, *Census of Population: 1960, Subject Reports, Nativity and Parentage* (Washington, DC., 1965), Table 3, based on a 25 percent sample of the population.

U.S. Bureau of the Census, *Census of Population, 1970, Public Use Sample, Microdata, State File* (Washington, D.C., 1973), 1/100 sample, 5 percent questionnaire.

Men born in Mexico and living in the United States in 1960 show more dramatic changes in their schooling distribution (Table 4). The proportion of men with less than five years of schooling declined sharply, overall from 50 percent in 1960 to 37 percent in 1970. If this were the result of a disproportionate emigration of men with less than five years of schooling, the proportion in all other schooling groups should increase accordingly. This does, in fact, appear to be the situation. Overall, the proportion with five to seven years of schooling increased from 22 percent to 26 percent (18% increase). The proportion with eight or more years of schooling increased from 29 percent to 37 percent (28% increase). The eight-percentage-points increase in the proportion of Mexican-born men with eight or more years of schooling can be compared with the two-percentage-points increase for all white men. Thus, it would appear that either the entire schooling distribution increased substantially during the decade (which is highly unlikely) or the propensity for return migration among men born in Mexico was particularly high for those with less than five years of schooling.

The procedures adopted in this section are rough, primarily because of the absence of data on year of immigration in the 1960 census. Yet the findings are suggestive. The similar changes in the schooling distributions from 1960 to 1970 for the foreign born from Europe and Can-

Table 4. Frequency Distributions of Schooling in 1960 and 1970 by Age Cohorts for Men Born in Mexico

Years of Schooling Completed	Age in 1960							
	25 to 34		25 to 34		35 to 44		45 to 54	
	1960	1970 <sup>a</sup>	1960	1970 <sup>a</sup>	1960	1970 <sup>a</sup>	1960	1970 <sup>a</sup>
0-4	49.8	37.2	49.3	32.1	47.5	32.8	52.5	45.8
5-7	21.7	26.2	21.7	28.8	21.6	25.3	21.7	24.5
8	8.5	9.8	7.1	9.5	8.9	11.8	9.4	8.3
9-11	8.0	10.1	8.4	10.5	8.8	10.6	7.0	9.3
12	6.3	9.1	6.2	10.8	7.3	9.5	5.5	7.1
13-15	3.2	3.9	3.9	3.3	3.4	5.2	2.3	3.3
≥16	2.5	3.8	3.4	5.0	2.5	4.9	1.6	1.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Size	38,699	1,168	12,585	399	12,967	348	13,148	421

<sup>a</sup>Immigrated prior to 1960.

Sources: U.S. Bureau of the Census, *Census of Population: 1960, Subject Reports, Nativity and Parentage* (Washington, DC., 1965), Table 4, based on a 25 percent sample of the population.

U.S. Bureau of the Census, *Census of Population, 1970, Public Use Sample, Microdata, State File* (Washington, D.C., 1973), 1/100 sample, 5 percent questionnaire.

ada and all white men suggests that either the number of foreign-born emigrants is relatively small or that their schooling distribution does not differ sharply from that of the foreign born who did not emigrate in the 1960s. For those born in Mexico, however, the data suggest a disproportionate rate of emigration among those with less than five years of schooling, but for those with five or more years of schooling in 1960, the emigration is either very small or does not seem to vary by education. Thus, with the possible exception of Mexican immigrants with less than five years of schooling, there does not appear to be selectivity by schooling level in the emigration of the foreign born.

## V. INTERGENERATIONAL TRANSMISSION OF ABILITIES

The model outlined in Section II implies that the earnings of the foreign-born economic migrants may eventually exceed those of the native born because the former are self-selected on the basis of ability. Once the disadvantages of a foreign origin become sufficiently small with duration in the United States, the greater ability results in equal and then higher earnings. This pattern emerges in the empirical analy-

sis. The relevant ability dimensions are not obvious, and they may vary among individuals. The traits such as entrepreneurship, aggressiveness, persistence, ambition, energy, drive, and so on are dimensions of ability that may not be measured in standardized ability tests.

Suppose that this hypothesis is correct. Also assume that some or all of these unmeasured dimensions of ability can be transmitted from parents to children, either genetically or through the transmission of family values. As with biological traits, a "regression to the mean" may be expected in the transmission of these ability dimensions (Humphrey 1978). That is, the children of high-ability parents would, on average, have an ability level less than that of their parents, but greater than the average. And the children of low-ability parents would, on average, have an ability level greater than that of their parents, but less than the average. Then, the native-born children of immigrants (second generation) would be of higher average ability than those with native-born parents (third and higher generation), and the native-parentage with foreign grandparents (third generation) would be expected to have greater ability than those with native-born grandparents (fourth and higher generation), and so on. Formally, if  $A(i)$  is the ability level of the  $i$ th immigrant generation, then  $A(2) > A(3) > \dots > A(n-1) > A(n)$ , where the differences become smaller between successive generations.

The hypothesis that the foreign born are self-selected on the basis of ability may be contrasted with an alternative hypothesis. Suppose there are no differences in ability between the native and foreign born. There are, however, unmeasured differences in investment in human capital and other unobservables, including pure luck. Potential immigrants who expect to draw a high earnings profile in the United States are more likely to migrate. After overcoming the initial disadvantages of a foreign origin, they have higher earnings, but there are no differences in ability between them and the native born. This hypothesis would not predict ability differences among later immigrant generations. Formally, in terms of ability,  $A(2) = A(3) = \dots = A(n)$ .

There are no data files that contain direct measures of ability relevant for the labor market. In this instance, as in others, tests regarding ability differences are indirect. Other things the same, differences in earnings among adult men by immigrant generation may reflect differences in ability. The self-selection model predicts  $Y(2) > (Y3) > \dots > Y(n)$  where  $Y(i)$  is the earnings of the  $i$ th immigrant generation, and

the differences become smaller between successive generations. The alternative model for other unmeasured differences (for example, pure luck) predicts  $Y(2) = Y(3) = \dots = Y(n)$ .

Earnings differences, however, are often attributed to discrimination in studies of earnings by race, ethnicity, and national origin. If there is labor market discrimination among the native born by immigrant generation, it is more likely to be against the most recent group, second-generation Americans (one or both parents foreign born). The discrimination hypothesis implies  $Y(2) < Y(3) < \dots < Y(N)$ , where the differential decreases between successive generations.<sup>16</sup> Overall, the discrimination hypothesis implies a dampening or even a reversal of the earnings differences by immigration generation predicted from the immigrant self-selection model discussed above.

The 1970 census of population and the National Longitudinal Survey file for adult men permit analyses among the native born by immigrant generation.<sup>17</sup> The 1970 census (15 percent questionnaire) asked the nativity of the person and the person's parents, thereby permitting a comparative analysis of second-generation Americans and those who are third- and higher-generation Americans. The limited number of generations identified is offset by the large sample size which permits analyses for a range of race and ethnic groups. The NLS file is relatively small, so it is useful only for white men, but it identifies the nativity of the person, his parents, and his four grandparents. Therefore, both sources are used to test the hypotheses.

Among adult white men born in the United States, the 1970 census data indicate that nearly 20 percent have a foreign-born parent. The men with a foreign-born parent have 15 percent higher earnings, but there are no differences on the basis of parents' nativity in years of schooling or in the partial effect of schooling on earnings in an earnings function. Other things the same, however, second-generation white men earn a statistically significant 4.9 percent ( $t = 4.67$ ) more than third- and higher-generation Americans. The more favorable geographic location of the foreign parentage—that is, their concentration in the North and urban areas—accounts for most of the other ten percentage points.

The earnings advantage of the second generation is not an artifact of the all-white sample. When analyses are done within several race-ethnic groups, a consistent pattern emerges for the foreign parentage to earn 5 to 10 percent more than those with native-born parents.<sup>18</sup>



Among adult native-born men, controlling for schooling, experience, marital status, weeks worked, and place of residence, the partial effect on earnings of having foreign-born parents (one or both) is:

<i>Race-Ethnic Group</i>	<i>Coefficient (percent)</i>
White	4.9*
Mexican	5.1*
Mexican (Spanish mother tongue)	8.6*
Black (urban, English mother tongue)	
All states	8.4*
New York State	10.7*
Japanese	5.2
Chinese	4.3
Filipino	9.0

\*Statistically significant coefficient at the 2.5 percent level, one-tailed test.

In the National Longitudinal Survey there were 2,822 native-born white men (aged forty-five to fifty-nine in 1966) who reported their earnings and other variables relevant for the analysis. The men responded to questions on their parents' and grandparents' nativity.<sup>14</sup> In this sample of older white men, 29 percent reported a foreign-born parent, 24 percent had native-born parents but at least one foreign-born grandparent, and 47 percent had four native-born grandparents. Other things the same, those with foreign-born parents earned 6.4 percent ( $t = 2.25$ ) more than the men with native-born parents. The difference between 6.4 percent in the NLS and 4.9 percent found in the 1970 census data is not statistically significant.

Among native-born men with native-born parents, the effect of foreign grandparents is positive but small and not statistically significant. Although the  $t$ -ratios are below unity, having at least one foreign-born grandparent raises earnings by 1.4 percent, having at least one maternal and one paternal foreign-born grandparent raises earnings by 3.7 percent, and earnings are higher by 0.9 percentage points for each foreign-born grandparent. Thus, between third-generation and fourth- and higher-generation American men there appears to be a small and positive, although statistically insignificant, earnings differential.

The 1970 census and NLS data for native-born men suggest that, other things the same, there are earnings differences by immigrant gen-

eration. The most recent immigrant generation has higher earnings, but the immigrant generation differential narrows and disappears by the third or fourth generation. This pattern is consistent with the hypothesis that the immigrant ancestors were favorably self-selected on the basis of ability and that this characteristic is dissipated with successive generations born in the United States.<sup>30</sup> The pattern is not consistent with the discrimination or adverse self-selection hypotheses.

## VI. SUMMARY AND CONCLUSIONS

This paper has presented alternative models and hypotheses regarding the economic adjustment of immigrants. These models are tested to determine which is more successful for explaining the data.

A model of immigrant adjustment is presented based on human capital theory. It focuses on the international transferability of skills and the self-selection of immigrants in terms of labor market ability. The model generates testable hypotheses, namely, that the economic status of immigrants improves with their duration, of residence, that pre-immigration years of schooling and labor market experience have smaller effects than similar investments among the native-born, and that these patterns vary systematically by the transferability of skill and motive for migrating. Another implication is that the greater ability of the favorably self-selected economic migrants would generate a higher economic status for the native-born children of immigrants than those with native-born parents.

Several alternative hypotheses are considered. One is that the rise in economic status with duration of residence in cross-sectional data is due to the return migration of the less-successful immigrants. This hypothesis is tested with longitudinal data on earnings and occupation, and by comparing the effect of duration of residence on earnings and employment across countries of origin that differ by the extent of return migration. The rise in earnings with duration of residence, other things the same, is found to be the same in longitudinal and cross-sectional data. These tests support the transferability-of-skill hypothesis rather than selective emigration of the less successful. Although return migration is substantial, it does not appear to be selective with respect to ability or earnings, perhaps because for many the original migration was viewed as temporary and for others noneconomic factors (for example, family obligations) influenced the decision to return.

This conclusion is strengthened by the analysis of the schooling distribution of foreign-born emigrants. There is no compelling evidence of selective out-migration of immigrants with less schooling, with the exception of Mexican nationals with five or fewer years of schooling.

Another alternative hypothesis is that there are no ability differences between the native and foreign born and that the foreign born eventually have higher earnings than the native born because the migrants are those who were lucky enough to draw a high earnings profile or who have high earnings for other reasons unrelated to ability. This hypothesis offers no strong implications for the earnings of the children of immigrants relative to the children of native-born parents, other things the same. A discrimination model or a model of adverse selection of immigrants would imply lower earnings for the children of immigrants. Empirically, among the native born in the United States, those with foreign-born parents earn 5 to 10 percent more than those with native-born parents, and the intergenerational effect appears to diminish with successive immigrant generations. This supports the hypothesis of selective migration on the basis of ability.

The paper provides further evidence supporting the robustness of the skill-transferability and selective-migration models for explaining the economic adjustment of immigrants.

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## NOTES

1. See Chiswick 1978a, 1978b, 1979, 1980a, 1982 for the theoretical development for the different measures of economic status.

2. For additional empirical studies of immigrant adjustment, see Amir 1981; Blau 1979, 1984; Borjas 1982; Carliner 1980; Chiswick 1980b, 1983, 1986; Chiswick and Miller 1985; DeFreitas 1979; Featherman 1978; Martin and Poston 1970; North 1978; North and Houston 1976; Portes 1982; Portes and Bach 1980; Reimers 1982; Schultz 1981; Stein 1979; Sullivan and Pedraza-Bailey 1980; Tandon 1978.

3. This section presents a thumbnail sketch of the models. For detailed developments with specific reference to occupational status, earnings, and employment see Chiswick, 1978a, 1978b, 1979, 1980a, 1982.

4. For analyses of differences in labor market outcomes between tied and other female migrants in the United States, see Mincer 1978 for internal migrants and Chiswick 1980a:ch. 9 for international migrants.

5. Perhaps the primary examples of ideological migration in recent decades have been the migration of North American and West European Jews to Israel and the migration of U.S. males to Canada during the 1960s to avoid the draft. For an international comparison of the progress of immigrants in Israel and several other countries, see Chiswick 1979.

6. Tidwick 1976, for example, provides evidence of a greater intention to emigrate from Jamaica among university students who are more able. On the other hand, recent research on asymmetric information suggests that there may be negative self-selection in migration (Katz and Stark 1983). Suppose the migrants and employers in the origin know the migrant's true ability level, but employers in the destination cannot discern an individual migrant's ability and assume it is the average for all migrants. Then less-able workers have a greater economic incentive to migrate. The smaller the differences in the costs to employers of identifying worker ability in the origin and destination, the smaller is the effect. It is not likely that these cost differences will be large or will persist over many years. In addition, since employers will learn that migrants are less-favorably self-selected and hence have lower ability than natives, this model implies lower earnings for immigrants, and if ability is transmitted from one generation to the next, it implies lower earnings for their children than for the native-origin population.

7. For example, it is generally assumed that black males make much smaller investments in on-the-job training than do white males because of their flatter experience-earnings profile. Blacks do have a flatter experience-earnings profile in cross-sectional data. Longitudinal profiles indicate a roughly similar percentage increase in earnings with labor market experience, implying that as a percentage of full-year earnings, black and white males make similar investments and receive similar rates of return. What seems to be a paradox is explained by the higher black-white earnings ratio among younger age cohorts. See Chiswick and O'Neill 1977: 20-23.

8. See, for example, Cross and Sandos 1981; Jasso and Rosensweig 1982; Warren 1979.

9. Controlling for schooling, total labor market experience, weeks worked, marital status and place of residence in the United States.

10. Includes Canada, the British Isles, Australia, and New Zealand.

11. This section is based on Chiswick 1978a.

12. North (1978) also finds a rise in occupational status with duration of residence in longitudinal data.

13. Borjas (1982) notes the higher rate of school enrollment among recent immigrants from Cuba than from Mexico.

14. See Vroman (1977) for an analysis of the over-reporting of schooling by age cohorts.

15. Finifter (1976) suggests that among the native born, those with higher levels

of schooling expressed a greater willingness to live permanently in another country. However, the emigration rate of persons born in the United States is very low.

16. If there were adverse selection of immigrants, as implied by the asymmetric information model, the second generation would earn less than the third generation, and so forth.

17. The data discussed below are reported in detail in Chiswick 1980a:ch. 4.

18. In Penalosa's (1969) study of family income among United States-born Spanish-surname males in the Southwest, using the 1960 census of population, he found that the second generation had higher income in spite of a slightly lower level of schooling.

19. Under the NLS procedures, parents and grandparents born in Canada were given the same code as those born in the United States. Given the extremely high transferability of skills between the United States and Canada and the small costs of this migration, one would expect very small or no differences in ability and earnings. If so, the NLS estimate of the earnings advantage of second-generation Americans would be larger than the advantage found in the 1970 census analysis.

20. Jewish immigrants to Israel in the twentieth century have been predominantly refugees and ideological immigrants. This implies a less-intense favorable self-selection for labor market success and a smaller earnings advantage of second-generation Israeli Jews compared with those with both parents born in the country. In fact, other things the same, second-generation men of Asian-African origin have significantly lower earnings than the native parentage while those of European-American origin show no earnings differential (Chiswick 1980a:ch. 12).

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# INTERNATIONAL TRADE THEORY AND INTERNATIONAL MIGRATION

Wilfred J. Ethier

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This essay concerns what the pure theory of international trade has to teach us about the international migration of labor. I shall by and large ignore work on migration that is disjointed from trade theory, such as the large empirical literature on the determinants of interregional migration<sup>1</sup> and the work on local public goods provision with a mobile population.

This is not a survey. First I examine how existing models of international trade can be used to expose the role of international migration, and then I discuss how those models are inadequate to come to grips with certain central aspects of migration. This leads to a discussion of necessary modifications in model structure. The discussion takes the form of the analysis of special, but suggestive, models intended to par-

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tially capture the central aspects. There is no attempt at a comprehensive treatment.

In Sections I, II, and III the standard textbook models of international trade are briefly reviewed, and I discuss how labor migration affects the central conclusion of these models.<sup>2</sup> Labor is treated as homogeneous across industries and countries.

## I. THE RICARDIAN WORLD

### A. Free Trade

Start with the simple Ricardian model so often used to explain the concept of comparative advantage.<sup>3</sup> Suppose that two goods, wine and cloth, can be produced at home or abroad by a single productive factor, labor, subject to constant returns to scale. Let  $a_w$  and  $a_c$  denote the labor requirements for a single unit of wine and cloth, respectively, produced at home, and let  $a_w^*$  and  $a_c^*$  denote the analogous foreign requirements. For concreteness, suppose that

$$a_c/a_w < a_c^*/a_w^*. \quad (1)$$

Production possibility frontiers for both countries are determined once the sizes of the two labor forces are known. In Figure 1, home and foreign production sets are illustrated by TAB and T\*AB\*, respectively, with the relative slopes of the frontiers of these sets reflecting Inequality (1). The world production possibility frontier is accordingly TAT\*. Free trade equilibrium will entail production somewhere along this frontier, so that three conclusions about such an equilibrium follow:

- (i) The home country will export cloth and import wine.
- (ii) The free trade relative price of cloth in terms of wine will fall between the two ratios in Inequality (1).
- (iii) The ratio  $w^*/w$  of foreign wages to home wages, in free trade, will fall between  $a_c/a_c^*$  and  $a_w/a_w^*$ .

Conclusion (i) follows from the fact that the foreign country specializes in wine production along the TA portion of the world frontier, and

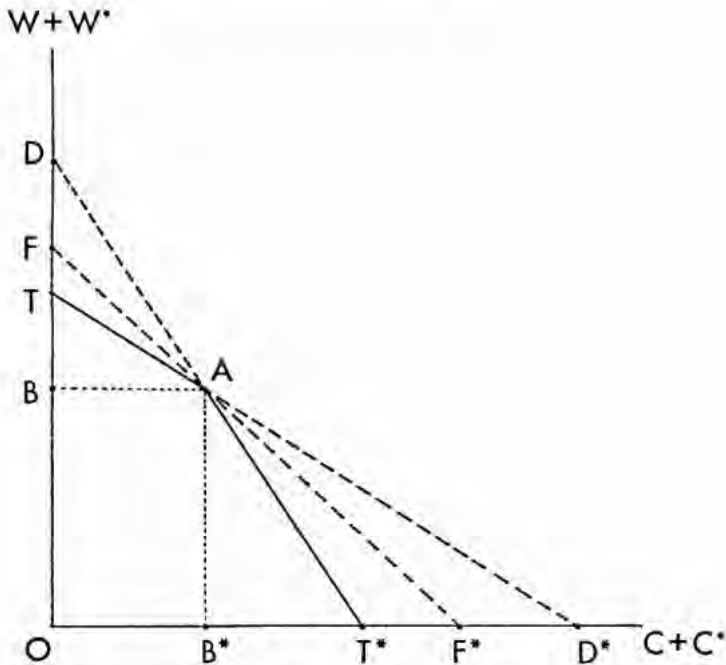


Figure 1.

the home country specializes in cloth production along the  $AT^*$  portion. Conclusion (ii) holds because the left-hand side of Inequality (1) equals (minus) the slope of the  $TA$  portion of the frontier, and the right-hand side equals (minus) the slope of the  $AT^*$  portion. Finally, with the home country producing at least some cloth and the foreign country at least some wine,  $P_c = a_c w$  and  $P_w = a_w^* w^*$ . Thus  $w^*/w = (P_w/P_c)(a_c/a_w^*)$  so that (iii) follows from (ii).

The first two conclusions, known as the Principle of Comparative Advantage, state that a comparison of *comparative* cost ratios in the two countries predicts the pattern of trade and sets bounds on the terms of trade. Absolute costs are irrelevant, in the sense that neither conclusion is influenced by changes in absolute costs that leave the comparative cost ratios unaltered. This is definitely not true of the third conclusion, which says that *absolute* cost differences set bounds for the ratio of free trade wages in the two countries.

## B. Migration

Now suppose that, in addition to free trade in commodities, free migration of labor is allowed. Then a single world wage,  $w = w^*$ , will be established. Now each good will be produced where its absolute cost of production is lower, whereas in the above discussion comparative cost differences determined trade patterns. This is the essential modification introduced by migration. Assuming that Inequality (1) still holds, three alternative patterns of absolute cost differences are possible.

$$\begin{aligned}
 \text{(a)} \quad & a_c < a_c^* ; a_w \leq a_w^* \\
 \text{(b)} \quad & a_c < a_c^* ; a_w > a_w^* \\
 \text{(c)} \quad & a_c \geq a_c^* ; a_w > a_w^*
 \end{aligned}
 \tag{2}$$

In case (2c) the foreign economy has an absolute advantage in neither good, and there is no reason for any labor to remain abroad. The world production possibility frontier is now illustrated in Figure 1 by the line TAD\* if  $a_w = a_w^*$ ; the frontier is parallel to TAD\* but further from the origin if  $a_w < a_w^*$ . In either case the free trade commodity price ratio will equal the home autarkic ratio.

In case (2a), the home economy has an absolute advantage in neither good. Labor migrates abroad and the world production possibility frontier is DAT\* (or parallel to it). The free trade price ratio will equal the foreign autarkic ratio.

In the intermediate case (2b), each country has an absolute advantage in the good in which it has a comparative advantage, so that each country will specialize. The production possibility frontier is given by FAF\* in Figure 1, so that relative commodity prices, and the international wage in terms of each good, are determined independently of tastes. But migration is not. If demand is such that markets clear between F and A, labor migrates from the home country to the foreign; between A and F\* the reverse is true. Commodity trade, though, does not depend on tastes: Neither country will ever import a good in which it has an absolute advantage.

Note that conclusion (ii) of subsection (1a) still holds: the comparative cost ratios in Inequality (1) remain bounds for the relative commodity price. Conclusion (iii) is also unchanged. In case (2b),  $w/w^*$

equals unity and so falls between the two absolute cost ratios. In case (2a),  $w$  is the actual wage and  $w^*$  must be interpreted as the highest wage firms would pay to employ workers abroad. Thus  $w = P_c/a_c = P_w/a_w$  and  $w^* = \max \{P_c/a_c^*, P_w/a_w^*\} = P_w/a_w^*$ , from (1). Then  $w^*/w = a_w/a_w^*$ . In like manner, case (2c) will result in  $w^*/w = a_c/a_c^*$ .

We can now summarize the effect of free labor migration on the simple Ricardian model of international trade. Conclusion (i) is changed in the basic sense that the pattern of trade in goods is now determined by absolute cost advantages rather than comparative advantage. Conclusions (ii) and (iii), setting bounds to relative commodity prices and to relative wage rates on the basis of comparative cost differences and absolute cost differences, respectively, remain valid. In addition we now have a fourth basic conclusion: The direction of migration (as well as its magnitude) depends on tastes, unless one country has an absolute advantage in no good.

## II. THE HECKSCHER-OHLIN-SAMUELSON MODEL

The simple Ricardian model, so useful in trade theory for expounding the fundamental idea of comparative advantage, also clearly brings out the central position of absolute advantage in international migration theory. But, again analogous to the case of trade theory, the model is too simple for many important aspects of migration. In particular, the assumption of just one primary factor of production renders migration indistinguishable from a general international movement of productive capacity. The inability to isolate any distinctive features of labor is a serious limitation, except perhaps to one who views labor as the sole ultimate source of all value. The Heckscher-Ohlin-Samuelson model is the principal tool used by trade theory to study the effects of relative endowment differences, so it is the most natural point of departure for introducing distinctions between factors into migration theory. First, a brief description of the model with trade only.

### A. International Trade

As in the previous section, two countries produce two goods, cloth and wine. But now each good is produced by two factors, capital and labor, via constant returns to scale technologies that are identical

across countries. The two factors are freely mobile between sectors within a country but, for now, are not at all mobile across countries.<sup>4</sup>

The patterns of trade is explained in this world by the *Heckscher-Ohlin theorem*: Each country exports that good that makes relatively intensive use of the country's relatively abundant factor.<sup>5</sup> This theorem is based on the further technological assumption that there are no factor-intensity reversals; that is, the identity of the relatively labor-intensive industry will not change no matter what the variation in the wage-rental ratio confronting firms. Under these circumstances, the cost of production of the labor-intensive good, relative to that of the capital-intensive good, will be an increasing function of the wage-rental ratio. There are two variants of the Heckscher-Ohlin theorem. The *price version* measures relative factor abundance by means of autarkic factor price ratios: The relatively labor-abundant country is the one that, in autarky, would have a lower wage-rental ratio than the other country would have in autarky. Although such abundance can be directly measured only by observation of autarky, this version has the advantage of a simple logic: A lower autarky wage-rental ratio implies a lower autarky relative price of the labor-intensive good and therefore a comparative advantage in that good. If the autarkic equilibrium is unique, the labor-intensive good will be exported with free trade.

The *quantity version* measures relative factor abundance in physical terms: The relatively labor-abundant country is the one with the larger endowment of labor per unit of capital endowment. This measure can be applied independently of the state of the world economy, if there is no migration, but it introduces the possibility that international taste differences could vitiate the theorem: A labor-abundant country could conceivably import labor-intensive goods if it has a much greater preference for them than does its trading partner. To rule out such cases, the quantity version must impose an additional assumption, usually that the two countries share identical and homothetic tastes.

A second basic result of the Heckscher-Ohlin-Samuelson model is the *factor-price equalization theorem*: If relative endowments are sufficiently similar, free trade in goods will equalize both factor prices across countries. Thus free trade substitutes for international factor mobility. Endowments are "sufficiently similar" if the free-trade, least-cost relative factor intensities in each country bound the relative factor endowments of all countries. This implies (but it is not implied by, unless factor-intensity reversals are ruled out) that all countries produce both goods. Since both goods are produced, production costs

equal commodity prices. Free trade equalizes the latter and therefore the former as well. Since relative commodity costs are uniquely related to relative factor prices, as argued above, those factor prices must be the same in all countries.

In Figure 2, home and foreign production sets are respectively illustrated by  $TAB$  and  $T^*AB^*$  in each panel. The home frontier is everywhere flatter than all points on the foreign frontier in panel (a); this requires endowments in the two countries to be sufficiently dissimilar. The world frontier in this case is  $TAT^*$ , with a kink at  $A$ . Along  $TA$  the home economy produces both goods, and the foreign specializes in wine. Along  $AT^*$  the reverse is the case, and both countries specialize at the kink  $A$ . The analogy to Figure 1 should be apparent.

In panel (b), the home frontier along  $DA$  has the same shape as the foreign frontier along  $AD^*$ : Such a case results if relative endowments are sufficiently close. The world frontier is  $TDD^*T^*$ : Along  $TD$  the home economy produces both goods and the foreign country specializes in wine production; along  $DD^*$  both countries produce both goods; and along  $D^*T^*$  the home economy specializes in cloth and the rest of the world diversifies. Adopting the convention that wine is relatively labor intensive and the foreign economy is labor abundant, wages will be higher and rents lower at home than abroad along  $TD$  and  $D^*T^*$ . But factor prices will be equalized along  $DD^*$ . Figure (2b) could also arise from quite diverse relative endowments, if separating

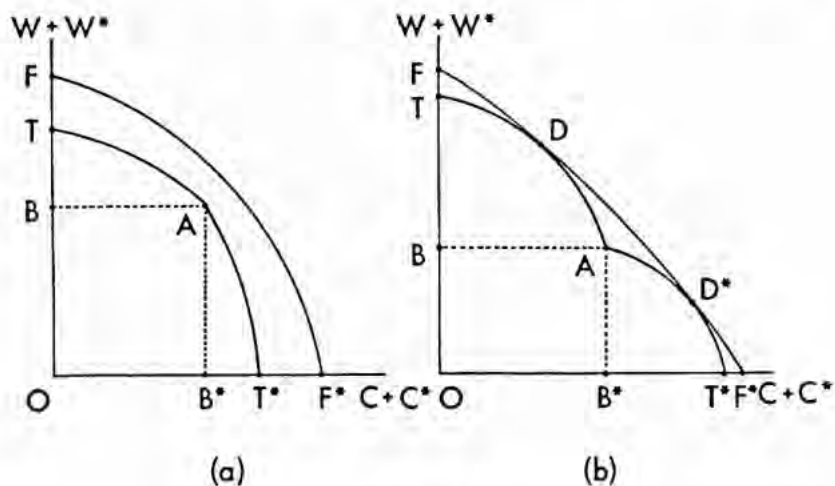


Figure 2.

factor-intensity reversals are present. In such a case factor prices will not be equalized, even along  $DD^*$ .

Two comparative statics propositions complete the catalog of major Heckscher-Ohlin-Samuelson results. The *Stolper-Samuelson theorem* states that a change in relative commodity prices will raise, in terms of both goods, the reward of the factor employed intensively in the production of the now more-expensive good and will reduce, in terms of both goods, the other factor reward, provided that both goods are produced. Thus commodity price changes produce changes in *real* factor rewards, regardless of how the latter are actually spent by their recipients. The *Rybczynski theorem* holds that a change in relative endowments will increase, relative to both endowments, the output of the good that makes intensive use of the factor that has become relatively more abundant and will reduce, relative to both endowments, the output of the other good.

## B. International Migration

The basic result of Section I was the role of absolute advantage once migration was allowed. Here the fundamental message is the substitutability (or lack of it) of migration for other international transactions. Suppose now that, in addition to free trade in goods, there is free international movement of labor, so that  $w = w^*$ . The distinctive feature of capital is now that it is internationally immobile.

If relative endowments are sufficiently close, trade alone will produce factor price equalization and so can completely substitute for migration of labor (and capital also). If relative endowments are too dissimilar for this, trade alone will still cause factor prices to be more nearly equal than autarky (assuming away factor-intensity reversals) and so partially substitutes for migration. In the absence of trade, emigration from the labor-abundant (in the price sense) country would reduce factor-price disparities, thereby driving commodity prices together and reducing the basis for trade. In these senses, therefore, migration is a substitute, whole or partial, for international trade.

Suppose next that, in the presence of free trade, migration takes place so that  $w = w^*$ , even if trade itself does not produce factor-price equalization. Then it must also be the case, even though capital is not mobile, that  $r = r^*$ ; otherwise the country with the higher rental would have higher costs for both commodities and so could compete in nei-

ther market. Thus trade plus migration causes factor-price equalization, regardless of endowment differences, factor-intensity reversals, and so on. (Indeed, migration eliminates the possibility of separating factor-intensity reversals.) Migration allows commodity trade to substitute completely for capital mobility; equivalently, commodity trade allows migration to substitute for capital mobility.

In each panel of Figure 2, the curve  $FF^*$  shows the world-production possibility frontier with free migration.  $FF^*$  necessarily lies outside  $TT^*$  when trade alone does not produce factor-price equalization. If it does do so along part of  $TT^*$ , as I now suppose to be the case on  $DD^*$  in panel (b), that portion of  $TT^*$  also lies on  $FF^*$ . Everywhere along  $FF^*$  factor prices are equalized and both countries produce both goods. Indeed,  $FF^*$  is identical to the frontier obtained from world endowments and the common technology if the two economies are considered together as a single one: National boundaries play no role.

### C. The Complementarity of Trade and Migration

The substitutability of trade and factor movements is due to the fact that relative endowment differences constitute the sole basis for trade in the Heckscher-Ohlin-Samuelson model. Reduce those differences via migration and you reduce the basis for trade. But if we depart from this model by introducing a distinct basis for trade, this substitutability may well disappear.<sup>6</sup> If free trade takes place and some factors are made internationally mobile, they will tend to migrate to the countries with a comparative advantage in the goods that make relatively intensive use of the now-mobile factors. This international reallocation of factors will therefore increase degrees of comparative advantage and so stimulate trade. Trade and migration will be complements.

A simple example is instructive. Consider the  $2 \times 2 \times 2$  Heckscher-Ohlin-Samuelson model in which all consumers have identical homothetic tastes, and suppose that endowments are identical at home and abroad. There is no need for trade in this model. If endowment differences were introduced, trade would be induced in substitution, as discussed earlier. But suppose that instead we introduce technological differences by making the domestic wine industry and the foreign cloth industry uniformly less productive than before (Hicks-neutral technical regress). If trade is allowed, the home country will now export cloth for wine; suppose for simplicity that each coun-



try specializes completely in the new free-trade equilibrium. Let cloth production be relatively labor intensive. Then the home economy has a higher wage-rental ratio than the foreign. Now suppose that we allow labor to move internationally, and that some migrates from the foreign country to the home one. Domestic cloth production will rise and exports of it will increase. Migration is complementary to trade, measured in terms of cloth. (Trade may rise or fall in terms of wine depending on consumers' elasticity of substitution.)

Note that, if migration and trade are complements, an examination of trade patterns that ignored migration might appear to confirm the Heckscher-Ohlin theorem, since the labor-abundant country could well be exporting the labor-intensive good, as in the above example. But the labor abundance is not a *cause* of the trade pattern. Rather, it is a reflection of migration which, like the trade, is due to some other cause.<sup>7</sup>

The Heckscher-Ohlin-Samuelson model generates four basic results, but discussion thus far has addressed only two. The Stolper-Samuelson and Rybczynski theorems have not been mentioned because these comparative statics propositions describe relations among variables that are implied by the technology of the model. The presence of migration has no direct bearing on these relationships.

### III. SECTOR-SPECIFIC FACTORS

In our consideration of labor migration thus far, the only distinction between capital and labor has been that the former is assumed immobile internationally. Now let the two factors differ in regard to domestic mobility as well. Continue with the model of the previous section, but suppose that the labor force consists of unskilled labor (U), used only to make wine, and skilled labor (S), used in both wine and cloth production. Capital (K) is used only to make cloth. Thus there are in effect three factors, with S and U employed in the wine sector and K and S in the cloth sector.<sup>8</sup> Skilled labor is internally mobile and unskilled labor is not. There are evidently two distinct possibilities: The internationally mobile factor might be that which is internally mobile or that which is not. Consider the former case, with intersectoral and international mobility going hand in hand.

### A. International Trade and Migration

Suppose the home and foreign countries allow free trade and free migration of skilled labor. Each country will in fact produce both goods because, with  $U$  and  $K$  trapped in their individual sectors, the factor reward of each will fall enough to allow each sector to operate and thereby employ that type of specific factor. Now free migration will equalize the wage ( $v$ ) of skilled labor across countries:  $v = v^*$ . This will require unskilled labor's wage ( $w$ ) also to be internationally equalized,  $w = w^*$ , since otherwise the country with the higher wage would be unable to produce wine competitively, and to so utilize its unskilled labor. For a similar reason capital's rental,  $r$ , is also equalized across countries,  $r = r^*$ . Thus free trade in goods, coupled with international migration of the internally mobile factor, guarantees factor-price equalization, regardless of disparities in factor endowments, factor intensity reversals, and so forth.

Consider now the pattern of commodity trade. Suppose, as in the quantity version of the Heckscher-Ohlin theorem, that the two countries possess identical homothetic tastes. With skilled labor mobile and technology identical, the relative endowment of capital and unskilled labor becomes the key variable across countries. With free trade the two countries must consume the two goods in equal proportions. We have just seen that factor-price equalization must hold, and this means that both countries will employ the same technique of production for each good. Thus the two countries will consume the two factors—indirectly, embodied in the goods consumed—in equal proportions. Thus the country relatively abundant in unskilled labor must export relatively more wine than cloth and the country abundant in capital must export relatively more cloth than wine. The statements are relative because the country of emigration might actually import both goods. Otherwise, with free migration of the internally mobile factor, the Heckscher-Ohlin theorem (quantity version) holds exactly, in terms of relative endowments of the specific factors.

Next we consider the possibility that the internally mobile factor is not internationally mobile, but that one of the specific factors is. Suppose that unskilled labor is free to migrate between countries, and that free trade in goods also takes place. Migration implies  $w = w^*$ . If not all the unskilled labor leaves the emigrant country, so that both coun-

tries produce some wine,  $v = v^*$ , since otherwise the country with the higher skilled-labor wage could not in fact compete in the wine market. This in turn requires  $r = r^*$  for both countries to produce cloth. Thus factor-price equalization must ensue, if wine is produced in both countries. This will be the case *if* skilled labor/capital ratios,  $S/K$ , are sufficiently similar across countries. To see this, note that *if* both countries produce wine, they will do so with a common unskilled labor/skilled labor ratio  $u_c$  determined by

$$w/P_w = f'(u_c),$$

where  $f(u)$  is the production function showing output of wine per unit of skilled labor when technique  $u$  is used, and where the unskilled labor wage  $w$  and the price of wine  $P_w$  are at their international equilibrium values. Each country produces some cloth so, in this case where both also produce wine,  $r$  is equalized, as we have seen. Thus the cloth industry in each country uses the skilled labor/capital ratio  $s_c$  determined by

$$v/P_c = g'(s_c),$$

where  $g(s)$  is the production function showing output of cloth per unit of capital and  $P_c$  the free-trade price of cloth.

In Figure 3 the  $s_c$  line and the  $S$  axis determine a *diversification cone*. This cone depends on the equilibrium values of  $w$ ,  $P_w$  and  $P_c$ —since  $s_c$  does—and has the property that any country with an endowment  $(S, K)$  in the cone will produce both goods and have the same factor prices as any other country with an endowment in the cone. For example, if a country's endowment point is  $H$ ,  $S_c$  units of  $S$  will be used in the cloth industry and the rest in the wine industry. If its endowment is not in the cone it will specialize in cloth production, and  $v$  and  $r$  will depend on the exact endowment.

Thus free trade in goods and free migration of one of the specific factors imply essentially the same factor-price equalization theorem as does the Heckscher-Ohlin-Samuelson model: Sufficiently similar relative endowments of the internationally immobile factors equalize their rewards.

If such equalization does occur and if the two countries have identical homothetic tastes, then each must export relatively more of the good making relatively intensive use of the country's relatively abun-

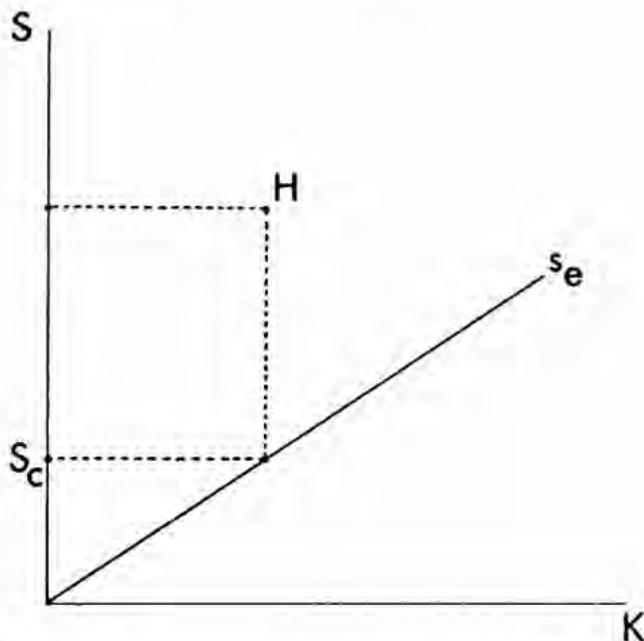


Figure 3.

dant, internationally immobile factor—for the same reason as in the previous case. A failure of factor-price equalization indicates that the country with a relative abundance of capital is specializing in cloth production. Thus the specific-factors model has the general property that, with free migration of one factor, the Heckscher-Ohlin theorem (quantity version) holds with respect to relative endowments of the two internationally immobile factors.

The same is not true of the price version. If unskilled labor is free to migrate, for example, the distribution of  $U$  across countries has no effect on world demands for goods (if migrants don't change their tastes when they move), so the free-trade equilibrium is independent of how  $U$  is distributed among countries in autarky. But the latter does affect autarkic prices of all factors.

#### B. Comparative Statics in the Specific-Factors Model with Migration

Since the specific-factors model has, in effect, three factors rather than two, the two comparative statics propositions are presumably

influenced by such an environment. We are here interested in those propositions when one of the three factors is internationally mobile. I take the latter to be unskilled labor, and leave to the reader analysis of the case where the intersectorally mobile factor is also the internationally mobile one.

Consider first the Stolper-Samuelson theorem. Suppose an exogenous rise in the price of wine ( $P_w$ ), the good using the internationally mobile factor, with no change in the prices on the other two international markets. With  $P_w$  increasing and  $w$  unchanged, the price of skilled labor  $v$  must rise, and in greater proportion than  $P_w$ , to preserve the equilibrium condition of zero profits in the wine industry. But with  $v$  increasing and  $P_c$  unchanged,  $r$  must fall for the cloth industry to remain viable. Thus, if a circumflex denotes proportional change,

$$\hat{v} > \hat{P}_w > \hat{P}_c = \hat{w} > \hat{r}.$$

The Stolper-Samuelson theorem holds with respect to the internationally mobile factor *if* the initial disturbance is a change in the relative price of the good using the internationally mobile specific factor. So consider instead a rise in the price of cloth,  $P_c$ . With  $P_w$  and  $w$  unchanged,  $v$  cannot change either, for the wine industry to remain in equilibrium. Thus  $r$  must rise, and relative to  $P_c$ , to keep cost equal to price in the cloth sector. We have

$$\hat{r} > \hat{P}_c > \hat{P}_w = \hat{w} = \hat{v}.$$

Thus the Stolper-Samuelson theorem almost holds with respect to the internationally immobile factors: "almost" because the return to skilled labor,  $v$ , does not change relative to  $P_w$ , so skilled laborers who consume only wine would not be made strictly worse off by the price change. (But they would suffer if they consumed any cloth at all.)

Since  $w$ , like  $P_w$  and  $P_c$ , is determined on world markets, we should consider as well an exogenous rise in it. With  $P_w$  unchanged,  $v$  must fall. Then with  $P_c$  unchanged,  $r$  must rise. Thus

$$\hat{r} > \hat{P}_w = \hat{P}_c > \hat{v}.$$

This result is fully in the Stolper-Samuelson spirit: An increase in the price of an internationally mobile but specific factor causes a fall in the

reward of the intersectorally mobile factor, in terms of both goods, and a rise in the reward of the specific factor, in terms of both goods.

Turn now to the Rybczynski theorem. Take  $w$ ,  $P_w$ , and  $P_c$  as determined on world markets. Then if both goods are produced, as I assume,  $r$  and  $v$  are also determined, by the above factor-price equalization argument. This sets all techniques of production. Consider first a rise in the endowment of the internally mobile factor,  $S$ . With the amount of capital unchanged and techniques unaltered, the amount of skilled labor employed in the cloth sector does not change either, so the entire rise in  $S$  constitutes a rise,  $\hat{S}_w$ , in the skilled labor employed in wine production. With technique also unaltered there, enough unskilled labor must immigrate to allow its employment to rise in proportion:  $\hat{U} = \hat{S}_w > \hat{S} > 0$ . As the output  $W$  of wine rises in this common proportion, we have

$$(\hat{U} =) \hat{W} > \hat{S} > \hat{K} = \hat{C},$$

where  $C$  denotes cloth production. Thus the Rybczynski theorem almost completely holds: "almost" because  $C$  does not strictly fall relative to  $K$ .

Now suppose instead that  $K$ , the other specific factor, experiences a rise in supply. Then  $S_c$  must rise in equal proportion, since technique cannot alter, and this additional skilled labor can come to the cloth industry only from the wine industry. As skilled labor leaves the latter, unskilled labor must leave also, and thus be forced to emigrate. Thus

$$\hat{C} = \hat{K} > \hat{S} > \hat{W} (= \hat{U})$$

and again we obtain "nearly" the complete Rybczynski result. Then the general conclusion is that, with free trade and free migration of one specific factor, the Rybczynski theorem holds—"almost" completely—with regard to the other two factors and the two goods.

#### IV. THE LITERATURE ON INTERNATIONAL FACTOR MOBILITY

Thus far I have approached migration by asking how the standard models of international trade theory change when migration is added to them. This is an effective way to isolate and examine fundamental im-

plications. An alternative approach is to directly examine the literature on international factor movements. A detailed discussion will be avoided, as this is not a survey, but a few words are needed for perspective.

At the most general level, a recent literature examines the effects of international markets for a subset of factors, within multicommodity, multifactor models of international trade.<sup>9</sup> In these models, as in the less general cases we have examined in Sections I, II, and III, the only qualitative differences between factors are their mobility, so distinctive attributes of labor play no role. The same is true of a very large literature devoted to various issues involving international capital movements in (low-dimensional) models of international trade.<sup>10</sup> The optimal combination of commercial policies toward trade and capital flows is a prominent theme. But since distinctive properties of individual factors do not appear, this entire literature can be thought of as dealing with migration, after little more than a change in terminology from *capital* to *labor*. Such work "by translation" would in fact constitute a large part of the formal theory of trade and migration. (Much of the remainder specifically addresses the brain drain, which I shall come to later.)

Even in the most abstract environments where all factors seem the same, one should recognize the fact that labor movements have the distinction that they involve the migration of the owner of a factor service as well as the migration of the service itself.<sup>11</sup> This has implications for both positive and normative analysis. In the former case, an export of (labor) services does not generate in exchange a flow of (wage) payments, unless one assumes that wages are in fact repatriated. Of course, this is very often just the case, and foreign investment earnings are often reinvested, so it is by no means clear that this distinction is of practical significance. On the normative side, one must decide whether to treat the welfare of migrants as of policy concern to the country from which they have come or to that to which they have gone. Of course, arbitrary assumptions can make migration like other factor movements in this regard as well, and this is indeed done implicitly when one takes the general factor-movements literature or the capital-movements literature to be of direct reference to labor migration. It can also be done in studies explicitly addressing labor migration, although recent work has in fact tended to discuss this distinction rather than to avoid it.<sup>12</sup>

## V. TYPES OF MIGRATION

I now begin the descent from those heights of generality from which all factors look the same down to a vantage point where distinct features of labor migration become discernible. As is so often the case, a closer look reveals a good deal of variety. Thus we shall find ourselves left, not with a single unified theory of trade and migration, but with several theories, each relevant to a significant part of actual international labor movements. Some of the theories follow in straightforward fashion from traditional international trade theory. Others do not, and are concerned with problems for which trade theory is inadequate. Thus the latter must be supplemented.

There are, I think, three central criteria that distinguish actual incidents of international migration from each other. One has to do with the quality of the mobile labor, one with the intentions of the mobile laborer (and those who wish to employ him), and the last with the attitude of the host (or potential host) government. Consider each in turn.

1. *Skilled vs. unskilled labor.* It is common to break down migration totals in this way. The sizable illegal immigration into the United States and the labor flows under the auspices of European guest-worker systems involve mostly unskilled labor, especially from the perspective of the host country. Immigration laws often give preference to individuals with skills. Overall, flows of both types of labor have been large, although those of unskilled labor appear to have become relatively more important in recent decades.<sup>11</sup>

2. *Permanent vs. temporary migration.* Much the larger part of world migration involves workers who intend to return whence they came. This is of course formalized in guest-worker systems but is very common otherwise also. Of course, even when most participants in a labor flow intend to return, some do not, and some of those who do so intend never, in fact, do return. Even if these exceptions are, at any moment, only a small part of the total flow, they could result, over time, in the accumulation of a significant stock of permanent migrants. And for some purposes, reversibility of the individual's move may not matter: A permanent labor migration can be the result if returning migrants are continuously replaced by new (temporary) migrants. But reversible flows are themselves worthy of study, and theoretical implica-



tions of the transitory nature of much migration have not been worked out.

3. *Legal vs. illegal migration.* Much actual migration is in fact illegal and occurs in the face of (varying) efforts to prevent it. Illegal immigration seems to be of the same order of magnitude as legal for the United States and is also significant elsewhere. The implications of enforcement effort as a policy tool, and the effects of illegality on the decision process of migrants, deserve theoretical scrutiny.

The various types of migration are set out in Table 1, for convenient reference.

Only two of the eight varieties have as yet induced substantial theoretical investigation. Type 1 (legal, permanent, unskilled migration) is the direct area of application of the work, discussed thus far in this paper, that adds factor mobility to the conventional models of international trade. Type 2 is the subject of the substantial literature concerned with the "brain drain." The distinctive features of the remaining six types have been largely ignored, in the theoretical literature, although it should be remembered that conventional trade theory is presumably of some relevance here as well, since the international movement of a factor of production is one aspect, at least, of every type of migration.

I have divided the six untreated types into two groups: those so important in practice that the need for direct theoretical treatment is overwhelming and those that I feel can be safely ignored, at least for now. For example, type 3 (legal, temporary, unskilled migration) includes what is in fact the single most important type of international labor movement in the modern world economy. Illegal flows of unskilled

*Table 1. Types of Migration*

<i>Type</i>	<i>Status</i>
1. Legal, permanent, unskilled	Conventional trade
2. Legal, permanent, skilled	Brain drain
3. Legal, temporary, unskilled	N
4. Legal, temporary, skilled	X
5. Illegal, permanent, unskilled	N
6. Illegal, permanent, skilled	X
7. Illegal, temporary, unskilled	N
8. Illegal, temporary, skilled	X

Key: N = acute need for theoretical treatment; X = less important.

workers (types 5 and 7) are clearly of major importance. My choice of the three "unimportant" types is admittedly subjective and perhaps arbitrary. Types 6 and 8 seem safe enough, because host countries are by and large willing to admit legally migrants with skills. But there are exceptions and there are also some prominent cases of source countries not allowing emigration of such persons (and others). Type 4 is more problematic, but I have classified it as I have on the grounds that most that is distinctive about it and that is important has in fact received attention in the brain drain literature.

The rest of this paper proceeds as follows. Some neglected aspects of the brain drain are discussed in Section VI. Sections VII and VIII then turn to the neglected types 3, 5, and 7, discussing what needs to be done and taking some steps in that direction.

## VI. THE BRAIN DRAIN

The migration of skilled labor elicited, during the 1960s and 1970s, a substantial literature under the title "the brain drain," the name indicating the source-country point of view usually taken.<sup>14</sup> The distinguishing feature of this migration is that the flow of labor is simultaneously a flow of human capital. Thus the literature on human capital is directly relevant.<sup>15</sup> This has been exploited in investigations of the brain drain, which have often involved analysis of dynamic decision making in stark contrast to the timeless environment of most traditional trade theory. In this section I do not review this work, but instead discuss briefly another aspect of the brain drain, suggested by traditional trade theory.

The fact that skilled labor migration involves the simultaneous flow of two factors (labor and human capital), and the fact that potential host countries often severely circumscribe the inflow of labor accompanied by little human capital while at the same time welcoming those with useful skills, suggests a new line of investigation, *bundled international factor flows*: Some factors may be able to freely move between countries in the combination in which those factors are actually used by the host country, while flows of individual factors are not allowed. Standard models can easily be used for such a purpose, although this hasn't yet been done. I don't intend to offer a comprehensive analysis now either, but only hints and suggestions.

Suppose capital and labor cannot move across borders independ-

ently but can move when bundled together in the combination used by the host country. One would not be surprised to observe phenomena such as a labor-abundant and capital-scarce country exporting capital, in effect as a ticket of admission into the host country for the bundled labor. Such behavior seems germane to concerns of the brain drain literature.

In order to be a little more concrete, consider now a particular model, say, the specific-factors model discussed in Section III. Recall that this has two goods—cloth (C), produced by skilled labor (S) and capital (K), and wine (W), produced by skilled labor and unskilled labor (U). Thus capital and unskilled labor are specific factors and skilled labor is mobile, within a country. Section III examined, successively, the effects of international mobility of a specific factor and of the internally mobile factor. We now allow instead two of the factors to move together if bundled. Evidently this must be the internally mobile factor and one of the specific factors. To be concrete, suppose that skilled labor and capital can flow internationally when bundled in the proportions used by the host-country cloth industry.

Consider now an international equilibrium with such bundled factor movements and also free trade in both goods. The cloth will be produced in the host country, so

$$P_c = v a_{sc} + r a_{kc} \quad (3)$$

where  $P_c$  denotes the international price of cloth,  $v$  and  $r$  the host-country prices of skilled labor and capital, and  $a_{sc}$  and  $a_{kc}$  the amounts of skilled labor and capital employed in the host country to produce a unit of cloth. Factor-market equilibrium with bundled mobility requires that the combination  $(a_{sc}, a_{kc})$  earn no more in the source country than it could in the host country, namely,  $P_c$ . Thus we also have

$$P_c \geq v^* a_{sc} + r^* a_{kc} \quad (4)$$

where  $v^*$  and  $r^*$  denote foreign prices. Finally, equilibrium in the source country cloth industry requires

$$P_c \leq v^* a_{sc}^* + r^* a_{kc}^* \quad (5)$$

where  $a_{sc}^*$  and  $a_{kc}^*$  denote the source-country technology's least-cost technique at prices  $(v^*, r^*)$ . If the foreign country actually produces

cloth, Inequalities (4) and (5) hold with equality. Note that in this case Eq. (3) and Inequality (4) do not imply that  $v$  and  $r$  are equalized across countries, but only that  $v$  and  $r$  in each country lie on a common line.

Figure 4 shows equilibrium in the cloth industry. The II curve is the host-country isocost curve: the set of all  $(v,r)$  satisfying Eq. (3) for the given equilibrium value of  $P_c$ , when  $a_{sc}$  and  $a_{kc}$  are chosen from the host-country technology to minimize costs. Differentiation of Eq. (3), for a fixed  $P_c$ , gives

$$0 = (dv) a_{sc} + (dr) a_{kc} + v(da_{sc}) + r(da_{kc}).$$

But cost minimization requires  $v(da_{sc}) + r(da_{kc}) = 0$ , so that  $(dv) a_{sc} + (dr) a_{kc} = 0$ . That is, the slope of II at any point equals  $-(a_{kc}/a_{sc})$ , minus the capital-skilled labor ratio chosen at that point.

Host-country factor prices must lie somewhere on II. Suppose this is at A. Then condition (4) requires that source-country factor prices lie on or below the line BAD, which is the graph of the right-hand side of (4).

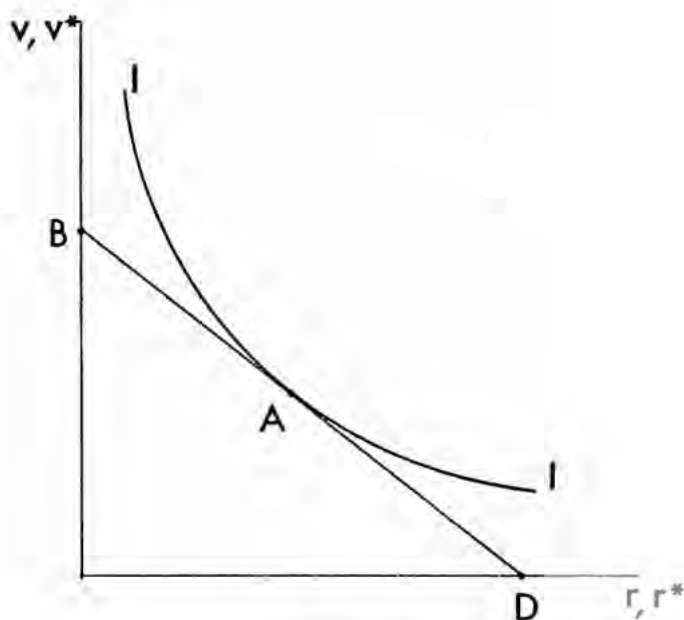


Figure 4.

Now follow the practice of Section II and assume that technology is internationally identical. Then the curve II must also apply to the source country, since this curve depends only on technology and on  $P_c$ , which is equalized by free trade in cloth. Then condition (5) requires that  $(v^*, r^*)$  lie on or above II. Clearly only point A is consistent with both conditions (4) and (5), so we obtain  $v = v^*$  and  $r = r^*$ . Both countries produce wine, since unskilled labor is immobile both between industries and between countries. Since  $v = v^*$  and free trade in wine equalizes  $P_w$ , we must have  $w = w^*$  also.

Thus free trade in goods and the bundled movement of two factors equalize all factor prices in the specific-factors model. Note that this result follows despite the fact that no factor is individually mobile internationally, that factor endowments have not been restricted in any way to be similar across countries, and, most surprisingly of all, that cloth may or may not be produced in both countries in the free trade equilibrium.

Because of this strong factor-price equalization result, free trade plus bundled factor movements leads to exactly the same situation as would free trade plus international mobility of the internally mobile factor, or as would, if endowments are sufficiently similar, free trade plus international mobility of a specific factor. The allocation of world production between the two countries could differ among these cases, but that is of no significance—provided that workers do not change their tastes when they cross borders. With bundled-factor mobility, the equilibrium location of world cloth production is indeterminate, since shifting such production between countries produces no other effects and is an example of bundled mobility. Yet there could easily be cases where countries poorly endowed with  $K$  nevertheless export it, bundled together with some of the abundant  $S$ , but there is no significance to these cases.

We can conclude, then, that within the specific-factors model there is no basis for any concern over a choice between bundled factor mobility or free mobility of the internally mobile factor. Likewise no interest attaches to a choice between bundled mobility or free mobility of a specific factor, provided that initial endowments are sufficiently similar across countries. But if this is not so, policy significance attaches to the latter choice. This is also true if the choice is between bundled factor flows and *no* international factor movements at all, or if trade policy is also available. In such circumstances initial factor endow-

ments become important. But with regard to such issues I am content for now merely to point the way.

The above conclusions depend crucially on our factor-price equalization result, which in turn depends on the assumption of internationally identical technology. So briefly consider the implications of technological differences. In Figure 5,  $I$  denotes the host-country isocost curve for cloth production and  $I^*$  the source-country curve. Both are drawn for the same free-trade equilibrium price of cloth. The figure is drawn so that, at a common  $v/r$  ratio, the host industry would always employ more skilled labor per unit of capital than would the source industry. To see the implications in this equilibrium of bundled factor mobility, draw the common tangent to the two isocost curves; this is the line  $BD$ . As before, Inequality (4) requires  $(v^*, r^*)$  to be on or below  $BD$  and Inequality (5) requires it to be above  $I^*$ . Similarly, Eq. (3) requires  $(v, r)$  to be on  $I$ , and the host analog to Inequality (4) requires it to be on or below  $BD$ . Thus host factor prices are at  $A$  and source prices at  $A^*$ . This is true regardless of whether cloth is pro-

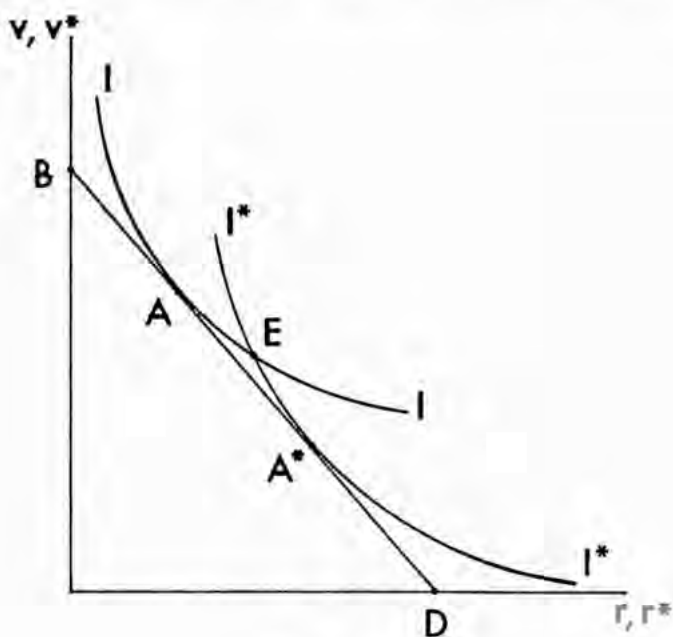


Figure 5.

duced in both countries or not. Note that, if it is, we have "technique equalization"—despite the difference in technology both countries choose to use the same technique to produce cloth! Factor prices are not equalized. Again, it is true that cloth production can be reallocated between countries, consistently with bundled-factor mobility, while leaving world outputs unchanged. But now such a shift will redistribute income between capital and skilled labor and so could disturb world equilibrium if aggregate demand is sensitive to this distribution. Thus the location of cloth production need not be indeterminate.

It is instructive to compare this equilibrium with the one that would obtain, at the same world commodity prices, if capital and skilled labor were allowed to migrate independently. In this case  $v = v^*$  and  $r = r^*$ , so both countries must be at E in Figure 5. Thus we have just the reverse situation to the bundled mobility case: Factor prices are equalized but chosen techniques are different. Comparing the two cases, it is evident that bundled factor mobility results, in each country, in a higher price for the factor used more intensively, relative to the other country; a lower price for the other factor; and a less intensive use of the intensively employed factor than would an equilibrium with free mobility of both factors. This conclusion is independent of the direction of factor flow, since my usage of the terms *host* and *source* is simply an arbitrary designation. But the result depends on  $P_c$  and  $P_w$  being the same across the comparisons, and this is of course problematic should such a change in regimes take place. If the host country moves from A to E,  $v$  falls so that  $w$  rises and the host wine industry uses a more skilled labor-intensive technique. This must draw skilled labor from the cloth industry to work with the constant stock of unskilled labor. Thus the change in regimes causes host-country wine production to rise and income to be redistributed from skilled labor to unskilled labor and capital. The reverse happens in the other country but, unless the changes just balance out, equilibrium will alter.

This discussion has tried to show how conventional trade theory can be used to give an additional perspective on the brain drain. This is not a substitute, of course, for the existing literature that focuses on quite different aspects of the phenomenon. Also, the sketchy treatment offered here should not substitute for a thorough analysis of the questions that have been raised.

## VII. THE TEMPORARY MIGRATION OF UNSKILLED LABOR

The movement to a new land, for a new and better life, of the poor—and so presumably unskilled—is the classic theme of migration. That the movements are also intended to be temporary is not, to be sure, often part of the legend, but it does seem to have been part of the fact. Certainly it is so now.

The temporary migration of unskilled labor is the dominant contemporary form of international labor mobility. North European guest-worker systems have attempted to control the quantity of temporary migrants to match their economies' needs for unskilled workers. In peak years such migrants constituted, on average, 10 percent of the total labor supply, with the proportion exceeding one-quarter in some cases. Large flows of such migrants occur in other parts of the world with few controls—or in defiance of them. For many host countries, or regions, these workers constitute a significant part of the total labor supply, particularly at the unskilled part of the quality spectrum. For source countries, the remittances of temporary emigrants constitute a significant portion of total foreign earnings; in some cases they are of the same general order of magnitude as receipts from commodity exports.

Because they are unskilled relative to native host-country workers, migrants are certainly not perfect substitutes for the latter in production. Indeed, it is often claimed that migrants take jobs that natives do not want, and this seems crucial to the political acceptance of migration by host countries, when they do accept it. Our earlier treatment of labor as homogeneous would seem to be inadequate.

Because they typically intend to work abroad only long enough to attain a savings target, migrants typically do not establish the explicit or implicit long-run relationship with employers often characteristic of native workers. (This contrast is reinforced by the skill differential.) Migrants seem more willing to expose themselves to unexpected variations in employment or employment conditions, and host-country employers use them for such purposes. Furthermore, once contact has been established with source-country labor pools, host countries often



find themselves facing a perfectly elastic supply of migrants (though not necessarily at unchanging wage rates).

Three arguments have been advanced often for the benefit of migrants and guest-worker systems, from the host-country viewpoint. (The countervailing negative arguments usually stress noneconomic considerations.) Native workers, it is said, can be insulated from economic fluctuations if migrants are let in during booms and sent packing during slumps. Second, the availability of cheap migrant labor enables the host country to preserve industries—and thus native jobs—threatened by import competition. Finally, the native population can shift onto migrants the need to adapt to unforeseen secular change, both intersectoral and interregional.

The traditional models of international trade theory do not furnish an adequate basis for the understanding and analysis of arguments such as these, or of the distinctive features of temporary, unskilled labor migration described above. That such analysis is needed should be evident. For example, the first of these three arguments requires native workers and migrants to be close substitutes in production, whereas the second apparently requires complementarity. Thus the relationship of these arguments to each other, and to the economic structure, require clarification.

This essay does not describe a comprehensive theory of legal, temporary unskilled migration.<sup>16</sup> Rather, in this section I attempt to be suggestive of the ways in which I feel that one must depart from standard trade theory. I limit the scope of my discussion by limiting my perspective entirely to a host-country one, and also by a selection of simplifying assumptions.

Suppose a host country imports unskilled, temporary migrants (U) and also a composite, traded consumption good. The migrants are used with skilled native workers (S) to produce a single traded good, cloth (C), via a neoclassical production function:  $C = Sf(u)$ , where  $u$  denotes the ratio of unskilled to skilled workers. I assume for simplicity that all cloth is exported, and only the composite good is consumed.

The host country is assumed to be sizable in the world cloth market but small in every other market. In particular, relative prices of the constituents of the composite good will be assumed constant and independent of host country actions. Also, the wage ( $w$ ) of unskilled migrants will be exogenous to the host country, though not necessarily

constant. But the amount of cloth that is exported will influence the relative price ( $P$ ) of cloth in terms of the composite consumption good.

Host-country cloth firms are exposed to uncertainty through international markets. I assume that these firms do not know beforehand what the migrant wage will be or what demand conditions will be like on the world cloth market.

Migrant and native workers are distinguished in two ways. First, they are treated as distinct inputs and are not added together to obtain a single labor supply figure. Second, the two relate to employers in different ways. I model the more permanent arrangements of natives by assuming that they contract with the firms for employment at a particular wage before the state of nature is known. On the other hand, firms defer hiring decisions concerning migrants until the resolution of uncertainty, at which point they temporarily hire as many as conditions warrant.

Suppose for simplicity that there are but two possible states of nature, denoted by the subscripts A and B. Then export equilibrium in the world cloth market, in each state, is given by:

$$X_A D(P_A) = S f(u_A) \quad (6)$$

$$X_B D(P_B) = S f(u_B). \quad (7)$$

In these equations  $D(P)$  is the state invariant component of the world demand for host-country cloth, and  $X_i$  is the multiplicative random component.  $S$  denotes employment of native skilled workers and is state-independent as these arrangements are made *ex ante*. The technique  $u$  is state-dependent since it can be controlled *ex post* by firms via migrant hiring decisions.

Since cloth firms wish to maximize profits, they hire migrants until the value of their marginal product equals their wage:

$$f'(u_A) = w_A/P_A \quad (8)$$

$$f'(u_B) = w_B/P_B. \quad (9)$$

In Eqs. (6) through (9),  $X_i$  and  $w_i$  are exogenous and  $S$  is determined *ex ante*. then Eqs. (6) and (8) determine  $u_A$  and  $P_A$ , conditional on the

prior choice of  $S$ . These determine the value of the marginal product of native labor:

$$a_A = P_A[f(u_A) - u_A f'(u_A)]. \quad (10)$$

Similarly, Eqs. (7) and (9) determine  $u_B$  and  $P_B$ , and in turn  $a_B$ , conditional on  $S$ .

$$a_B = P_B[f(u_B) - u_B f'(u_B)]. \quad (11)$$

I assume that the native labor force is exogenously given and that the (ex ante) market for native labor clears. Firms, when they enter the native labor market, wish to maximize expected profit. Competition among firms drives this expected profit to zero. Thus, if  $v$  denotes the (state-independent) wage received by native skilled workers,

$$v = \frac{1}{2} a_A + \frac{1}{2} a_B, \quad (12)$$

assuming an equal probability of each state's occurring.

Full host-country equilibrium is described by Eqs. (6) through (12), which solve for  $v$ ,  $P_A$ ,  $P_B$ ,  $u_A$ ,  $u_B$ ,  $a_A$  and  $a_B$  and where  $S$  equals the exogenous supply of native skilled workers. Migrant employment in each state equals  $u_A S$  and  $u_B S$ , and I measure the variability across states of migrant employment by  $m = u_A/u_B$ .

In this model, the availability of migrants at low wages would make host-country cloth more competitive on world markets and would thereby allow higher domestic wages. Also, firms can respond to unforeseen changes by varying migrant employment while leaving native employment unaffected. Label the two states so that  $a_A \leq a_B$ . If the inequality is strict, it follows from Eqs. (8), (9), and (12) that cloth firms suffer losses in state A and make profits in state B. When the unfortunate former state materializes, firms are able to maintain native employment and wages by responding in two ways: They alter their employment of migrants and they dump cloth onto world markets (that is, sell it at a price below its cost of production).

We can obtain a clearer understanding of this behavior by examining how it changes in response to a change in the stochastic structure facing the host country. Consider changes in  $w_A$  and  $X_A$ , with  $w_B$  and  $X_B$  held fixed as a point of reference. Each panel of Figure 6 shows alternative values of the  $(w_A, X_A)$  pair. (Note that each *point* in the

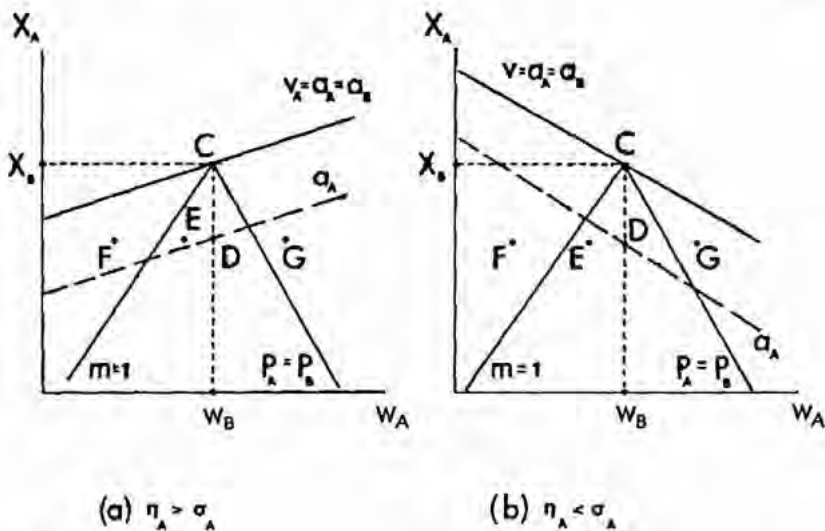


Figure 6.

figure determines an equilibrium solution to Eqs. (6) through (12); a movement from one point to another corresponds to a change in this entire equilibrium and *not* a comparison of states A and B within a single equilibrium.) With  $w_B$  and  $X_B$  fixed,  $P_B$ ,  $u_B$ , and  $a_B$  are the same across all equilibria.

At point C in each panel  $w_A = w_B$  and  $X_A = X_B$ , so the host country lives in a certain world and the two states are indistinguishable. Thus  $a_A = a_B = v$ . A line drawn through C, in each panel, shows values of  $w_A$  and  $X_A$  for which  $a_A$ , and therefore  $w$  as well, remains equal to  $a_B$ . Along this line native workers are in the same situation as they would be in the certain world at C because cloth firms can find a combination of migrant-employment variation and cloth dumping that just neutralizes the uncertainty to which the country is exposed.

This locus of equal values of  $a_A$  will have a positive or negative slope as the state A value of the elasticity of world demand for host-country cloth ( $\eta_A$ ) exceeds or falls short of the state A value of the elasticity of substitution of unskilled workers for skilled workers in the cloth production function ( $\sigma_A$ ). This can be verified by implicitly differentiating Eqs. (6), (8), and (10) for  $dw_A/dX_A$  with  $a_A$  and  $S$  held fixed. Intuitively, an increase in  $X_A$  can be expected to raise unambiguously  $a_A$  because of the expanded world demand for cloth,

but a fall in  $w_A$  has ambiguous consequences. On the one hand it causes firms to substitute migrants for natives, and thereby raise  $a_A$ . But it also reduces overall costs, causing firms to expand output and so depress the price of cloth, and thereby  $a_A$  as well. Not surprisingly, the former effect dominates as  $\sigma_A$  exceeds  $\eta_A$  or not. The respective panels of Figure 6 illustrate the two possibilities.

Contours can also be drawn corresponding to constant values of  $a_A$  other than  $a_B$ . The dashed line in each panel illustrates another such contour. Downward movements in the figure bring one to lines corresponding to lower values of  $a_A$ , and therefore from Eq. (12), to lower values of  $v$  as well. Thus these lines can be interpreted as indifference curves, over alternative stochastic processes, for native workers.

The line labeled  $m = 1$  shows all of the stochastic processes for which  $u_A = u_B$ ; that is, the economy's employment of migrants does not vary across states so that migrant employment is as stable as native employment. Below the line  $m < 1$ , and above it  $m > 1$ . Since  $u_B$  is always the same, a constant value of  $m$  means a constant value of  $u_A$ . Thus it should not be surprising that increases in  $X_A$  tend to cancel increases in  $w_A$ , giving the curve a positive slope.

Finally, each panel also contains a curve showing the locus of points where  $P_A = P_B$ , so that the price of cloth in terms of the composite import is stable across states. Below this line  $P_A < P_B$ , and  $P_A > P_B$  above it. Again, such a line requires  $P_A$  to be constant and so has a negative slope, reflecting the fact that, not unexpectedly, rises in  $X_A$  tend to be cancelled by declines in  $w_A$ .

At a point such as D in each panel the host country is exposed to uncertainty in the export market but not in the migrant-labor market. Clearly  $a_B > v > a_A$ . When bad times strike, via depressed world demand for cloth, firms are able to maintain the employment and the wage of native workers by sending migrants home ( $m < 1$ ) and by dumping cloth abroad ( $P_A < P_B$ ).

Points to the left of D have the property that bad times in the export market are correlated with good times (from the host-country perspective) in the migrant-labor market. A shift from D to E, for example, would increase  $m$ , so that migrant employment becomes less volatile. Depressed conditions in the cloth market cause firms to maintain native employment less by sending migrants home (and thereby substituting natives for them) and more by trying to maintain cloth production by lower costs and cutting prices:  $P_A$  also falls as we move from D to E. This strategy works best if migrants and natives are very complemen-

tary in production (low  $\sigma_A$ ) and if price reductions are very effective in maintaining cloth demand. A comparison of the two panels of Figure 6 reveals that the shift from D to E increases native wages (in *each* state) if in fact  $\eta_A > \sigma_A$ . But if  $\eta_A < \sigma_A$  native workers are worse off, even though the only change for the host country is that in one state it need pay less to hire migrants! This occurs because the increase in cloth output induced by cheaper migrants causes a large decline in the terms of trade. This can be prevented by a (state A) export tax on cloth. A tax on migrant wages could also prevent the large fall in  $P_A$ , but in this case  $a_A$  would be directly increased by the higher costs. The reason that an export tax is effective whereas a migrant tax is not is, of course, that the host country has been assumed to have some market power in cloth but not in the migrant labor market.

If the shift is all the way to F, we have  $m > 1$ . When the cloth market becomes depressed, firms hire more migrants. Thus cloth dumping and "migrant dumping" are negatively correlated.

Points to the right of D correspond to worlds in which favorable export-market conditions are positively correlated with favorable migrant-labor conditions. Shifts in this direction have results exactly the opposite of those just discussed. Note that at point G,  $P_A > P_B$  so that cloth firms raise prices at the same time that they dump their output abroad! The reason is that they increase prices enough to cover only part of the cost increase due to the simultaneously more-expensive migrant labor.

It should be evident that elaboration of this simple model would allow examination of a host of further issues. Also, I have not taken even a peek at the welfare or behavior of the migrants or of those they leave behind in the source countries. My discussion is intended only to be suggestive.

## VIII. ILLEGAL IMMIGRATION

Illegal immigration is important in the U.S. economy. It is also of significance elsewhere, especially if one includes abuse of guest-worker systems and of procedures for the admission of political refugees. These migrants are basically unskilled, by host-country standards. They are also predominantly temporary migrants, but this aspect of the phenomenon will not receive emphasis in my discussion, as I addressed it in the previous section. Indeed, my approach here, as

elsewhere in this paper, will be to develop a simple special model intended to be suggestive, and no attempt will be made to touch on all aspects of the problem.<sup>17</sup>

### A. A Simple Model of Illegal Immigration and Border Interdiction

To start with, I simplify by once again confining myself to a host-country perspective, and also by ignoring the international trade of commodities. Suppose, as in the previous section, that skilled workers (S) and unskilled workers (U) can be used to produce output (Q) via a neoclassical production function:

$$Q = Sf(u)$$

where  $u = U/S$ . Skilled workers are all natives. The stock of unskilled labor consists of two parts,  $U = L + I$ , with  $L$  denoting a supply of native unskilled workers plus legal immigrants and  $I$  the number of illegal immigrants employed.

Of those ( $M$ ) who illegally attempt to immigrate, a certain number ( $C$ ) are caught and denied entry, so that  $I = M - C$ . The authorities' success in preventing illegal entry presumably depends on the resources devoted to border interdiction. Denote by  $E$  the quantity, in terms of output, of such resources. An increase in  $E$  would increase the authorities' apprehension ratio,  $C/M$ , although probably at a decreasing rate. I accordingly assume that

$$C/M = g(E)$$

where  $g(0) = 0$ ,  $g' > 0$ ,  $g'' < 0$ ,  $g < 1$ .

Since border interdiction requires real resources, it must be financed. A key question is whether the migrants themselves pay part of the cost. (This corresponds to a significant unsettled empirical issue: the fiscal consequences of illegal immigration into the United States.) To see what difference it makes, I consider each case in turn. Suppose first that the enforcement effort is financed by means of a proportional tax on production (or on all incomes) at the rate  $t = E/Q$ . Thus the (posttax) wages  $w$  and  $v$  of unskilled and skilled workers are

$$w = (1 - t)f'(u) \quad (13)$$

$$v = (1 - t)[f(u) - uf'(u)]. \quad (14)$$

Because foreign workers who attempt to migrate face the risk of being caught, it is necessary to model the migration decision to at least some degree, in contrast to the previous section. I assume that foreign workers in the source country have the choice of remaining there and earning the wage (or wage equivalent)  $w^*$ , which I take to be exogenous, or of attempting to migrate. If successful, they earn the wage  $w$ , because legal and illegal migrants are indistinguishable to firms. If unsuccessful, they earn  $w^* - k$ , where  $k$  is (the wage equivalent of) the penalty suffered by those who are caught. The probability of a typical would-be migrant's getting caught is just  $C/M$ , or  $g(E)$ . Assuming that foreign workers are risk-neutral, attempted migration adjusts so as to equate the expected reward from migration to the local wage:

$$(w^* - k)g + w(1 - g) = w^*.$$

Thus we have

$$w = w^* + k \frac{g(E)}{1 - g(E)} \equiv w(E). \quad (15)$$

It follows then that the wage of unskilled labor is directly determined by the effort put into border interdiction.

Suppose now that border interdiction is a tool of policy, and that some level of  $E$  is chosen by the authorities. Then this determines the after-tax, unskilled-labor wage  $w$ , as just discussed. From Eq. (13) and the definition of  $u$ ,

$$w(E) = (1 - t)f' \left( \frac{L + I}{S} \right). \quad (16)$$

With  $L$  and  $S$  exogenous and  $E$  set by policy, this gives the negative relationship between  $t$  and  $I$  depicted in Figure 7 below as the  $WW$  curve. This relationship, which I term the *wage schedule*, shows for each tax rate  $t$  the volume of illegal migration required to bring the value of the marginal product of labor, after taxes, into equality with the level of  $w$  determined by the given enforcement policy. This schedule slopes downward but has no necessary curvature. An increase in enforcement effort will raise  $w$  and thereby shift the  $WW$  schedule toward the origin. It is also necessary that  $E$  be financed;  $E = tQ$ , or

$$t S f' \left( \frac{L + I}{S} \right) = E. \quad (17)$$



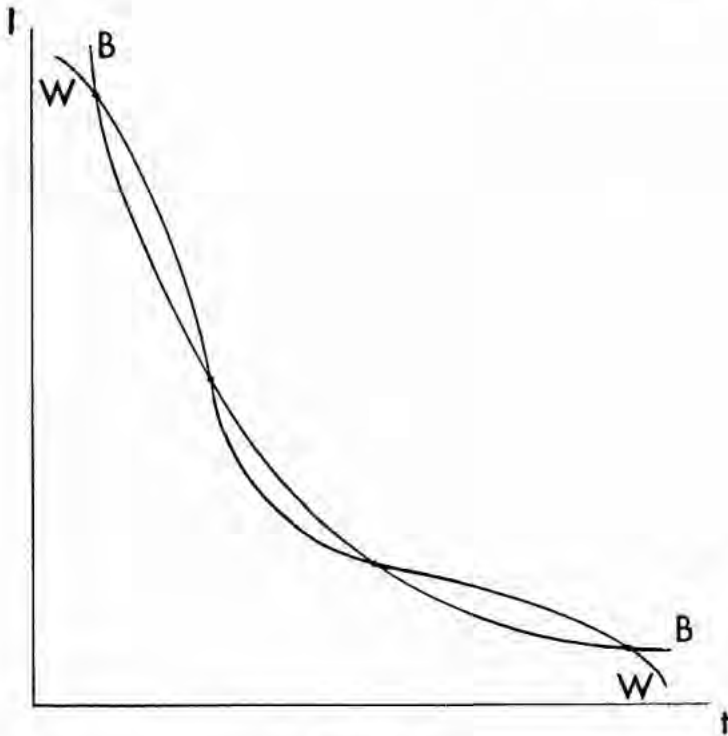


Figure 7.

This gives another relationship between  $t$  and  $I$ , depicted as the  $BB$  curve in Figure 7. This *budget schedule* shows for each tax rate  $t$  the volume of illegal immigration that produces just enough national output so that government revenue equals  $E$ . This curve also slopes downward and is convex to the origin. An increase in  $E$  shifts the budget schedule outward.

An intersection of the wage and budget schedules determines an equilibrium consistent with the given level of enforcement  $E$ . Such an intersection yields  $I$  and  $t$ , which then determine the technique  $u = (L + I)/S$  and, from (14), the wage received by skilled workers.

#### B. Paradoxical Enforcement and the Indeterminate Results of Enforcement Policy

As illustrated in Figure 7, the curvatures of the wage and budget schedules are such that multiple equilibria cannot be ruled out without further information. Thus the combination of  $I$  and  $t$  resulting from any

particular enforcement policy  $E$  need not be determinate, and, indeed, we cannot be confident that any combination actually attained need be preserved for any extended period of time. In the above analysis  $I$  and  $t$  allowed us to deduce  $v$ , so this sorry conclusion applies also to the wage received by skilled workers. On the other hand, we have seen that the authorities' choice of  $E$  directly determines what  $w$  must be.

We are accordingly driven to the conclusion that interdiction policy—in the form of a choice of  $E$ —is an effective means of influencing the wage paid to those native unskilled workers and legal migrants who compete directly with illegal immigrants, but that it could well be an unpredictable and unstable influence on both the number of illegal immigrants who actually enter the country and on the wages of native skilled workers who compete only indirectly with the migrants.

These conclusions of course have implications for the effects of a change in interdiction policy. As we have seen, an increase in  $E$  shifts the wage schedule in toward the origin and the budget schedule out. It is then clear from Figure 7 that  $I$  and  $t$  must change in opposite directions, but that the direction each moves in depends on the relative slopes of the two curves. If there are multiple equilibria, some will move northeast and some southeast; the effects of an intensification of border enforcement are unpredictable, even in a qualitative sense, without further information. If at some equilibrium the wage schedule intersects the budget schedule from above, an increase in border enforcement will actually cause the level of illegal immigration to rise!

This paradoxical result and the possible indeterminacy are themselves interesting conclusions, but of course they also motivate an investigation into what implies that the two schedules intersect just once and in a particular way. Manipulation of Eqs. (16) and (17) ultimately reveals that, at an intersection, the budget schedule is flatter than the wage schedule if and only if

$$t > \frac{\theta_s}{\sigma + (1 - \sigma)\theta_s} = \frac{1}{1 + \sigma(\theta_u/\theta_s)} \quad (18)$$

where  $\sigma$  denotes the elasticity of substitution in production of unskilled labor for skilled labor,  $\theta_s$  denotes the distributive share of skilled labor, and  $\theta_u = 1 - \theta_s$  denotes that of unskilled labor. If this condition is violated at all equilibria, there can in fact be only one equilibrium, and we can be confident that an increase in border enforcement will increase the wage of unskilled workers, reduce the volume of illegal im-

migration, require an increased tax rate, and, as a consequence, reduce the wage received by skilled native workers. If Eq. (18) is satisfied at each equilibrium there will again be only one equilibrium, but a rise in  $E$  will produce paradoxical results.

Evidently the critical value of  $t$  in Eq. (18) depends on  $\sigma$  and  $\theta_s$ . If immigrants are essentially perfect substitutes for native skilled workers, so that  $\sigma$  is extremely high, Eq. (18) will hold in equilibrium. The equilibrium will be unique for a given level of enforcement, but changes in the latter will definitely induce paradoxical results. If, on the other hand, migrants and native skilled workers are really "different," in the sense of significant complementarity in production, satisfaction of Eq. (18) becomes more problematic. For example, if  $\sigma$  is less than or equal to unity, Eq. (18) requires that  $t$  exceed  $\theta_s$ , that is, that the country spend more on border interdiction than the entire income of all skilled workers.

The possibility of multiple equilibria, it should be noted, depends on enforcement policy's taking the form of setting  $E$ . If authorities instead set  $t$  at some level and then spend whatever revenue they obtain on interdiction, equilibrium will be unique. Furthermore, a rise in  $t$  will always reduce  $I$ . The paradoxical case will manifest itself in an increase in  $t$  producing a fall in actual enforcement,  $E$ .

### C. Objectives of Enforcement

The possibilities of multiple equilibria and paradoxical enforcement arose because migrants helped pay the costs of interdiction. That this is indeed the case will become clear as I now assume that  $E$  is financed by a tax on the wage of skilled workers only. Then

$$w = f'(u) \quad (19)$$

$$v = f(u) - uf'(u) \quad (20)$$

$$E = t v S \quad (21)$$

where  $v$  now denotes the *pretax* wage received by skilled native workers. Now  $E$  determines  $w$  from Eq. (15), as before,  $w$  then determines  $u$  from Eq. (19), Eq. (20) gives  $v$ , and Eq. (21) determines the tax rate  $t$ . Then each value of  $E$  yields a unique equilibrium, and an increase in  $E$  will raise  $w$ , reduce  $u$ ,  $v$ , and  $I$ , and require a larger  $t$ .

Why should a nation have an enforcement policy? The international capital movements literature, with its emphasis on the optimal rate of

taxation of foreign earnings, suggests one answer: to exploit market power with respect to mobile labor. One would expect border interdiction to be inferior to a tax on migrant wages in this regard, since the former uses up revenues instead of generating them. But a migrant wage tax may not be feasible. At any rate, in order to investigate the effectiveness of border interdiction, I no longer take  $w^*$  as exogenous, but instead suppose that it is negatively related to employment in the source country. The latter will in turn be negatively related to  $M$ , the number attempting to migrate. So assume that

$$w^* = \phi(M) \quad (22)$$

where  $\phi' > 0$ . Now  $M = I + C = I/(1 - g(E)) = (uS - L)/(1 - g(E))$ . Thus for any enforcement policy  $E$ , Eq. (22) gives a relationship between  $u$  and  $w^*$ . Substitution of Eq. (22) into Eq. (15) then gives a relationship between  $u$  and  $w$ , depicted as the  $II$  curve in Figure 8. This schedule has a positive slope, as illustrated, and a rise in border enforcement shifts it up. The  $II$  line, which shows for each wage  $w$  what value of  $u$  will be produced by the resulting immigration, would be

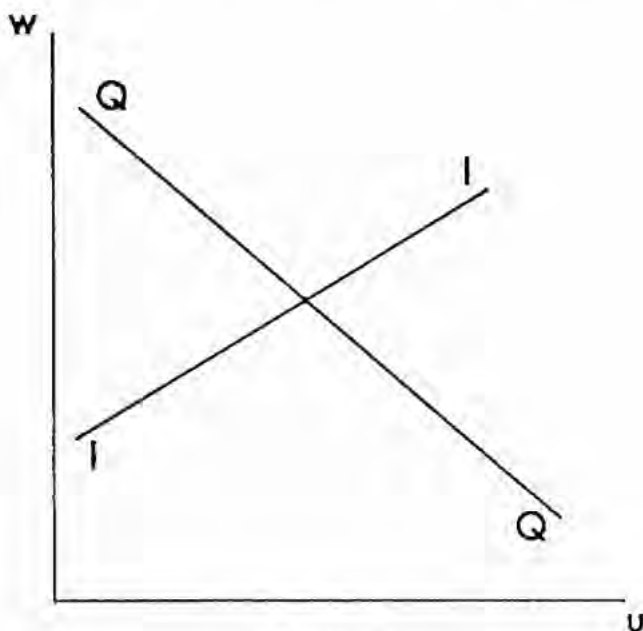


Figure 8.

horizontal with an exogenous  $w^*$ ; higher values of  $\phi'$  make the curve steeper.

A second relationship, depicted as QQ in Figure 8, comes from Eq. (19) and shows simply the marginal product of unskilled labor implied by each value of  $u$ . This clearly has a negative slope, so the two curves have a single intersection. A given value of  $E$  still generates a unique equilibrium.

It follows immediately that an increase in  $E$  shifts the  $\Pi$  curve upward and thereby raises  $w$  and reduces  $u$  (and so  $I$  also). High values of  $\phi'$  can dampen this movement, but they cannot reverse it. It follows from this that the host country can never use border interdiction to increase its income by exploiting the migrant labor market! To see this, measure home real income as follows:

$$Y = wL + vS - E. \quad (23)$$

Note that we include the wages of native unskilled workers and legal migrants but exclude wages paid to illegal immigrants. From Eq. (23),

$$\frac{dY}{dE} = L \frac{dw}{dE} + S \frac{dv}{dE} - 1.$$

Now from Eqs. (19) and (20) we have  $dv/dw = -u$  so that

$$\frac{dY}{dE} = (L - uS) \frac{dw}{dE} - 1 = -I \frac{dw}{dE} - 1. \quad (24)$$

But we have just seen that  $dw/dE \geq 0$  regardless of the degree of host-market power. Thus  $dY/dE < 0$  always and the optimal border enforcement policy is no enforcement at all, when the objective is maximization of real national income.

But other objectives could motivate policy. A second possibility is the domestic distribution of income. An increase in border interdiction will reduce national income, but it will also increase the real wage received by unskilled workers. The entire burden of the policy, and then some, falls on skilled workers, who both experience a lower real pretax wage and also have to pay the direct cost of the enforcement. Finally, it might be thought desirable to limit  $I$  for social reasons. This conceivably could be a policy objective for which skilled workers would voluntarily pay, in contrast to the preceding objective. We have

seen that, in the present model, interdiction can limit  $I$ , but at the sacrifice of some real income. What is the policy trade-off? The loss in real income is given by Eq. (24). The definition of  $u$  and Eq. (19) imply  $dI/dE = (S/f'')(dw/dE)$  so that

$$\frac{dY}{dE} = \left( -\frac{I}{S} f'' \right) \frac{dI}{dE} - 1, \text{ or}$$

$$\frac{dY}{dE} = w \left( \frac{\theta_s}{\sigma} \frac{I}{L + 1} \right) \frac{dI}{dE} - 1. \tag{25}$$

Thus the trade-off will be the more unfavorable (that is, a given reduction in  $I$  will require a larger reduction in  $Y$ ) the smaller the distributive share of unskilled workers, the greater the degree of complementarity between skilled and unskilled workers, and the more important are illegal immigrants in the national supply of unskilled workers.

I have discussed policy as a matter of setting the level of border enforcement,  $E$ , but an alternative tool is the number of migrants admitted legally. That is,  $L$  can be varied directly. But this is not, in fact, an independent instrument. As we have seen, the amount of enforcement directly determines the technique of production. It follows, therefore, that any change in  $L$  will cause simply an offsetting change in  $I$ , and thus in  $C$  and  $M$  also. Reducing the number of legal immigrants will increase by a greater amount those who attempt illegal entry, and by an equal amount those who succeed.

#### D. Employer Sanctions

Enforcement has thus far been confined to the border so that, once inside, illegal immigrants were indistinguishable from other unskilled workers. But we have found good reasons to search for another form of enforcement. First, we have seen that border interdiction is necessarily costly, so there is a motive for trying to reduce that cost by combining interdiction with another method. Second, internal income distribution and the level of  $I$  are two independent policy goals, so that another instrument will in general be necessary if both goals are to be met. If, in addition to interdiction, the employment of illegal immigrants is prohibited, and if this prohibition is backed up by some degree of enforcement, firms will no longer see the two types of workers as iden-

tical. Thus such employer sanctions constitute an independent second method of enforcement.

Suppose that this enforcement takes the form of random inspections of firms. Let  $J$  denote the number of illegal immigrants discovered at work by such inspections, and let  $D$  denote the total resources, in terms of domestic output, devoted to the inspection effort. I assume

$$J/I = h(D)$$

where  $h' > 0$ ,  $h'' < 0$ ,  $h(0) = 0$ ,  $h \leq 1$ . Suppose for simplicity that illegal immigrants who are caught working are paid anyway so that only employers are subjected to direct penalties. (Thus I have the direct punishment from border enforcement falling exclusively on migrants and that from domestic enforcement falling exclusively on firms.) Suppose that this sanction can be expressed as an incremental cost of  $k^*$  per discovered illegal immigrant.

Continue to denote by  $w$  the wage received by illegal immigrants. Our earlier argument continues to apply, so  $w$  is still determined by border enforcement  $E$  as indicated in Eq. (15)—I again take  $w^*$  as exogenous. Now let  $w_L$  denote the wage received by domestic unskilled workers and by legal migrants. A crucial consideration is whether domestic firms are able to distinguish these workers from illegal immigrants. If they cannot, then  $w = w_L$  and the effect of domestic enforcement will be to disadvantage unskilled workers relative to native skilled workers. The firm that hires one of the former takes the risk that the new employee is an illegal immigrant and that the authorities will discover this fact, thereby increasing the expected cost to the firm of employing this worker by  $k^* h(D)I/U$ . But if firms can distinguish illegal immigrants, employer sanctions will disadvantage these laborers relative to native unskilled workers and legal migrants. Thus the effect of the policy on the welfare of this latter group is essentially sensitive to the ability of firms to distinguish between the two types of potential employees.

In this paper I consider only the case where a firm can tell whether a prospective unskilled employee is in fact an illegal immigrant or not. In this case, Eq. (19) will apply only to native unskilled workers and legal migrants and so is replaced by

$$w_L = f'(u). \quad (19')$$

Risk-neutral firms will ensure that  $w_L$  equals the expected labor cost of hiring an illegal immigrant

$$w_L = w + h(D)k^*. \quad (26)$$

Finally, taxes must now finance both enforcement policies

$$D + E = t v S. \quad (27')$$

Thus  $E$  determines  $w$  in Eq. (15); this then gives  $w_L$  from Eq. (26), which then determines  $u$  from Eq. (19'),  $v$  from Eq. (20), and  $t$  from Eq. (21'). Each policy pair  $(D, E)$  generates a unique equilibrium.

I wish to expose the considerations relevant to the choice of policy mix between  $D$  and  $E$ . The authorities might be using policy to try to control the level of illegal immigration  $I$  for social reasons, or they might be trying to influence domestic income distribution by affecting  $w_L$ . An immediate conclusion is that the mix of policy tools is irrelevant to any trade-off between these possible targets. This is so because  $w_L$  is directly related to  $u$ —and therefore to  $I$  as well—by Eq. (19'), regardless of the relative reliance of the authorities on border enforcement or internal enforcement. Thus employer sanctions are of no use in attaining independent targets for  $I$  and for internal income distribution, if firms can in fact distinguish illegal immigrants.

Suppose, then, that the authorities have as a policy target a particular level of  $w_L = w_L^0$ , either for its own sake or because of its associated level of  $I$ . Then substitution of this target value and of Eq. (15) into Eq. (26) yields

$$w_L^0 = w^* + k \frac{g(E)}{1 - g(E)} + h(D)k^*. \quad (27)$$

Equation (27) determines all combinations of the policy variables  $D$  and  $E$  that will achieve the stipulated target. These combinations are graphed as the  $AA'$  schedule in Figure 9. As drawn, the schedule has a negative slope and is strictly convex to the origin. At point  $A$ , the wage received by illegal immigrants  $w = w^*$ . Moving down the schedule, with border enforcement substituted for domestic enforcement so as to keep the actual level  $I$  of illegal immigration unchanged, the wage given the latter,  $w$ , steadily rises, until at point  $A'$  it equals  $w_L^0$ , the



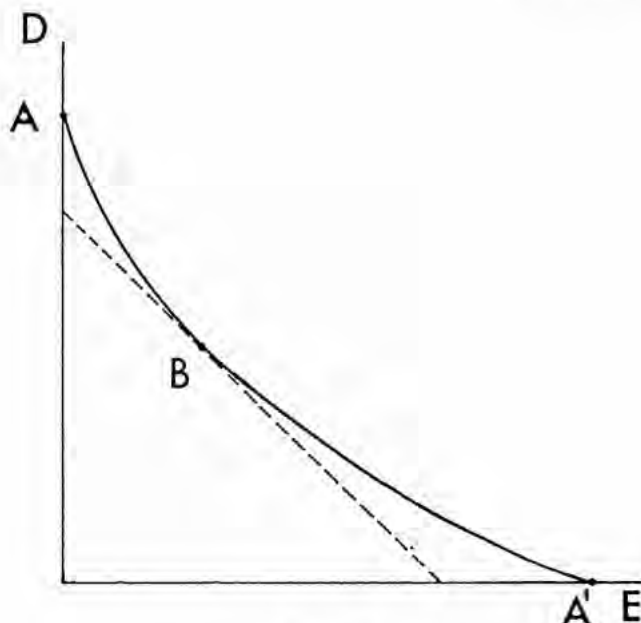


Figure 9.

(constant) wage received by native unskilled workers and legal migrants. It is also clear that such a substitution, by raising  $E$ , must increase the ratio  $C/M$ . With  $I$  unchanged and  $D$  falling,  $J$  must fall as well.

What determines which  $(D, E)$  combination the authorities should choose? This depends, of course, on their objectives. To minimize the total cost  $D + E$  of immigration policy, the authorities need to choose that combination of  $(D, E)$  for which the  $AA'$  schedule has a slope of minus unity, illustrated by point  $B$  in Figure 9. Manipulation of Eq. (27) reveals that this point is characterized by

$$(w_L - w) \eta_I \frac{E}{M} = (w - w^*) \eta_B \frac{D}{I}$$

where  $\eta_I = h'D/h$ , the elasticity of the internal enforcement schedule, and  $\eta_B = g'E/g$ , the elasticity of the border enforcement schedule.

Now consider a movement along  $AA'$  away from  $B$  in a northwest direction. This will clearly lower  $w$ . The level of  $I$  will be unchanged, as will the incomes of  $S$  and  $L$ . The fall in  $wI$  must just equal, from Eq.

(26), the rise in  $k^*$  J: Penalties on employers are substituted for the wages of illegal immigrants.

Now suppose that the penalties levied on firms take the form of fines and that the resultant revenues are, in effect, distributed in lump-sum fashion to (legal) residents. It will evidently be in the national interest to depart from point B in a northwest direction along AA'.

To where should the authorities move? Assuming that they wish to choose D and E so as to maximize

$$Sf(u) - wI - E - F,$$

subject to the condition that  $w_L$  attain the desired value, leads to the following condition:

$$(w - w^*) \eta_B \left[ \frac{D}{I} - (w_L - w) \eta_1 \right] = (w_L - w) \eta_1 \frac{E}{M}.$$

Finally, it should be pointed out that, given the policy variables D and E, changes in legal-migration L would again be exactly offset by equal changes in I (and so also in J, M, and C), leaving  $w_L$  and U unaltered. But if  $D > 0$ ,  $w_L > w$  so that it is better (from the native point of view) to keep any migration illegal; that is,  $L = 0$  is now optimal policy.

## IX. CONCLUDING REMARKS

Sections I, II, and III investigated the implications of adding international labor migration to the standard models used by the pure theory of international trade. Thus they directly answer the question: What does trade theory have to tell us about migration? In these sections of the paper, labor was homogeneous and was distinguished from other factors in no way, except possibly regarding its mobility between sectors or industries.

I then briefly discussed the distinctive features of labor migration and identified three key characteristics. The remainder of the paper concerned these features. A sequence of models was developed to analyze those characteristics that are important in practice but are ignored in international economic theory. The models increasingly diverged

from the standard theory of international trade: Section VI featured a straightforward modification of a standard trade model; Section VII focused on uncertainty and contracts, not discussed in basic trade models; Section VIII dispensed with trade entirely.

Sections VI through VIII are clearly meant to be suggestive and to expose new issues in theory. None offers a comprehensive treatment of its subject. Numerous extensions, modifications, and completions of the analysis offered here should be obvious. But two areas are important enough to deserve special mention: Sections VII and VIII clearly bring out the role of information and decision making under uncertainty. This strongly suggests the need to address international asymmetries of information.<sup>18</sup> Second, these two sections were also confined almost entirely to analyses from a host-country perspective. Source-country issues—and an international general equilibrium—need to be addressed.

Migration is a key component of international economic exchange. Thus far, trade theory has given it only a miniscule share of the attention it deserves, and that share has by and large ignored the characteristic attributes of migration. A preliminary look at the subject reveals a rich array of interesting issues. It is time to tackle them.

## ACKNOWLEDGMENTS

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## NOTES

1. See Greenwood (1975) for a survey of this work.
2. Despite, or perhaps because of, its very elementary nature, this has not been discussed much in the literature. For a textbook treatment, see Ethier (1983, pp. 246–251).
3. For a standard textbook treatment, see Ethier (1983, pp. 6–25).
4. See Ethier (1983, ch. 3) for a standard textbook treatment.
5. The relatively labor-intensive industry is the one that would employ a lower capital-labor ratio, when both industries face the same factor prices and use cost-minimizing techniques.
6. See Markusen (1983).
7. This point has been stressed by Markusen (1983).
8. For a textbook treatment of international trade in this model, see Ethier (1983, pp. 239–244).

9. The normative aspects are treated in Grossman (1983) and the positive aspects are developed in Ethier and Svensson (1986). See also Rodriguez (1975a); Neary (1985); Svensson (1984); and Ethier (1984).

10. See Caves (1960) and references cited therein; Mundell (1957); MacDougall (1960); Hamada (1966); Kemp (1966, 1966); Jones (1967); Kemp and Inada (1969); Chipman (1971); Jones and Ruffin (1975); Brecher and Diaz-Alejandro (1977); Burgess (1978); Markusen and Melvin (1979); Bhagwati and Brecher (1980); Brecher and Bhagwati (1981); Minabe (1981); Bhagwati (1982); Srinivasan (1983); Jones (1983); Jones and Dei (1983); Sapir (1983); and Jones, Neary, and Ruane (1983). Some of these papers explicitly note a relevance to the international mobility of factors other than capital. There is also a more recent literature devoted to the possibility of choosing between the international mobility of one factor (called capital) and that of another (labor): Ramaswami (1968); Bhagwati (1979); Calvo and Wellisz (1983); Bhagwati and Srinivasan (1983); Wong (1983); Hamilton and Svensson (1983); and Jones, Coelho, and Easton (1983).

11. In some cases the owner migrates *without* taking along a factor service, as with dependents and retirees. This paper does not consider migration of this sort.

12. See, for example, Bhagwati (1979).

13. See Greenwood (1983) for a brief but useful recent discussion.

14. See Grubel and Scott (1966a,b); Johnson (1967); Adams (1968); Berry and Soligo (1969); Rodriguez (1975b); Bhagwati and Partington (1976); Bhagwati (1976, 1979); Bhagwati and Hamada (1982); Wilson (1982a,b); and Kwok and Leland (1982).

15. See Berry and Soligo (1969), Rodriguez (1975b); and Findlay and Kierzkowski (1983).

16. For more detail, see Ethier (1985).

17. See Ethier (1986b).

18. For a start in this direction, see Kwok and Leland (1982); and Katz and Stark (1984a,b).

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# WHAT'S IN A NAME?

## COUNTRY-OF-ORIGIN INFLUENCES ON THE EARNINGS OF IMMIGRANTS IN THE UNITED STATES

Guillermina Jasso and Mark R. Rosenzweig

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The question of how foreign-born residents in the United States and their immediate descendants differ with respect to labor-market behavior and earnings has long concerned social scientists as well as policy makers engaged in formulating U.S. immigration policy. Studies that have described immigrant cohorts, assessed the progress of immigrants in the United States, and examined the role of ethnicity in labor market behavior have assigned to country of origin a prominent part. The measured differences in earnings across country-of-origin groups in the United States have been hypothesized to be related, implicitly or explicitly, variously to (1) labor market discrimination (e.g., Reimers

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1983), (2) differences in preferences for certain jobs, and (3) constraints and incentives for immigration. While Chiswick (1978, 1985) has advanced a number of hypotheses regarding how immigration law and the similarity of a country of origin to the United States may influence the "quality" distribution of immigrants, empirical research has exclusively focused on the "effects" of named origin countries rather than on the interrelationships among specific country-of-origin characteristics and immigration behavior (Borjas 1984; Chiswick 1985). The root causes of earnings differences across such groups have thus not been disentangled.

In this paper we focus on the migration-related processes that may lead to the well-documented differences in earnings and in naturalization rates across country-of-origin groups in the United States. Our theoretical framework examines how the forces of selectivity associated with the decisions by residents of non-U.S. countries to migrate to the United States and with the decisions by foreign-born U.S. residents to remain in the United States are influenced by country conditions and are reflected ultimately in the observed earnings differences among the "survivors" of these processes who are enumerated in U.S. sample surveys. In particular, we assess how economic conditions, origin-country attractiveness, costs of migration, the quantity and quality of information, and the country-specific restrictions of U.S. immigration law influence both who migrates to and, among the migrants, who remains in the United States.

The framework is applied to two U.S. data sets—a sample of the foreign born in the 1980 Census and a sample from the 1971 cohort of legal immigrants. These microdata sets are merged with data describing the characteristics of the origin countries using the country-of-origin information provided in the micro files. Our results, based on measures of both occupational attainment and wage rates, indicate that almost all named country-of-origin differences in naturalization rates and in earnings are eliminated when differences in country characteristics influencing migration and re-migration decisions are taken into account. In particular, the well-documented lower wage rates and naturalization propensities of the Mexican foreign born compared with other foreign-born groups are evidently completely explained by variables associated with migration costs and home-country economic conditions. Our results also suggest that the selectivity associated with immigration rather than that with re-migration or emigration is most

important in determining the distribution of earnings across country-of-origin groups in the United States, at least for the foreign born from the Eastern Hemisphere.

## I. THEORETICAL FRAMEWORK

Foreign-born persons resident in the United States at a point in time represent, for the most part, the subset of persons from their home country who decided and were able to emigrate to the United States and who also had not yet decided (or carried out the decision) to leave the United States after entry. Thus, the observed characteristics (earnings, age, and so forth) of the U.S. foreign born reflect two decisions—to immigrate to the United States and to remain in the United States. To the extent that such decisions are based on a comparison of U.S. and home-country conditions, as these influence the relative well-being of the potential immigrant, the personal characteristics of foreign-born U.S. residents will be correlated with their origin-country characteristics.

Consider first the decision by a person born abroad to migrate to the United States in period 1, given the feasibility of such a move within the constraints of U.S. immigration law (and of the origin-country's emigration restrictions, if any). Let maximum well-being in the home country  $V^H$  be a function of the potential immigrant's income  $Y^H$  and the amenities of the home country  $\xi^H$ ,<sup>1</sup> that is,

$$V^H = V(Y^H, \xi^H). \quad (1)$$

The potential immigrant's perceived postmove maximum well-being in the United States, based on his or her information set  $\Omega$ , is given by

$$V^{US} = V(Y^{EUS}(\Omega) - C, \xi^{US}), \quad (2)$$

where  $Y^{EUS}$  equals expected income in the United States,  $C$  is the cost of moving, and  $\xi^{US}$  is U.S. conditions relevant to the immigrant's well-being.<sup>2</sup> The individual decides to move when expected maximum postmigration U.S. well-being exceeds the maximum well-being from remaining at home, that is, when

$$\delta_i^E = V^{US} - V^H > 0. \quad (3)$$

To ascertain how conditions in the home country are related to the characteristics of the groups of foreign born who come to the United States, via the immigration decision, we utilize the concept of the "marginal migrant," that person who is just indifferent between staying home and immigrating, that is, for whom  $\delta_i^E = 0$  (Rosenzweig and Wolpin 1984). The expected U.S. incomes of the marginal migrants from different countries are perfectly positively correlated with the mean expected U.S. income of the migrants from those countries. By altering  $Y^H$ ,  $C$ , and  $\xi^H$ , we can assess how the expected U.S. income of the marginal migrant must change and, therefore, how the mean expected U.S. income of migrants is related to origin-country conditions.

Total differentiation of Eq. (3), with  $d\delta_i^E = 0$ , yields the following relationships:

$$dY^{EUS}/dY^H = V_Y^H/V_Y^{US} > 0 \quad (4)$$

$$dY^{EUS}/dC = 1 \quad (5)$$

$$dY^{EUS}/d\xi^H = V_\xi^H/V_Y^{US} > 0 \quad (6)$$

where  $V_i = \delta V/\delta i$ .

Expressions (4) through (6) indicate, respectively: First, for given migration costs and home-country characteristics, the higher the marginal migrant's home-country income, the higher must be his or her expected U.S. income. Thus, the U.S. foreign born from countries in which persons of given characteristics are able to earn relatively high incomes will, on average, have relatively high earnings in the United States, as long as realized and expected U.S. income are positively correlated. (See below.) Second, for a given income in the home country, migrants from locations associated with high migration costs will have, on average, higher earnings in the United States than other immigrants, as higher U.S. earnings are required to compensate for such costs. Finally, for given home-country incomes and costs of migration, migrants from more "attractive" countries will on average have (require) higher U.S. earnings compared with other immigrants.

Given that information is imperfect (costly), each immigrant's expected and realized postimmigration U.S. incomes may diverge. We assume that realized U.S. incomes of a country-of-origin group will be related to their pre-immigration information set. Persons in countries

with highly imperfect information will make more errors in their migration decisions. In particular, some individuals will underestimate  $Y^{EUS}$  and will therefore not migrate to the United States even though they would have realized a net gain by migrating, while some other individuals will mistakenly migrate, having overestimated  $Y^{EUS}$ . Therefore, a migrant group from a low-information country is likely to have lower mean realized earnings in the United States than would an otherwise similar migrant group from a country with generally superior information about the United States.

For the subset of immigrants whose U.S. incomes fall short of expectations, given unchanged home-country circumstances, a return home may be optimal. Such U.S. immigrants compare realized well-being in the United States with postreturn well-being at home. They re-migrate if

$$\delta_2 = V(Y^{RUS}(\Omega), \xi^{US}) - V(Y^{II} - C, \xi^{II}) > 0. \quad (7)$$

We can ascertain how the realized incomes of the U.S. foreign born are related to home-country characteristics via return migration by again using the concept of the marginal migrant, this time defining the marginal *return* migrant, for whom  $\delta_2 = 0$  (and for whom  $Y^{RUS} < Y^{EUS}$ ). It can be easily shown that

$$dY^{RUS}/dY^{II} = V_Y^I/V_Y^{US} > 0 \quad (8)$$

$$dY^{RUS}/dC = -V_Y^I/V_Y^{US} < 0 \quad (9)$$

$$dY^{RUS}/d\xi^{II} = C/V_Y^{US} > 0. \quad (10)$$

Expressions (8) and (9) indicate that with respect to origin-country income potential and origin-country attractiveness, re-migration decisions reinforce immigration selectivity: only (expected) high-U.S. income individuals immigrate from high-income and otherwise attractive origin countries and only those among them with high realized U.S. incomes remain in the United States. However, while high migration costs act as a barrier to immigrants with low expected U.S. incomes (expression (5)), such costs also make it less profitable for immigrants with relatively low realized incomes in the United States to return (expression (9)), given home-country earnings. The relationship between migration costs and the observed earnings of the foreign born in the

United States is thus ambiguous, but it is more likely to be positive the less imperfect is pre-immigration information about the United States held by immigrants.

## II. DATA

### A. Country-of-Origin Characteristics

As indicated above, characteristics of the origin country are reflected in the earnings (and the characteristics) of the U.S. foreign born inasmuch as such characteristics influence who among the origin populations immigrate and who among the immigrant population remain in the United States. In particular, earnings of the U.S. foreign born differ by origin country to the extent that the opportunity costs of migration, the direct costs of migrating, and the quantity and quality of information available about the United States vary across countries. To test the hypothesis that differences among the foreign born by named countries of origin are fundamentally differences associated with these three factors, we assembled a set of country-specific variables, including the country's distance from the United States, its GNP per capita, its literacy and inflation rates, whether or not the Voice of America (VOA) broadcasts to the country in one of its native languages, whether or not English is an official or principal language, whether or not the country's economy is centrally planned and its government authoritarian, whether or not the country has one or more U.S. military bases, the number of persons from the country residing in the United States, and the number of naturalized citizens from the country in the United States.

The country variables were selected according to two criteria: (1) potential importance in determining opportunity costs, direct migration costs, and country-specific information about the United States; and (2) availability of data on the characteristic for most of the origin countries represented in the U.S. foreign-born population in recent decades. The variables listed are available for eighty-seven countries, representing the countries of origin for over 92 percent of the adult foreign-born U.S. population in 1980 (based on the 1980 Census).

To predict the influence of the specific country-characteristic variables on the observed earnings of the U.S. foreign born, it is necessary to specify how each variable measures or influences the major determi-

nants of the migration decisions as depicted in expressions (4) through (6) and (8) through (10), that is, how each is related to home-country earnings potential and attractiveness, migration costs, and information. We specify the following functional relationships:

$$Y'' = Y \text{ (per-capita GNP, literacy rate)} \quad (11)$$

$$\xi'' = \xi \text{ (centrally planned, inflation rate)} \quad (12)$$

$$C = C \text{ (distance, number of citizens from country, U.S. bases)} \quad (13)$$

$$\Omega = \Omega \text{ (distance, bases, VOA, English, number of persons from country, literacy rate),} \quad (14)$$

where  $Y_1 > 0$ ,  $Y_2 < 0$ ;  $\xi_1, \xi_2 < 0$ ;  $C_1 > 0$ ;  $C_2, C_3 < 0$ ;  $\Omega_1 < 0$ ; and  $\Omega_2, \Omega_3, \Omega_4, \Omega_5, \Omega_6 > 0$ .

In expression (11) we assume that among countries with a given level of literacy, higher levels of per-capita GNP indicate that returns to skills are more highly rewarded; opportunity costs of migration to the United States are thus relatively high for migrants from high-GNP countries. For given levels of income, however, higher levels of literacy must be associated with lower returns to skills and lower opportunity costs for the skilled. Thus, while only relatively high-income individuals will immigrate and remain in the United States from high-GNP countries, the opposite may be true for high-literacy countries (for given per-capita GNP levels). We also assume, in expression (12), that centrally planned, authoritarian countries are relatively unattractive (for given economic and social conditions) as are high inflation rates; immigrants from such countries would thus exhibit, *ceteris paribus*, lower earnings in the United States, as they would require less favorable economic returns in the United States to immigrate or to remain.

Relation (13) incorporates the conventional notion that distance is an important determinant of the direct costs of migration. The migration-cost function also reflects the constraints and opportunities associated with U.S. immigration law. During the historical period on which this research focuses, U.S. immigration law has facilitated the entry of the foreign-born spouses, parents, and minor children of adult U.S. citizens. However, from 1965 to 1978 the law provided additional opportunities for the immigration of Eastern Hemisphere relatives of U.S. citizens and immigrants (for example, siblings of U.S. citizens,

spouses of immigrants, and adult children of U.S. citizens and immigrants). Thus, for persons residing in the Eastern Hemisphere who have relatives in the United States, migration barriers are significantly lower, a more likely occurrence the higher the number of U.S. citizens and immigrants from the individual's country. The stock of immigrants would be irrelevant and the stock of naturalized citizens less relevant, however, for natives of Western Hemisphere countries, to whom (numerically limited) visas were allocated on a first-come, first-served basis subject to screening by employment criteria (labor certification).

As noted above, an important feature of U.S. immigration law is that it permits the unlimited immigration of the foreign-born spouses of U.S. citizens. Thus, a side effect of placing a U.S. military base in a given country is to increase opportunities for citizens of that country to immigrate. Accordingly, residents of countries with large numbers of emigrants who became naturalized citizens of the United States or countries that host U.S. military bases face lower direct immigration costs than do inhabitants of other countries, and thus they do not "require" as high economic returns to immigration; they should be characterized by lower earnings, *ceteris paribus*, relative to U.S. immigrants from other countries.

While a country's distance from the United States serves to screen for high-earnings immigrants (to the extent that distance adds to the costs of migration), if distance also impedes information dissemination, then immigrants from more distant countries may also be less informed about the United States and a higher proportion may have low realized earnings. Moreover, distance also serves as an impediment, symmetrically, to return migration, as noted above. Thus, immigrants who are from distant countries and who have low realized incomes are more likely to remain in the United States. Other characteristics of countries that we assume to facilitate information dissemination and thus lead to fewer low-outcome immigrants are whether or not the VOA broadcasts in one of the country's languages, whether or not English is an official or prevalent language, the literacy rate, and the number of individuals from that country in the United States, who may be an important information source for new, potential immigrants. A U.S. military base may also serve as a source of information about the United States to residents of the host country; the net association between the presence of a U.S. base and the realized incomes of the emigrants from that country, given relation (13), is thus ambiguous.

## B. Samples of the U.S. Foreign Born

To study the relationships between the origin-country characteristics and the earnings of the U.S. foreign born, information on earnings of the foreign born, their country of origin, and length of stay in the United States is required. We use two microdata files, which are merged with the set of country-specific variables. The first is a 10 percent random sample of foreign-born males aged twenty-one to sixty-five years who reported entering the United States between 1970 and 1980, drawn from the 5:100 A-Sample of the Public Use Tapes of the 1980 Census. The Census has been a principal data source for studies of differences in earnings among country of origin and ethnic groups. This cross-sectional data base, however, has two limitations. First, the foreign-born population is heterogeneous in legal status—a mixture, in unknown proportions, of legal immigrants (permanent resident aliens), of legal holders of a variety of nonimmigrant visas, and of deportable aliens (including persons who overstayed or who otherwise failed to comply with the terms of a legal nonimmigrant visa). Since statutory visa status is associated with important employment constraints that will affect earnings (Jasso and Rosenzweig, forthcoming) and since the composition of the foreign born may differ significantly by country of origin, some of the associations between country characteristics and foreign-born earnings may be obscured by such heterogeneity. Second, the census data do not permit separate analyses of emigration and immigration; foreign-born entry cohorts represented in a given year are the survivors of original entrants.

The second data set we employ is a 1 in 100 sample of men aged 21 to 65 admitted to permanent resident status in fiscal year 1971, drawn from the Immigration and Naturalization Service's (INS) new-immigrant file for that year. The immigrant file includes information on age, date of admission to permanent residence, country of birth, whether or not the immigrant is adjusting status from a nonimmigrant status, and, if so, the date of admission to that nonimmigrant status. We have linked the new-immigrant records with the INS naturalization files so that for those members of the cohort sample who naturalized between July 1971 and February 1981 inclusive, data include as well the date of naturalization and occupation at the time of naturalization.

The advantage of the longitudinal INS data are that (1) the sample is homogeneous in legal status, (2) time in a legal status is more precisely defined compared with the Census, and (3) the determinants of the



original-entry cohort's decisions to naturalize can be estimated, permitting the identification of both the immigration and re-migration linkages between the earnings of immigrants who remain in the United States and their country of origin. This data base has two limitations, however. First, the data do not provide measures of wages or earnings, only of occupation. Second, while the data provide information on naturalization for the entire cohort sample, they provide longitudinal information on occupation only for the subset who naturalize. Thus, to estimate the determinants of economic status from these data requires the construction of a measure of the earnings associated with an occupation as well as attentiveness to the selectivity associated with the decision to naturalize.

Occupation in the INS data is recorded by the three-digit code used in the 1970 U.S. Census. These detailed occupational titles can be classified into fifty-three occupational groups (U.S. Bureau of the Census 1982, Table 58). We use this information to construct a cardinal measure of occupational attainment in which each occupation is represented by the log of the mean earnings of full-time, year-round male workers in the occupation group. To ensure that all observations are in constant dollars, all occupations were coded by the mean earnings in 1979. To assess comparability with the Census, we also constructed this same measure of occupational earnings for the 1980 Census sample.

The INS data enable construction of an exact measure of experience as a permanent resident and a less-precise measure of pre-immigration experience. Postimmigration experience is measured by the length of the period between the date of admission to permanent residence and the date of naturalization. Pre-immigration experience is measured by the length of the period between the date of admission to permanent residence and the date of admission to prior nonimmigrant status. In 1971, U.S. law did not permit status adjustment for natives of Western Hemisphere countries who were entering under "normal flow" immigration procedures. Thus, the only natives of the Western Hemisphere adjusting status in the INS sample are Cuban persons "paroled" into the United States during the political upheavals of the early 1960s. Our measure of preimmigration U.S. experience hence ignores the pre-immigration U.S. experience of all other natives of the Western Hemisphere and ignores as well experience not immediately prior to immigration and experience in an illegal status.

Table 1 contains the definitions of the country-specific variables and documents some of the considerable variation in these characteristics

Table 1. Characteristics of Countries of Origin of U.S. Immigrants and the U.S. Foreign Born, 1971 INS and 1980 Census Samples<sup>a</sup>

Variable	Western Hemisphere									
	Eastern Hemisphere					Western Hemisphere				
	Taiwan and Hong Kong	India	Japan	Philippines	Total <sup>b</sup>	Mexico	Canada	Cuba	Brazil	
GNP per capita, 1970 (\$)	1,331	156.3	5,274	370.5	1,264	1,100	7,113	551.0	993.9	
Literacy rate, percent, 1975	83.6	36.0	99.0	87.0	76.2	76.0	98.0	96.0	72.0	
Distance to U.S., miles	7,115	7,959	5,149	7,334	620	0	0	235	4,249	
English a principal or official language	.448	1	0	1	.120	0	1	0	0	
U.S. military base present	.328	0	1	1	.050	0	0	0	0	
Centrally planned economy	.157	0	0	0	.076	0	0	1	0	
Receives VOA broadcasts in native language	.626	1	1	1	1	1	1	1	1	
Inflation rate, percent per year, 1970-1978	11.1	9.1	8.2	13.4	19.1	17.5	9.4	0.0	30.3	
Number of persons from country in United States in 1970, arrived 1965-1970	10,050	25,100	26,200	52,800	68,100	101,300	58,100	115,200	1,250	
Number of naturalized U.S. citizens from country in 1970, arrived 1955-1965	18,049	3,000	14,100	13,200	51,307	80,800	52,900	66,800	575	
Sample number, Census foreign born, arrived 1970-1980	396	67	64	154	1,210	737	54	92	18	
Sample number, 1971 INS immigrant cohort	294	13	6	63	337	96	34	55	3	

<sup>a</sup>Foreign born in the Census who arrived between 1970 and 1980.

<sup>b</sup>Country characteristics weighted by foreign-born population represented in Census sample described in note a.

<sup>c</sup>Caribbean countries except Jamaica and Tobago excluded because of missing comparable information.

by major "sending" areas and countries. The table also suggests important compositional differences between the INS and Census samples with respect to country of origin. For example, Japan contributes 6 of the 584 Eastern Hemisphere INS male immigrants (or approximately 1 percent), but 64 of the 970 Eastern Hemisphere census foreign-born males (or about 6.6 percent); Mexico contributes 28 percent of the Western Hemisphere INS sample, but 61 percent of the comparable census sample. These results suggest that the ratio of immigrant visa holders to nonimmigrant visa holders or non-visa holders is not constant across origin countries, suggesting, in turn, that countries differ in the extent to which their nationals are constrained in the labor market (Jasso and Rosenzweig forthcoming).

Table 2 reports the means and standard deviations of the principal characteristics of the men in the Census and INS samples, stratified by hemisphere. A notable feature, revealed in the INS sample, is the difference between the two hemispheres in the propensity of immigrants to naturalize, a difference that might be anticipated given that the right to petition for (nonimmediate) relatives was until 1978 essentially confined to Eastern Hemisphere naturalized citizens. Of the 584 Eastern Hemisphere immigrants, 278 (or almost half) had naturalized by early 1981. In contrast, of the 337 Western Hemisphere immigrants, only 71 (or 21 percent) had done so. Indeed, the small number of Western Hemisphere naturalized persons makes it impossible to estimate a model of economic status using the Western Hemisphere subset of the INS sample.

### III. EMPIRICAL RESULTS

#### A. Census Sample

Tables 3 and 4 report estimates by hemisphere of the determinants of two measures of earnings attainment—the log of mean full-time earnings in the individual's occupation and the log of the hourly wage rate—for three specifications, based on the Census sample. In the first, country-of-origin influences are represented exclusively by proper-name dummy variables. In the second specification, the origin-country characteristic variables are added, and in the third specification the name dummy variables are excluded. Comparison of the estimates

Table 2. Characteristics of Immigrants and the Foreign Born, by Sample and Hemisphere

Variable/Sample:	Eastern Hemisphere		Western Hemisphere	
	1971 INS Cohort	1980 Census	1971 INS Cohort	1980 Census
Age, years	33.4 (9.47)	35.7 (10.4)	34.8 (10.9)	31.6 (9.19)
Black	— <sup>a</sup>	.0381 (.192)	— <sup>a</sup>	.291 (.288)
Pre-immigration U.S. experience, years	1.02 (1.96)	— <sup>a</sup>	.538 (1.38)	— <sup>a</sup>
Postimmigration U.S. experience, years <sup>b</sup>	6.49 (1.49)	— <sup>a</sup>	— <sup>a</sup>	— <sup>a</sup>
Entered the U.S. 1970-1974	1.0 (0.0)	.523 (.499)	1.0 (0.0)	.490 (.500)
Occupational earnings (log)	—	9.822 (.416)	—	9.578 (.328)
Hourly wage (log)	— <sup>a</sup>	1.853 (.753)	— <sup>a</sup>	1.504 (.725)
Occupational earnings at naturalization <sup>b</sup>	10.001	— <sup>a</sup>	— <sup>a</sup>	— <sup>a</sup>
Sample size	584	970	337	1210

<sup>a</sup>Not available for INS sample.

<sup>b</sup>For subset of immigrant sample who naturalized by 1981 (n = 278 for Eastern Hemisphere immigrants).

<sup>c</sup>Not available from Census.

<sup>d</sup>Sample size too small for multivariate analysis (n = 71).

Table 3. Determinants of Log of Occupational Earnings and Wage Rates: U.S. Foreign-born Males from the Eastern Hemisphere, Census Sample<sup>a</sup>

Variable	Log of Occupational Earnings			Log of Hourly Wage		
	(1)	(2)	(3)	(1)	(2)	(3)
Age	.0653 (7.64)	.0654 (7.67)	.0654 (7.70)	.0994 (5.83)	.0982 (5.78)	.0969 (5.74)
Age squared	-.000794 (7.53)	-.000788 (7.49)	-.000790 (7.54)	-.00116 (5.47)	-.00114 (5.40)	-.00113 (5.37)
Immigrated 1970-1974	.00815 (0.32)	-.00166 (0.06)	.00474 (0.18)	.176 (3.50)	.200 (3.92)	.200 (3.93)
Black	-.183 (2.57)	-.173 (1.77)	-.187 (2.55)	-.217 (1.49)	-.431 (2.20)	-.283 (1.72)
Europe	-1.83 (5.16)	-.0759 (1.12)	—	-.00624 (0.09)	-.107 (0.79)	—
Taiwan, Hong Kong	-.0227 (0.39)	.0224 (0.31)	—	-.0543 (.047)	.0695 (0.48)	—
India	.0289 (0.64)	.0130 (0.15)	—	.0962 (1.08)	.0142 (0.08)	—
Japan	-.105 (1.73)	-.0374 (0.38)	—	.0899 (0.75)	.0433 (0.33)	—
Philippines	-.217 (4.83)	-.166 (1.79)	—	-.0432 (0.51)	.168 (0.78)	—

GNP, 1970 ( $\times 10^{-4}$ )	—	.257 (2.24)	.244 (3.24)	—	.942 (4.31)	.836 (4.58)
Literacy Rate	—	-.00169 (1.08)	-.00166 (2.06)	—	-.00693 (2.25)	-.00509 (2.90)
Distance ( $\times 10^{-4}$ )	—	.365 (2.28)	.325 (2.90)	—	.0388 (1.84)	.0257 (1.17)
English language	—	.0294 (0.63)	.0570 (1.30)	—	.0678 (0.73)	-.0517 (0.67)
U.S. military base	—	-.0492 (1.12)	-.0457 (1.26)	—	-.0389 (0.48)	-.0109 (0.15)
Centrally planned	—	-.0660 (1.01)	-.0860 (1.58)	—	.0925 (0.73)	.0449 (0.42)
VOA broadcasts	—	.0825 (2.08)	.0491 (1.27)	—	.0278 (0.31)	.0578 (0.74)
Foreign born in the United States ( $\times 10^{-1}$ )	—	-.220 (0.83)	-.271 (1.81)	—	.186 (0.36)	.416 (1.49)
Naturalized citizens in the United States ( $\times 10^{-4}$ )	—	1.10 (0.29)	.833 (0.32)	—	-2.30 (0.31)	-7.10 (1.36)
Constant	8.71 (52.8)	8.57 (37.3)	8.45 (41.3)	-3.49 (1.06)	.165 (0.36)	-3.40 (0.87)

<sup>t</sup>-ratios are shown in parentheses beneath regression coefficients.

*Table 4. Determinants of Log of Occupational Earnings and Wage Rates: U.S. Foreign-born Males from the Western Hemisphere, Census Sample<sup>a</sup>*

<i>Variable</i>	<i>Log of Occupational Earnings</i>			<i>Log of Hourly Wage</i>		
	(1)	(2)	(3)	(1)	(2)	(3)
Age	.0231 (3.73)	.0220 (3.58)	.0220 (3.51)	.0296 (1.95)	.0274 (1.83)	.0276 (1.84)
Age squared	-.00320 (3.91)	-.000307 (3.78)	-.000286 (3.46)	-.00352 (1.76)	-.000328 (1.65)	-.000330 (1.62)
Immigrated 1970-1974	.00645 (0.36)	-.00945 (0.53)	.0195 (1.09)	.153 (3.16)	.168 (3.84)	.174 (4.02)
Black	-.0152 (0.45)	-.00443 (0.10)	-.0164 (0.41)	-.209 (2.57)	-.306 (2.78)	-.217 (2.34)
Mexico	-.169 (7.76)	-.106 (2.01)	—	-.163 (3.05)	-.0635 (0.48)	—
Canada	-.307 (6.48)	.0264 (0.10)	—	-.6773 (5.99)	.0932 (1.36)	—

Cuba	.0585 (1.47)	.153 (1.94)	—	.0209 (0.21)	.263 (1.37)	—
Brazil	.157 (2.10)	.0191 (0.22)	—	.148 (0.71)	-.0832 (0.35)	—
GNP 1970 ( $\times 10^{-4}$ )	—	5.66 (1.20)	.452 (3.71)	—	2.58 (2.15)	.863 (3.03)
Literacy Rate ( $\times 10^{-4}$ )	—	-.2549 (0.17)	1.04 (1.33)	—	-.551 (0.16)	4.13 (2.19)
Distance ( $\times 10^{-3}$ )	—	.690 (2.23)	1.05 (8.43)	—	1.20 (1.59)	1.35 (4.43)
English language	—	.00995 (0.14)	.0896 (1.48)	—	.173 (0.99)	.212 (1.50)
U.S. military base	—	-.0627 (1.34)	-.0120 (0.30)	—	-.00822 (0.07)	.00533 (0.06)
Constant	9.26 (83.2)	9.17 (70.7)	8.98 (72.3)	-.800 (2.95)	.475 (1.50)	.238 (0.80)

t-ratios are shown in parentheses beneath regression coefficients.



from the first and second specifications permits a test of the hypothesis that the country-dummy coefficients are merely proxies for the operation of country-of-origin influences on migrant selectivity, since if the country characteristics we have measured capture these factors to a significant extent, their inclusion in the second specification should reduce or even eliminate earnings differences across named foreign-born groups.

The regressors included in all of the census-based occupational-earnings and wage equations to characterize personal attributes are the individual's age and its square and dummy variables indicating the individual's race and whether the person entered the United States between 1970 and 1974. The country characteristics included to capture the operation of origin-country conditions and U.S. immigration-law factors that influenced the decision to migrate as well as the accuracy of the immigrant's predictions about life in the United States are those listed in Table 1, except that the Western Hemisphere specifications exclude VOA broadcasts, since all countries in that hemisphere receive native-language VOA broadcasts, and the foreign-born and naturalized-citizen stock variables, which represent sources of U.S. visa entitlements primarily for the Eastern Hemisphere (until 1978).<sup>3</sup>

In Table 3, which reports the Eastern Hemisphere results, comparison of specifications (1) and (2) for occupational earnings indicates that inclusion of the set of country characteristics completely eliminates the influence of the country dummy variables. In the first specification, which excludes the country characteristics, the results suggest that, compared with the other foreign born from the Eastern Hemisphere, those individuals from Europe, the Philippines, and Japan are in occupations with significantly lower earnings, controlling for age and quinquennium of entry. However, all of these named-country differentials become statistically insignificant in the second specification which includes country-specific conditions. In contrast, the set of country-characteristic variables is statistically significant (F-test, 1 percent level).

All of the signs of the country-characteristic coefficients conform to the implications of our framework, although only three of eight are statistically significant at conventional levels. In particular, those migrants from high-GNP countries and from distant countries appear to be in high-earnings occupations, suggesting the importance of both opportunity and direct migration costs in migration decisions. Moreover, migrants from countries receiving VOA broadcasts appear to be in

higher-earnings occupations, suggesting the possibility that such broadcasts provide useful information about the United States. Finally, there is marginal support for the hypothesis that migrants from less-attractive centrally planned, authoritarian countries have lower occupational earnings.

The second set of specifications in Table 3 highlights the effects of origin-country influences on the foreign-born person's actual wage in the United States. The first-column estimates indicate that the named country of origin is not significantly associated with the wage of the Eastern Hemisphere foreign born. Thus, there is not much for the country characteristics to remove. However, the operation of the country characteristics in the third specification is qualitatively the same as for the measure of occupational earnings attainment, except for the effects of a centrally planned economy and the two stock variables. Of these, only the latter approach statistical significance. These results hint at differences between the process of climbing the occupational ladder and the process of increasing one's wage within an occupation.

Table 4 repeats the analyses of Table 3 for the Western Hemisphere foreign born in the Census sample. In the first specification of occupational earnings excluding country characteristics, the coefficients for Mexico, Canada, and Brazil are strongly statistically significant, and that for Cuba approaches significance as well, indicating that Canadian and Brazilian males are significantly more likely to be in occupations with higher mean earnings compared with the left-out group (non-blacks from all the remaining Hispanic countries in the Western Hemisphere), while Mexicans are in occupations with lower mean earnings compared with all the other Western Hemisphere groups. Inclusion of the country characteristics eliminates the difference between foreign-born Brazilians, Canadians, and Hispanics and reduces the Mexico differential by 37 percent. However, the Cuba effect almost triples. Thus, migrants from Mexico appear to be in occupations with mean earnings 10 percent lower than all migrants, net of country characteristics, while migrants from Cuba are in occupations with mean earnings that are 15 percent higher compared with all Western Hemisphere migrants, even when country characteristics are taken into account.

The partial immutability of the negative Mexico occupational-attainment differential to the inclusion of country characteristics may reflect the operation of legal status, as a larger proportion of the Mexico-origin foreign born, compared with other groups, may be in illegal status or may hold nonimmigrant visas, as suggested by the dif-

ferential in sample proportions for Mexicans in the immigrant and census samples in Table I. The anomalous positive occupational attainment of Cubans may in part reflect their initial special status as refugees, which made them beneficiaries of resettlement programs not provided to other foreign-born migrants.

The named-country differentials in the hourly-wage specification excluding country characteristics conform to the pattern displayed in the comparable occupational-earnings specification, with the negative Mexico and positive Canada wage effects again highly statistically significant. Here, however, inclusion of the country characteristics eliminates all country-specific differences; the set of country wage coefficients loses statistical significance when differences in country characteristics are accounted for, although, as in the occupational-earnings specifications, the positive Cuba "effect" increases (but not to statistical significance). Observed hourly-wage differences between the foreign-born Mexican population and other foreign-born populations, noted in almost all studies of immigrant or ethnic earnings determination, thus appear to be wholly explained by Mexico's unique combination of two important factors determining who immigrates to and remains in the United States—distance and per-capita GNP. These factors appear to be positively and significantly correlated with the wage and occupational earnings of the foreign born from both hemispheres. Of all countries, Mexico is (with Canada) the shortest distance from the United States but, unlike Canada, has in addition relatively low per-capita income.

### B. INS Sample

The estimates from the Census samples indicate that observed earnings differences across country-of-origin groups in the United States can be in part or wholly accounted for by the differing characteristics of the countries from which the foreign born have emigrated. Support for the hypothesis that the correlations between country attributes and the mean earnings of origin-specific groups arise out of the immigration and re-migration decisions of both non-U.S. residents and U.S. immigrants was also indicated. The Census data do not permit, however, an assessment of the relative importance of the two forces of selectivity—that associated with immigration and that associated with re-migration—since the foreign born represented in the census are the "survivors" of both filtering processes.

The INS data, as noted, allow us to observe the naturalization decisions of a complete immigration cohort from the time of their admission to permanent resident status. Since naturalization entails, for almost all immigrant groups, the relinquishing of rights in the origin country, the decision to naturalize presumably implies a commitment to remain in the United States (although not the reverse). Estimates of the determinants of naturalization thus may provide information about how country-of-origin characteristics describing home-country attractiveness, migration costs, and pre-immigration information influence the earnings characteristics of remaining immigrant groups defined by named countries via the selective re-migration of immigrants. Estimates of the determinants of the earnings of naturalized immigrants *corrected for the selectivity associated with the naturalization decision* then may permit identification of the forces associated solely with the immigration decision.

As discussed, the country characteristics most important in influencing the decision by an immigrant to remain in the United States are those that affect the accuracy of the immigrant's prediction about his own well-being in the United States and those affecting a new calculation about well-being in the origin country after immigration. Accordingly, we include in the naturalization equations, in addition to those origin-country variables used in the earnings and wage estimates, GNP in 1978, the average annual inflation rate in the period 1970–1978, and the quality of reception in the United States of the origin-country's shortwave broadcasts, as measured by the five-point SINPO rating scale, with five representing the highest quality. The first two are variables that could not have been perfectly forecast at the time of the decision to immigrate to the United States but that clearly might influence the decision to emigrate.

### 1. *Naturalization Probabilities of Immigrants*

Maximum-likelihood probit estimates of the naturalization equation estimated from the complete immigrant samples are reported in Table 5. In both hemisphere-specific samples, age at admission to permanent-resident status is negatively, and highly statistically significantly, related to the decision to naturalize. This suggests that the longer the remaining life span, the greater are the perceived returns to naturalization, both in the occupational sphere and through entitlements for the immigration of kin. Pre-immigration time in the United States is not significant in either hemisphere.

Table 5. Maximum-Likelihood Probit Estimates: Determinants of Naturalization, by Hemisphere, for the 1971 Cohort of Male Immigrants, INS Sample<sup>a</sup>

Variable	Eastern Hemisphere		Western Hemisphere	
Age at immigration	-.0280 (4.35)	-.0327 (4.74)	-.0159 (1.66)	-.0206 (1.96)
Pre-immigration time in United States	.00784 (0.26)	.00496 (0.15)	-.0565 (0.57)	-.0719 (0.64)
GNP, 1978 ( $\times 10^{-3}$ )	—	.0792 (1.00)	—	-.948 (1.83)
Literacy rate	—	.00921 (1.56)	—	.127 (2.24)
Distance ( $\times 10^{-4}$ )	—	.0216 (0.15)	—	-.664 (1.64)
Inflation rate, 1970-1978 $\times 10^{-3}$	—	.535 (2.04)	—	.143 (1.54)
English language	—	-.425 (2.21)	—	-1.36 (1.92)
Centrally planned	—	1.34 (2.44)	—	—
U.S. military base	—	.373 (1.47)	—	1.68 (2.23)
VOA broadcasts	—	.567 (2.57)	—	—
SINPO rating	—	-.255 (2.08)	—	-.301 (1.34)

Number of foreign born in the United States ( $\times 10^{-2}$ )	—	.233 (1.86)	—	—
Number of naturalized citizens in the United States ( $\times 10^{-1}$ )	—	-.986 (1.36)	—	—
Europe	-.840 (5.81)	-.832 (2.05)	—	—
Taiwan, Hong Kong	.233 (0.57)	.732 (1.19)	—	—
India	-.149 (0.82)	.0115 (0.021)	—	—
Philippines	.535 (2.46)	.0487 (0.11)	—	—
Mexico	—	—	-1.02 (2.92)	-.270 (0.38)
Canada	—	—	-3.59 (0.27)	3.63 (0.20)
Cuba	—	—	1.27 (2.84)	-.267 (0.22)
Brazil	—	—	.220 (0.29)	3.83 (2.15)
Constant	1.28 (5.19)	-.15 (0.02)	-.212 (0.63)	-1.02 (0.83)
Chi-squared	109.5	154.5	78.0	96.6

\*Asymptotic t-ratios are shown in parentheses beneath the coefficients.

In the Eastern Hemisphere specification that excludes country characteristics, the Europe and Philippines dummy coefficients of the set of Eastern Hemisphere named-country dummy variable coefficients are statistically significant. Natives of European countries appear to have a strongly lower propensity to naturalize than do natives of other Eastern Hemisphere countries, while natives of the Philippines exhibit significantly higher naturalization propensities. Inclusion of the country characteristics in the second specification eliminates the Philippines differential, but the coefficient for Europe remains virtually unchanged and its statistical significance, although reduced, remains very high.

In the Western Hemisphere subsample, there are also apparent significant differences among named-country groups in naturalization probabilities in the specification excluding country characteristics. In particular, the results from that specification replicate what is well known from published tabulations—that natives of Mexico have “very low” and natives of Cuba “very high” naturalization rates. Inclusion of the country characteristics, however, removes both the Mexico and the Cuba differentials and, indeed, changes the sign of the Cuba effect to negative. The coefficient for Canada remains insignificant. The coefficient for Brazil, on the other hand, becomes strongly statistically significant and its coefficient increases in magnitude by a factor of about 17.

Thus, it would appear that the set of country characteristics we have included in the naturalization equations are capturing the operation of most, but not all, of the factors associated with named countries. The variables we measured (for example, GNP, a centrally planned economy, distance, language, and so forth) appear to account for the apparently distinctive naturalization behavior of immigrants from the Philippines, Cuba, and Mexico; they only do not account for the distinctive behavior of Europeans. On the other hand, only when our measured country characteristics are “controlled for” do we find that it is the group of immigrants from Brazil that exhibit exceptionally high naturalization propensities.

The most important country-specific factors determining naturalization for Eastern Hemisphere immigrants are those associated with information and country attractiveness, rather than migration costs or home-country income. While neither GNP nor distance is statistically significant, Eastern Hemisphere immigrants from countries with a high inflation rate and with a centrally planned authoritarian economy are, as expected, much more likely to naturalize. The better the reception in

the United States of the origin country's shortwave broadcasts, the lower the propensity to naturalize, suggesting that (net of other measured factors) countries with sophisticated broadcast equipment tend to be otherwise attractive as places to which to return. Also as predicted, natives of countries to whom the VOA broadcasts in a native tongue are more likely to naturalize, their decision to immigrate presumably having been better informed. On the other hand, coming from a country where English is widely spoken leads to a reduced propensity to naturalize, suggesting that such countries, other things the same, may be attractive as places to live or have passports that are desirable to hold.

Literacy rate and the presence of U.S. military bases operate in the predicted direction, from the point of view of providing information about the United States, but do not reach high levels of statistical significance. In the case of the literacy rate, we noted that it operates in two opposing ways, not only being associated with the quality of information but also reflecting, for given per-capita GNP levels, lower returns to skills in the home country, and thus lower opportunity costs of immigration. While the operation of information appears to dominate, it does not do so strongly enough to yield high significance.

The two variables describing the U.S. stock of co-nationals operate as predicted. Recent entrants appear to provide information about the United States to their compatriots in their origin country, hence increasing the probability that the decision to immigrate was well informed and inducing higher rates of "commitment." The coefficient of the stock of naturalized citizens, on the other hand, while slightly below conventional levels of statistical significance, is negatively signed. Since Eastern Hemisphere immigrants from countries with larger numbers of naturalized U.S. citizens are more likely to acquire visas as relatives, they would themselves have a reduced need to naturalize in order to make use of immigration entitlements.<sup>4</sup>

In the Western Hemisphere, the country characteristics operate somewhat differently, due in part to the different immigration-related benefits accorded naturalized Western Hemisphere immigrants (until 1978) and to the different selection mechanisms associated with immigration. As in the Eastern Hemisphere, the literacy rate, inflation rate, and U.S. military base variables are positively signed, while the English-language and SINPO-rating variables are negatively signed. However, here GNP and distance are statistically significant determinants of naturalization. Origin-country GNP has a strong negative ef-



fect, indicating that, as predicted, the higher a country's GNP the more attractive it is as a country to which to return; thus, presumably among persons from such countries, only those with more favorable income realizations will remain in the United States. Distance also has a negatively signed coefficient, suggesting that the information element may dominate the costs element with respect to the re-migration decision. The stronger negative GNP effect on naturalization rates for Western Hemisphere immigrants compared with that for Eastern Hemisphere immigrants, who because of the hemispheric differences in U.S. legal entry criteria tended to have a higher proportion of "family" migrants, was evidently reflected in the Census earnings estimates, where origin-country GNP per capita exerts a stronger positive influence on the earnings of the foreign born from the Western Hemisphere than on the earnings of Eastern Hemisphere migrants.

## 2. *Economic Status of Immigrants*

To estimate the country-of-origin influences on the economic status of legal immigrants, we estimate the occupational earnings equations on the subset of the INS cohort who naturalize. Unfortunately, as noted above, there are not enough naturalized cases in the Western Hemisphere INS sample to sustain a multivariate analysis of economic attainment for that immigrant subgroup. Thus, we restrict analysis of the economic attainment of legal immigrants to natives of the Eastern Hemisphere.

As in the census data, the sample of immigrants from which we can estimate the determinants of earnings represents a self-selected subsample, in this case those among (also self-selected) immigrants who decided to become U.S. citizens within eleven years after becoming immigrants. However, for this sample, unlike for the Census, we can estimate the determinants of the sample selection rule associated with naturalization, as in Table 5.<sup>5</sup> Heckman (1979) has shown that if the unmeasured characteristics influencing sample selection and (log) earnings are jointly normally distributed, then the influence of the selectivity associated, in this case, with nonmigration and naturalization can be "taken out" of the earnings estimates, by first estimating the sample inclusion (naturalization) equation from the whole sample using probit and then including in the earnings equation estimated from the self-selected subsample the associated Mills-ratio ( $\lambda$ ) estimate. The "corrected" estimates of earnings in our case yield the determinants of

immigrant earnings solely as a function of immigration selectivity, that is, net of re-migration selectivity. The inclusion of the Mills-ratio variable in the earnings equation not only purges out the naturalization *cum* re-migration selectivity effects in the occupational-earnings equation, but as well its coefficient provides a consistent estimate of the covariance between the unmeasured characteristics in the occupational-earnings and naturalization (sample inclusion) equations. To the extent that persons who do not naturalize are qualitatively similar to persons who emigrate, we thus can detect the direction and importance of emigration selectivity associated with unmeasured as well as measured variables.

Separating out immigration from re-migration or naturalization selectivity effects using the Heckman procedure requires that we have a plausible set of variables that influence the decision to stay and naturalize (sample inclusion) but that do not influence earnings directly or via the original decision to immigrate. In our case, only the postimmigration, origin-country inflation rate (1970–1978) and per-capita GNP (1978) and the SINPO rating variables serve as identifying instruments, apart from the nonlinearities inherent in the probit specification. Moreover, the sample size for the Eastern Hemisphere subsample of naturalized citizens is relatively small, only 248, so that our estimates may be relatively imprecise.

Table 6 reports estimates from four specifications of the log of occupational earnings at naturalization, for the INS Eastern Hemisphere sample of male legal immigrants. The first two columns report OLS and selectivity-corrected (SC-OLS) estimates of the restricted model in which all origin-country influences are represented only by dummy variables. Except for India, all of the dummies are negatively signed, with those for Europe and Japan strongly statistically significant. There is not much difference between the estimates in the two specifications, suggesting that, as confirmed by the marginal significance of the inverse Mills-ratio variable and subject to the strength of the identifying instruments, emigration selectivity does not strongly affect the earnings estimates for the Eastern Hemisphere.

The third column reports estimates from the specification including both the country dummies and the country-condition variables. All of the coefficients of the country dummies lose their statistical significance when country characteristics are included except that for Japan, which remains negative and marginally significant. As in the Census sample, the set of named-country variables is not statistically

Table 6. Determinants of Log Occupational Earnings at Naturalization: 1971 Cohort of Eastern Hemisphere Male Immigrants, INS Sample

Variable	Specification/Estimation Procedure		
	OLS	SC-OLS	SC-OLS
Age	.0988 (3.51) <sup>*</sup>	.0973 (3.55) <sup>*</sup>	.108 (3.84) <sup>*</sup>
Age squared	-.00114 (3.39)	-.00109 (3.30)	-.00123 (3.28)
Pre-immigration experience	.0358 (3.00)	.0325 (2.71)	.0326 (2.67)
Postimmigration experience	.0476 (0.55)	.0418 (0.49)	.0418 (0.49)
Postimmigration experience squared	-.00340 (0.54)	-.00530 (0.86)	-.00522 (0.84)
Europe	-.303 (4.85)	-.228 (2.73)	-.0778 (0.28)
Taiwan, Hong Kong	-.0487 (0.37)	-.0495 (0.38)	.0116 (0.08)
India	.0817 (1.14)	.114 (1.54)	-.0582 (0.36)
Japan	-.523 (2.17)	-.476 (2.02)	-.585 (1.74)
Philippines	-.106 (1.50)	-.134 (1.84)	-.202 (1.02)
			.105 (3.76) <sup>*</sup>
			-.00118 (3.37)
			.0354 (3.05)
			.0805 (0.97)
			-.00755 (1.24)
			—
			—
			—
			—

GNP, 1970 ( $\times 10^{-3}$ )	—	—	.910 (1.53)	-.426 (0.93)
Literacy rate	—	—	-.00177 (0.44)	-.00152 (0.59)
Distance ( $\times 10^{-3}$ )	—	—	.142 (2.57)	.0836 (2.86)
English language	—	—	.145 (0.82)	.194 (1.67)
Centrally planned	—	—	.115 (0.66)	.120 (1.15)
U.S. military base	—	—	.147 (1.51)	.118 (1.45)
VOA broadcasts	—	—	-.0422 (0.19)	-.0507 (0.35)
Number of foreign born in the United States ( $\times 10^{-3}$ )	—	—	-.337 (0.06)	-5.02 (1.96)
Number of naturalized citizens in the United States ( $\times 10^{-3}$ )	—	—	-.0836 (0.24)	.221 (0.86)
Constant	8.16 (14.0)	8.25 (14.4)	7.21 (8.61)	7.30 (9.36)
$\lambda$	—	-.148 (1.31)	-.101 (0.24)	-.139 (0.88)
Chi-squared $p^2$	89.1	103.0	122.7	112.6
	—	.146	.0716	.128

<sup>a</sup>t-ratios are shown beneath regression coefficients.

<sup>b</sup>Selectivity-corrected t-ratios are shown beneath regression coefficients.

significant in the full specification, while country characteristics as a whole are statistically significant. Also, as in the Census sample, both per-capita GNP and distance are positively related to occupational earnings, with GNP only marginally statistically significant, however. Of the remaining country variables, only the presence of a U.S. military base approaches statistical significance; its coefficient is positive, consistent with the positive effects of information.

When the equation is estimated without the (insignificant) country dummies, the English-language variable and the number of natives among recent entrants to the United States achieve marginal statistical significance. The effect on occupational earnings of coming from a country where English is spoken is positive, as was found in the Census samples—a finding consistent with such immigrants having superior pre-immigration information as well as the advantage in the U.S. labor market of possessing English-language skills.

Inclusion of all the origin-country characteristic variables evidently leads to rejection of the hypothesis that the selectivity associated with naturalization significantly affects the parameter estimates for the Eastern Hemisphere immigrants. However, immigrants from the Eastern Hemisphere tend to have significantly higher naturalization *and* significantly lower emigration rates (Jasso and Rosenzweig 1982) compared with Western Hemisphere immigrants. The association between country of origin and occupational attainment thus appears to be mainly due to the selectivity associated with immigration decisions and the admission criteria of U.S. immigration law for the Eastern Hemisphere foreign born, but differences across Western Hemisphere immigrant groups may possibly reflect the influence of both immigration and re-migration forces.

#### IV. CONCLUSION

The empirical association between an immigrant's earnings in the United States and his country of origin is well documented. This paper has proposed a model in which the two fundamental behavioral decisions—to immigrate to a given country and, subsequently, to remain there—are based on a comparison of predicted maximum well-being in the origin and destination countries and which, hence, predicts the effects of three sets of origin-country factors on observed

earnings in the destination country. The three sets of factors are (1) the opportunity costs of migration, (2) the direct costs of migration, and (3) the quantity and quality of information available in the origin country about the destination country.

Estimates based on samples of the foreign born in the United States and recent U.S. immigrants, combined with origin-country characteristics, provide support for the hypothesis that characterizing the country of origin by its relevant attributes (relevant to the three sets of factors just cited) rather than by a dummy variable for its proper name would destroy the observed association between a country's proper name and the U.S. earnings of its emigrants. These results thus imply that changes in the earnings of foreign-born persons in the United States may depend as much on changes in the economic conditions of origin countries, changes in travel costs, changes in information dissemination, and changes in U.S. immigration policy as on changes in the U.S. labor market.

## ACKNOWLEDGMENTS

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## NOTES

1. We ignore relative prices, for simplicity. Note that differences in relative prices across origin and potential destination countries also may influence the migration decision and therefore migration selectivity.

2. We are assuming, again for simplicity, risk neutrality.

3. We estimated a specification including the naturalized-citizen stock variable for the Western Hemisphere sample, but its coefficient did not attain statistical significance and its magnitude was very small, suggesting that natives of the Western Hemisphere who do immigrate to the United States as spouses of U.S. citizens marry native-born U.S. citizens rather than persons from their own country who became naturalized citizens of the United States.

4. For example, given a family of six siblings, only the naturalization of one is required in order to sponsor the immigration of the remaining five.

5. Naturalized immigrants not reporting an occupation, less than 5 percent of the naturalized subgroup, are also selected out of the earnings subsample. The selectivity-corrected estimates reported below also take into account nonreporting. The probit sample-inclusion estimates are almost identical to the probit naturalization estimates reported in Table 5.

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# EMIGRATION, EMPLOYMENT, AND ACCUMULATION: THE MINERS OF SOUTHERN AFRICA

Robert E. B. Lucas

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## ABSTRACT

A simultaneous model of the determinants of international migration, formation of domestic wage and employment, and both short- and long-run effects of emigration on agricultural development is presented and estimated. The context is of a massive circular, male migration to the South African mines from Botswana, Lesotho, Malawi, Mozambique, and the South African "homelands," between 1946 and 1978. The emergence of a Marxist state in Mozambique (displacing a Portuguese regime with a modern history of widespread forced labor), the termination by Malawi of mine recruiting (apparently to protect local estate owners from competition for labor, reviving in extreme form an earlier British colonial practice), and the compulsory relocation of 3.5

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million South African blacks in alien "homelands" have all contributed to a dramatic, recent reshaping of the mine labor market. The paper, of necessity, incorporates and discusses these political and institutional changes within the model.

Although numerous internal migration functions have been estimated in various contexts, little econometric evidence exists on the determinants of international migration.<sup>1</sup> Neither for internal nor international migration have the consequences for capital accumulation in the sending area been much researched.<sup>2</sup> Whether emigration, particularly from less developed areas, serves to raise the domestic wage or only to diminish a labor surplus remains neglected. These three interrelated themes are analyzed here in a particular context, that of migration to the South African mines from five developing areas: Botswana, Lesotho, Malawi, Mozambique and the South African "homelands."<sup>3</sup> The period of analysis extends from 1946 until about 1978, depending upon data availability and relevance in the particular country.

The magnitude of miner recruitment and hence the potential effects on the labor-supplying economies are certainly comparatively large. At about the time of the 1970 censuses, the stock of men employed in the South African mines relative to the *de jure* male population ages 18 to 35 exceeded 80 percent for Lesotho, was close to 50 percent for Botswana, and about 15 percent even for Mozambique where the proportion was lowest.

The continuation of this circular migration by younger men for more than a century has profoundly affected the economies, political relations and social structures of the region, leading many to question the net benefits to labor-supplying countries.<sup>3</sup> Certain of these doubts are beyond the scope of the present study: the substantial external costs imposed by miners returning with tuberculosis or venereal diseases; the proliferation of single-parent households; the risks inherent in continued dependence on South Africa; or the political costs to front-line nations in implicitly supporting the apartheid regime. However, some of the doubts also hinge on the more limited range of economic issues considered here.

In fact, the economic consequences of diminished flows have been dramatically emphasized to both South Africa and the labor-supplying countries since 1974. In just three years, the number of foreign men employed in the mines fell from over 400,000 to below 250,000 as profound shifts in the political economy of the region induced policy shifts by both suppliers and importers of labor. With the advent of a

Marxist state in Mozambique (displacing a Portuguese regime with a modern history of forced labor), with suspension of recruiting in Malawi as estate owners pressed for a protected source of labor, and as compulsory relocation of the black populace in alien "homelands" increased the need for local employment of South Africans, the various states intervened directly to limit the flows of labor. Indeed, it is precisely the potential for such direct intervention and the relative ease of enforcement that distinguish determinants of international migration from those of internal mobility (at least in the absence of an internal pass system).

In a previous paper, I examined the structural break, after 1974, in the monopsonistic demand for mine labor in South Africa (Lucas 1985(b)). The present paper is essentially the corollary of that story, turning now to the supply side of the market. Section I outlines a stylized model of four elements: the determinants of mine migration; the effects of savings from mine earnings on productivity in traditional crop growing; investments in cattle, a major form of wealth in the region; plus wage and employment determination in the estate-plantation economies. Section II then modifies these stylized forms according to local conditions in each of the five contexts. Section III presents estimates of the simultaneous system of equations, derived from annual time series data, and Section IV closes the paper.

## I. A STYLIZED APPROACH

Certain elements of the four main blocks of the model are sufficiently similar, regardless of context, to warrant joint discussion within the present section, before turning to the specifics of each country.

### A. MINE MIGRATION

In Lucas (1985(b)) I showed that, from 1974 onwards, the South African mining houses, acting in concert through their centralized recruiting agency, exercised a preference for "domestic" (South African including the so-called Black States) workers. Thus, after 1974, the market for foreign recruits did not operate on its supply curve. Moreover, as is described in Section II, some of the sending countries imposed limits on the numbers of recruits during certain intervals. From any country the number of men employed in the mines,  $m$ , is therefore determined by one of two processes: equality with a quota,

$\bar{m}$ , imposed by the sending country or, after 1974, by the mining houses; or by a clearing process in a monopsonistic market with employment equal to supply.

In contrast to the Harris-Todaro (1970) model, no gamble with respect to likelihood or terms of employment prevails at the mine destination (though life, limb, and pride are certainly at risk). Recruits contract for a definite wage and fixed period of employment, after which they must be repatriated according to South African law.<sup>4</sup> The wage is known before migrating since recruitment occurs at depots scattered throughout the sending countries. Even working conditions are probably well understood by novices, for most are preceded by relatives. On the other hand, to remain at home does involve a gamble, both in the chances of finding paid employment and in the chances of crop failure on one's own land. Reversing Harris-Todaro but retaining their risk-neutrality assumption, mine migration from a given country may then be expressed as:

$$m = \begin{cases} \bar{m} & \text{if a quota prevails,} \\ m(w'_m - \bar{w}, n) & \text{otherwise,} \end{cases} \quad (1)$$

where  $\bar{w}$  is the expected pay if one remains at home,  $w_m$  is the real mine wage, and  $n$  is the male population within the potential recruitment age. The expected home pay is a weighted sum of remunerations from potential wage employment and returns to own account agriculture.<sup>5</sup> No matter whether a marginal product or average product story is told with respect to family labor application in agriculture, the implicit reward in this activity is some function  $p \cdot g(q, \ell)$  where  $p$  is the price of traditional crops,  $q$  is output, and  $\ell$  is labor involved in peasant agriculture. In addition, the expected wage if one seeks paid employment may be written  $w \cdot e / (n - m)$  where  $w$  is the domestic wage-rate and  $e$  is the extent of domestic male employment. Thus, the expected pay for those who remain in the country is:

$$\bar{w} = \frac{w}{c} \cdot \frac{e}{n - m} + \frac{p}{c} \cdot g(q, \ell) \cdot \left( 1 - \frac{e}{n - m} \right) \quad (2)$$

if  $c$  denotes the cost of living in the home country. But what of the real mine wage? This is complicated by the fact that although some of the mine earnings are spent while in South Africa, a substantial fraction (approximately 60 percent on average) is remitted or sent as deferred

pay for spending in the home country. The real mine wage is therefore written  $f \cdot w_m / (.6c + .4c_m)$  where  $c_m$  is the cost of living in South Africa,  $w_m$  is the nominal mine wage, and  $f$  is the foreign exchange rate between the South African Rand and local currency (where applicable). Assuming both  $n$  and  $\ell$  are increasing functions of total population,  $N$ , and adopting a linear form of the migration function, (1) may then be rewritten for nonquota periods as:<sup>a</sup>

$$m = \mu_0 + \mu_1 \left[ \frac{w_m}{.6c + .4c_m} - \frac{w}{c} \cdot \frac{e}{n - m} \right] + \mu_2 \cdot \frac{p}{c} \cdot \frac{q}{n - m} + \mu_3 \cdot N \quad (3)$$

in which  $\mu_2 \leq 0$  and  $\mu_3 \geq 0$ . It might be expected that  $\mu_1 \geq 0$ , but a backward bending supply response cannot be ruled out, a priori, particularly if miners are target savers (see Lipton 1980). Equation (3) gives the basic form of the migration function to be estimated here, but some modifications for particular circumstances are necessary in Section II.

## B. Own Account Crop Production

Almost no prior estimates of crop production functions exist for this region and in particular for the tribal areas—the so-called Customary Land of Malawi, the “homelands” of South Africa, Tribal Lands of Botswana, and so forth. (See, however, Lucas 1985.) As an initial step in this direction, consider a simple Cobb-Douglas production function:

$$\ell n q = \gamma_0 + \gamma_1 \cdot r + \gamma_2 \cdot \ell n \ell + \gamma_3 \cdot \ell n k \quad (4)$$

where  $k$  is capital,  $r$  is annual rainfall, and  $\ell$  and  $q$  are as before. If the total adult population is denoted by  $A$ ,  $\ell$  may be assumed to be proportional to, or at least approximated by,  $A - e - m$ , the adult population not elsewhere employed.<sup>7</sup> But the chief difficulty is that, as in almost all developing countries, no capital stock series exists for this sector. Suppose, however, that some unknown fraction,  $\sigma_w$ , of wage earnings is saved and invested in equipment, working capital, or technological improvement in traditional agriculture.<sup>8</sup> Thus  $k$  at time  $t$  would be:

$$k_t = k_{t-1} (1 - d) + \sigma_w \cdot (w \cdot e + w_m \cdot m), \quad (5)$$

where  $d$  is a rate of depreciation assumed equal to 0.1. From Eq. (5) a capital stock series denoted  $kw = k/\sigma_w$  may be computed. However, this is not the only plausible source of savings for investment in crops: Crop income itself obviously may also be capitalized in a similar fashion leading to a series denoted  $kq$ .<sup>9</sup> Dividing all variables by population  $N$ , the production function (4) may then be revised to provide:

$$\ln \frac{q}{N} = \gamma_0 + \frac{\gamma_1}{\gamma_4} \cdot r + \gamma_2 \ln \left( a - \frac{e+m}{N} \right) + \gamma_3 \ln \frac{kw}{N} + \gamma_5 \ln \frac{kq}{N} + \gamma_5 \ln N \quad (6)$$

where  $a$  is the adult population per capita and is assumed constant. In this form the intercept  $\gamma_0$  incorporates  $\ln \sigma_w$  and  $\ln \sigma_q$ , and  $\lambda_5$  is a scale parameter, representing diminishing returns to fixed factors such as land. Note in particular that Eq. (6) has the advantage of emphasizing the short-run role of labor withdrawal through migration to the mines or internally for wage employment, and the long-run possibility of enhanced productivity through accumulation out of migrants' earnings. Clearly, together the migration and production functions, Eqs. (3) and (6), are simultaneously determined.

### C. Investments in Cattle

In much of southern Africa, cattle are a major component in the traditional portfolio of assets. Several forms of investment are possible to accelerate the rate of growth in the herd: expenditures on improved veterinary techniques, selective breeding, import of prime beasts, installation of boreholes and fencing, and (at least transitionally) postponement of slaughter. To explore the contribution of savings by migrants to growth in the herd through such mechanisms, an approach related to Eq. (5) is adopted. In particular, let  $bw$  and  $bq$  be capitalized streams of wage and crop incomes, comparable to  $kw$  and  $kq$  but with a 20 percent rate of depreciation to allow for the shorter life span of cattle. The desired stock of beasts,  $b^*$ , may be written as:

$$b^* = \beta_0^* + \beta_1^* bw + \beta_2^* bq. \quad (7)$$

But ability to adjust quickly to a larger desired herd size is constrained by at least two factors:<sup>10</sup> the prior stock, both through calving rate and survival (assuming some limitation on numbers imported), and varia-

tions in rainfall. Imposing a flexible accelerator modified by an additive rain effect, the observed number of beasts may be written:

$$b = \beta_0 + \beta_1 bw + \beta_2 bq + \beta_3 r + \beta_4 b_{-1}. \quad (8)$$

#### D. Domestic Wage Labor

An a priori judgment must be made in each case whether the domestic wage labor market for men clears or even operates on its demand curve. In countries where much of the organized-sector employment is in the public domain and parastatals are encouraged to provide jobs, both wage and employment are treated as exogenous. However, in the plantation or estate economies this is not true. Local variations are, however, paramount in formulating any approach to modeling an endogenous wage or level of employment and are best considered within the context of specific countries in Section II.

## II. THE SPECIFIC CONTEXTS

In view of the diverse institutional arrangements and market conditions in each of the countries to be analyzed and because of the variegated nature of each nation's data, the precise specifications of the stylized forms must differ from context to context. Unfortunately, it is quite impossible to itemize the extensive set of documents from which consistent time series data were compiled for the present study, given the confines of space.<sup>11</sup> However, at least certain essential remarks on the data are made in developing the background to particular specifications in the present section.

### A. Malawi

In April 1974, the government of Dr. Hastings Banda suspended further recruitment of miners by the South African mines' centralized recruiting agency, The Employment Bureau of Africa (TEBA). Ostensibly the reason was a plane crash, killing seventy-four returning Malawian miners. However, there is evidence to suggest that the suspension was previously planned (Christiansen and Kydd 1983), and certainly another major motive may have been to ensure the supply of

labor to Malawi's estates. Though the 1974 cutoff was extreme, a precedent in milder form had existed during the colonial period. Prior to independence in 1964, the Nyasaland authorities imposed a quota on the number of men TEBA's predecessor was entitled to recruit each year. The quota was varied from year to year, apparently depending on the state of the domestic labor market, and was not always binding. By comparing the announced quota with recorded new recruits, years in which the quota actually restricted migration are distinguished. In accordance with Eq. (1), estimation of the mine labor supply equation is then confined to years prior to 1974 in which the quota was not binding.

The distance from Malawi to South Africa is greater than from any of the other major suppliers of miners. Given the greater fixed cost of transporting the Malawi miners, TEBA has used a two-year contract for Malawi in contrast to a six- or nine-month term in Botswana, Lesotho, and Swaziland. The imposition of a two-year contract, combined with a Master and Servants Law forbidding deserting that contract, presumably dampened the speed of adjustment to changing conditions for Malawians, and the number of mine workers lagged one year is therefore added to the migration Eq. (3).

Crop production on the Customary Lands of Malawi includes not only subsistence crops but also tobacco, cotton, and coffee. The number of growers licensed to produce tobacco on Customary Land has not been permitted to rise, in part because Malawi probably has monopoly power on the world market in certain, special kinds of tobacco (Dean 1966). However, productivity per acre in tobacco growing almost trebled from independence in 1964 to 1977 after far slower growth in the colonial period. In part, this may reflect the expanded use of fertilizers by the small-holder farmer, so to the crop-production-function Eq. (6) is added a term for per capita quantity of fertilizer sold to small holders.<sup>12</sup>

On the estates, the two major crops are tobacco and tea. The various estates compete among themselves for labor, but they also compete with own account agriculture, nonagricultural domestic employment, and the South African mines.<sup>13</sup> To examine the effects of these alternatives and in particular to look at the effect of mine migration on estate work, a reduced form of the labor demand and supply functions is estimated. The specifications adopted are:

$$w_a = \omega_0 + \omega_1 \cdot p_{tea} + \omega_2 \cdot p_{tea-1} + \omega_3 \cdot N + \omega_4 \cdot m + \omega_5 \cdot w_{na} + \omega_6 \cdot p \quad (9)$$

$$e_a = \epsilon_0 + \epsilon_1 \cdot p_{tea} + \epsilon_2 \cdot p_{tea-1} + \epsilon_3 \cdot N + \epsilon_4 \cdot m + \epsilon_5 \cdot w_{na} + \epsilon_6 \cdot p$$

where  $w_a$ ,  $e_a$  are the wage rate and number of employees in estate agriculture,  $p_{tea}$  is the auction price of tea,  $w_{na}$  is the wage rate in nonagricultural work, and  $N$ ,  $m$ , and  $p$  are population, miners, and price of traditional crops as before. The price of tea is used to represent shifts in demand for estate labor, in part because the other major estate crop, tobacco, is also the most important crop sold by small holders. Both current price of tea and a one-period lag are included because tea is a perennial crop and because demand for labor during the year may depend on expected price. The price of traditional sector crops,  $p$ , is a Divisia index created for crops grown by small holders and not also grown in significant quantities on estates. Two of the alternatives to estate work, nonagricultural jobs and own account agriculture, are represented by price terms. Mine labor is not. The reason is that following the 1974 cutoff and during times of binding quotas in the colonial period, the mine wage was not a freely available alternative. The number of mine workers is therefore included instead. Population is included as a factor likely to have shifted the supply of labor. Plausible hypotheses to be tested for Eq. (9) are thus:

$$\geq 0 \quad \omega_1, \omega_2, \omega_4, \omega_5, \omega_6, \quad (10)$$

$$\epsilon_1, \epsilon_2, \epsilon_3.$$

$$\leq 0 \quad \omega_3,$$

$$\epsilon_4, \epsilon_5, \epsilon_6.$$

## B. Mozambique

Mozambique finally gained independence from the Portuguese in 1975, after a protracted struggle. Since independence, the South African mines have deliberately avoided contracting Mozambican novices, fearing political disruption in the mine compounds by workers from a Marxist state. Indeed, immediately following independence, the number of Mozambican miners dropped by half though it is unclear to what



extent this reflected mistrust by the South Africans as opposed to initial disorganization in Mozambique and specifically the failure to issue appropriate passports. (See Breytenbach 1979; First 1977.) But disruption of mine recruiting preceded actual independence by several years as the armed conflict between FRELIMO and the Portuguese grew in severity. In particular, after 1970 the complement of Mozambican miners diminished through 1972 and 1973 to a level hardly seen since 1950 (though numbers did again rise thereafter when Mozambique suffered a major drought).

In the 1970s, it thus seems migration from Mozambique to the South African mines has been shaped by quite different factors from those outlined in the stylized migration Eq. (3). A form of this equation is, however, explored for the earlier interval from 1946 through 1970, with five modifications.

a. According to a 1942 circular issued by the Portuguese authorities, all working-age Africans were required to prove that they had worked for six months in every year (Vail and White 1980). This was to be checked by the administrator from the employment entries kept on the obligatory identity card carried by all Africans, and it was intended both to increase production in the colony and to ensure the necessary cash for tax payments. The required employment could be satisfied voluntarily either through domestic wage work or by contracting with an authorized recruiter for work abroad, of whom the predecessor of TEBA, recruiting for the South African mines, was most important. In principle, the 1930 Labour Code of Dr. Salazar's government strictly forbade forced labor for private purposes. But in practice, "for most of the period of Salazar's rule, the Mozambique administration acted consistently and flagrantly in defiance of its own laws" (Vail and White 1980, p. 253), and forced labor, at least for "vagrants," continued to be the subject of protest and investigation in the International Labour Organization throughout the 1950s (ILO 1962; Duffy 1967). In 1961, a series of decrees altered the system of compulsory employment, and forced labor seems to have been significantly reduced thereafter, though even into the early 1970s reports of some forced labor continue. During the main period of compulsory registration and employment, the need to volunteer for work or face forced labor, under even worse wage and working conditions, is likely to have increased the propensity to migrate to the mines (Penvenne 1979). To test for this, a dummy variable is introduced to

the migration Eq. (3), set equal to one for the period of extensive forced labor and registration up through 1961.

b. The measures of employment included in defining the expected wage differential between Mozambique and the Rand mines are employment in Mozambican industry, mines, and plantations. In addition, the construction sector has been a major source of employment, though no data on the number of workers involved could be located. As a proxy, the value of construction output, deflated by the Mozambican cost-of-living index, is therefore inserted into the migration equation.

c. In addition to the possibility of raising cash for taxes through employment, tax obligations could also be satisfied through marketing of crops. Even here, however, the African populace was not free to choose, for the Portuguese introduced a scheme of compulsory crop growing and marketing (Vail and White 1978). Though the colonial authorities were thus interested in marketed surplus, apparently little concern was shown for subsistence production and no data could be located. In estimating the migration equation, annual rainfall averaged over several stations is therefore included as a proxy for better and worse growing years in traditional agriculture.

d. In a series of agreements and amendments, the Portuguese and South African governments imposed minimum and maximum limits on the number of recruits permitted from Mozambique. Since these limits were rarely binding, they need not concern us too much here, though in 1962 a unilateral notification of recruiting restriction was issued by the South Africans to their agents in Mozambique. First (1977, p. 33) argues that the "drop in the standing force of Mozambican labour on the mines in 1963 reflects the results of this instruction." To allow for this restriction, a dummy variable is therefore included in the migration equation for the single year 1963.

e. That a 1962 notice had its main impact in 1963 is due, in part, to a typical eighteen-month tour of duty for a Mozambican miner. As in the case of Malawi, this means there is generally a lag in adjustment, and the number of mine workers lagged one year is therefore added to the migration equation.

In the case of Mozambique, the effects of savings from wages on crop output and cattle herds cannot be analyzed here, for appropriate data are not available. However, the effect of mine migration on plantation labor in Mozambique may be considered, and indeed the under-

lying relations between the Portuguese authorities, plantation owners, and the Rand mines is particularly intriguing.

The 1942 circular meant that "people were forced to work, but not forced to work for anyone in particular," and "[t]he effect of the abolition of the *prazos* [a system of indentured labor formally abolished by the 1930 Labour Code] was to make the search for labour competitive" (Vail and White 1980, pp. 304 and 292). As an approximation, a competitive demand for labor may therefore be envisioned and is estimated in a simple Cobb-Douglas derived demand form with a flexible accelerator term. However, while forced labor remained common, the supply of labor to this market cannot be modeled by a standard supply of labor equation. Nonetheless, the plantations had to compete for their labor with the recruiters from abroad and with nonagricultural employees at home, both of whom offered legal alternative methods of voluntarily satisfying employment requirements, and this competition is likely to have been heightened after 1961 as forced labor diminished. Equations for labor demand and wage determination in the Mozambican plantation sector are therefore estimated as:

$$\begin{aligned} \ln c_a &= \epsilon_0 + \epsilon_1 \cdot \ln \frac{w_a}{p_a} + \epsilon_2 \cdot \ln h + \epsilon_3 \ln e_{a(-1)} & (11) \\ \ln w_a &= \omega_0 + \omega_1 \cdot m + \omega_2 \cdot \ln w_{na} + \omega_3 \cdot dfr \end{aligned}$$

where  $p_a$  is a Divisia price index constructed for plantation crops,  $h$  is the hectares of plantation actually used for growing,  $dfr$  is a dummy set equal to one before 1962 for the period of forced registration, and  $e_a$ ,  $w_a$ ,  $m$ , and  $w_{na}$  are as before. Plausible hypotheses with respect to Eq. (11) are:

$$\begin{aligned} &\geq 0 \quad \epsilon_2, \epsilon_3 \\ &\quad \omega_1, \omega_2, \\ &\leq 0 \quad \epsilon_1, & (12) \\ &\quad \omega_3. \end{aligned}$$

That  $\omega_1$  should be non-negative also holds in a minor variant on Eq. (11), introduced because recruiting for the Rand mines has not been the only form of foreign recruiting permitted. Agricultural labor is also recruited for South Africa (though now severely restricted) and prior to the Unilateral Declaration of Independence (UDI) by Rhodesia, re-

cruiting for employment on their white farms also was common.<sup>14</sup> As a variant on the wage Eq. (11), mine labor  $m$  is therefore replaced by the sum of mine labor, employment elsewhere in South Africa and employment in Southern Rhodesia. The data on the last of these cease after the UDI. In this variant, the wage equation is therefore estimated only until 1965. The equations as written in (11) otherwise are estimated until 1967, after which even Mozambican data are discontinued.

### C. South Africa

South Africa's apartheid laws distinguish four racial groups: asian, black, colored, and white. According to the 1970 census, just over 70 percent of the population was defined as black, and in that same year about 90 percent of mine employees were blacks. In looking at South Africa, the entire focus falls here on this black population. But the picture is further complicated by a distinction between blacks with Section 10 rights, who are legally entitled to remain in prescribed "white areas" for more than seventy-two hours, and those without. Since 1960, and predominantly since 1970, some 3.5 million blacks deemed not entitled to remain in white areas have been forcibly relocated in an archipelago of exceedingly poor lands called "homelands" or occasionally "black states." It is this group, combined with prior homeland dwellers, who are of concern here, for almost no Section 10 blacks work in the mines.

As with foreign labor, South African blacks are recruited on contract by TEBA and must return to their homelands between contracts. The main alternatives are to help in own-crop cultivation or to seek wage employment elsewhere in South Africa. With regard to the latter, however, two provisions of South African law warrant a modification in the formulation of Eq. (3). Jobs in industry pay considerably better than either mine or farm work, but a substantial fraction of these jobs are held by Section 10 workers, to whom preference must be given in hiring. The second provision is that TEBA is banned from recruiting in prescribed "white farm areas." But this does not necessarily mean a worker from the homelands may not weigh the possibility of obtaining agricultural wage work rather than contracting as a miner, though preference in agricultural employment goes to those blacks not yet forcibly removed from the white farms. The result of these provisions is that industrial and agricultural alternatives probably weigh quite differently

in the considerations of potential miners, and in consequence these two expected wage terms and the mine wage are each inserted separately into the mine labor equation, the coefficients thus absorbing the unknown weights. However, since 1978, such deliberations have been largely irrelevant for South Africa's blacks. The program of compulsory internment in the homelands has generated a massive pool of unemployment, and TEBA has reported excess South African applicants after 1978. Estimation of the mine labor equation for South Africa is therefore confined to 1946 through 1978.

In constructing the capitalized wage bill series,  $kw$  and  $bw$ , for the crop production and cattle accumulation equations, agricultural wages are omitted entirely for South Africa. This omission is because at least regular farm black employees have often been permitted small plots of land on the white farms and both their crops grown and cattle owned are omitted from the series analyzed here.<sup>13</sup> Sixty percent of total earnings by blacks in industry are included in the capitalized wages, because Merle Lipton (1980, p. 84) estimates that "42 percent of the [black] work force appear to have Section 10 rights."

No attempt is made to model wage or employment determination in industry or agriculture in South Africa. Even unskilled blacks' wages in industry are far above those of miners. Real wages in agriculture have risen slightly in the 1970s, at a time when mine employment of South African blacks has risen dramatically, but the connection is probably spurious. The rise in farm wages has almost certainly been occasioned by the forcible removal of squatter families from white farms on the grounds that they pose a security threat.

#### D. Botswana and Lesotho

Lastly, Botswana and Lesotho have sufficient in common with regard to specification to warrant joint discussion here. From both, an excess supply of miners now exists and probably has since 1974. It is now difficult for a man without a valid Re-engagement Certificate, authenticating satisfactory prior performance, to obtain work and few novices are contracted (Lucas 1985(a)). The mine labor equations for Botswana and Lesotho are therefore estimated from 1946 through 1973.

Two variants of the mine labor equation are estimated for both countries: one as in Eq. (3), the other replacing crop production by rainfall. In fact, the two countries are each subject to severe, periodic droughts,

affecting both crops and livestock, and it seems reasonable to expect an increase in willingness to work in the mines at such times. The rainfall variant is particularly useful in the Lesotho context, however, for data on crop production are available only for occasional years during the colonial period, limiting the sample size and continuity for estimating Eq. (3).

In neither country is plantation farming significant, the Freehold Farms in Botswana being essentially cattle-breeding and -fattening stations employing comparatively little labor. Indeed, in the organized labor market of Botswana the government plays a major role by setting minimum wages and hiring substantial amounts of labor either directly or in parastatals paying well above any notion of opportunity cost (Michael Lipton 1978). In Lesotho, wage employment remains at a miniscule level.<sup>16</sup> No attempt is therefore made to model these labor markets, and the domestic wage and employment are taken to be exogenous variables in both cases.<sup>17</sup>

Cattle accumulation, though very unequal across households, is of major importance to Botswana (which exports high price beef to the EEC) and duly explored (Colclough and McCarthy 1980). Unfortunately, however, no time series data on the livestock of Lesotho (where both sheep and cattle are important) could be located.

### III. ESTIMATION AND RESULTS

The estimated equations for mine migration, crop production, cattle accumulation, and estate labor are presented in Tables 1 through 4, respectively. T-statistics for a zero null-hypothesis are given in parentheses beneath each coefficient estimate. The methods of estimation are indicated with each regression.<sup>18</sup> In addition to crop output, mine labor, and, hence, nonemployed labor in each case, plus plantation wage and employment in Mozambique and Malawi, the mine wage is also treated as an endogenous variable for the three largest suppliers of mine workers: Malawi, Mozambique, and South Africa.

#### A. Mine Labor Equations

In Lucas (1985(b)) I estimated that the mining industry had been faced with a significantly upward sloping, overall supply of labor with respect to the mine wage until 1974, and of South African Black labor in particular until 1978. Table 1 confirms further that from each of the

Table 1. Miners in South Africa

	Botswana		Lesotho		Malawi		Mozambique		South Africa	
Intercept	-19,403 (2.68)	-11,914 (1.34)	-51,887 (4.54)	-59,446 (6.61)	-42,041 (1.91)	1,956 (0.10)	9,974 (0.46)	151,893 (1.14)		
Expected wage differential	834 (2.42)	483 (1.27)	849 (1.31)	940 (1.78)	1,982 (1.86)	5,498 (3.54)	4,416 (2.19)			
Crop output		-309 (1.97)		-487 (2.18)	-1,161 (2.25)			-68,045 (3.77)		
Rainfall (mm)	-5.64 (2.72)		-15.9 (3.27)			-25.4 (1.86)	-23.9 (1.72)			
Population (000's)	68.3 (8.27)	59.3 (6.03)	131 (11.69)	129 (21.44)	8.96 (1.29)			17.3 (2.50)		
Number of miners lagged					1.29 (12.50)	.677 (3.34)	.705 (3.38)			
Construction output						-19.0 (1.89)	-16.0 (1.51)			

	AR	ARF	AR	IV	COF	ARF	ARF	IV
Period of forced registration			13,759 (2.79)				10,610 (1.65)	
Curtailed recruiting dummy for 1963							-4,247 (0.63)	
Mine wage								7,490 (4.17)
Expected wage in industry								-1,030 (3.23)
Expected wage in agriculture								-3,567 (0.24)
Estimation method	AR	ARF	AR	IV	COF	ARF	ARF	IV
Durbin-Watson statistic				1.93				2.11
Rho	.38	.40	.49		.50	.56	.56	
Standard error of Rho	.19	.19	.17		.24	.22	.23	
$\hat{R}^2$	.76		.89					
Number of observations	27	27	27	15	13	23	23	29



major suppliers of labor, the number of miners has responded positively to the expected wage differential between mine and home when not constrained by immigration or emigration quotas. Even from Mozambique, miners have been able to respond to the differential in earnings. Moreover, as construction output has expanded, presumably employing additional labor, Mozambican workers have been drawn away from mine work though not always voluntarily. South African black labor has been attracted to the mines by rising mine wages and deterred from accepting such contracts when the likelihood of obtaining the far-higher industrial wage has increased. A negative coefficient is also found on the expected wage in agriculture within South Africa, but the statistical confidence in this negative association is negligible: A hypothesis that changes in agricultural employment conditions have left mine recruiting in South Africa unaffected cannot be rejected, partly because of the ban on TEBA recruiting in white farm areas. Clearly, southern Africa has not been a labor reserve for the mining houses, in the sense of infinite elasticity of labor supply, and recognition of this has been the chief cause of centralized recruiting to exploit monopsony power.

In each country, more successful harvests or more ample rainfall has significantly reduced the incidence of mine work. Even from Botswana, Lesotho, and the South African homelands, in each of which crop-growing conditions are extremely difficult, better crops are seen within this simultaneous framework to have detracted from migration to the mines.

As population growth has swelled the various labor forces, mine employment has been promoted significantly from each country except Mozambique,<sup>19</sup> some of the employment needs of a growing labor force thus being met through emigration.

From both Malawi and Mozambique, the longer tours of duty combined with the South African Master and Servants Law against desertion are seen to have significantly retarded responsiveness of labor to changing conditions, for the flexible accelerator terms are significantly greater than zero and are indeed quite large.

In the Mozambique regression, the dummy for 1963, reflecting the notice from South Africa to limit recruiting in that year, does not prove to have a significant negative coefficient. The mining houses had no need to impose quantitative restrictions on themselves; they could simply discourage recruits by holding down the contract wage. However, the ending of widespread forced labor in the Portuguese colony is seen

to have significantly reduced the mine labor available to the Rand. Prior to that, even the harsh conditions in the mines could seem appealing relative to forced labor at home.

### B. Crop Production and Cattle Accumulation

In looking at the impact of out-migration on rural areas, there has been much discussion of the consequences of labor withdrawal in reducing subsistence output. The estimated crop production responses in Table 2 reject a simple labor surplus theory; the positive coefficients estimated on the nonemployed population variables indicate that increased wage employment (at home or in the mines) from any given level of adult population has reduced traditional crop output, *ceteris paribus*. But other things are not equal. The withdrawal of labor for wage employment is also seen in three out of four cases to have significantly raised productivity in crops through additions to the capitalized wage bill.<sup>20</sup> Moreover, in Table 3, the sizes of the cattle herds in Botswana, Malawi, and South Africa are also shown to have been significantly enhanced as cumulative wage earnings have risen. These findings corroborate the results of a growing number of case studies that illustrate the importance of wage earners in the household to both peasant crop and animal husbandry (Kerven 1983). More generally, it appears that wage income of migrants can enhance the working or fixed capital available to the traditional, rural sector, raising productivity in the longer run while in the short run reducing output.

To this, there is an exception in Table 2 for Lesotho. Earlier in this century, Basutoland was a net exporter of grain. Today it is utterly dependent on emigrant labor; crop production has been neglected and massive soil erosion has ensued (Cobbe 1982). Whether the soil erosion would have occurred anyway, resulting from extensive deforestation as population has grown, migration notwithstanding, is unclear.

Only in the context of South African cattle and crops from Customary Land in Malawi is there significant evidence to suggest that crop income itself permits savings that in the long run add to the cattle herd and crop output, respectively. It thus seems that some degree of out-migration for employment may even be a requirement of long-term development for the traditional sectors.<sup>21</sup>

Finally, it may be mentioned that the negative estimated coefficients on the logarithm of population in Table 2 support a hypothesis of diminishing returns in crop production.<sup>22</sup> Even in sparsely populated, ap-

Table 2. Crop Production

	Botswana	Lesotho	Malawi	South Africa		
Intercept	-112 (1.28)	-282 (2.38)	-2.33 (0.15)	-5.38 (0.35)	-4.34 (0.28)	-201 (2.70)
Logarithm capitalized wage bill/population	3.33 (2.32)	-.49 (0.36)	.835 (3.73)			2.78 (2.16)
Logarithm capitalized crop income/population	.579 (0.99)	.11 (0.12)		1.09 (4.05)		.638 (1.21)
Logarithm nonemployed population/population	18.24 (1.39)	39.4 (2.31)	4.67 (1.62)	4.21 (1.55)	4.47 (1.61)	38.1 (3.05)

Logarithm population	-4.07 (2.65)	5.62 (2.21)	-2.36 (1.93)	-1.78 (1.79)	-2.13 (1.94)	-2.20 (2.18)
Rainfall (m)	1.57 (2.05)	1.20 (1.20)	-.009 (0.40)	-.005 (0.22)	-.006 (0.30)	.204 (1.76)
Fertilizer/population		.094 (1.75)	.089 (1.80)			
Logarithm capitalized wage plus crop income/population					1.07 (3.97)	
Estimation method	IV	IV	IV	IV	IV	IV
Durbin-Watson statistic	1.94	2.09	1.71	1.84	1.81	1.68
Number of observations	31	19	32	32	32	28

Table 3. Size of Cattle Herd

	Botswana		Malawi		South Africa	
Intercept	75.6 (0.43)	141,235 (3.21)	18,956 (0.77)	37,444 (1.24)	467 (0.70)	
Capitalized wage bill	.746 (2.68)	.231 (3.26)			.106 (1.55)	
Capitalized crop income	.675 (0.61)		.017 (0.76)		.075 (1.68)	
Rainfall (mm)	.166 (1.67)	-2.52 (1.73)	-2.79 (1.61)	-2.75 (1.62)	.160 (1.96)	
Cattle lagged	.647 (3.86)	.468 (2.42)	1.01 (9.30)	.921 (6.61)	.553 (3.20)	
Capitalized wage and crop income				.023 (1.27)		
Estimation method	AR	OL	OL	OL	OL	OL
Durbin's h statistic		1.15	1.49	-1.33	-1.40	
Rho	.59					
Standard error of rho	.16					
$\bar{R}^2$	.88	.99	.99	.99	.49	
Number of observations	30	27	27	27	28	

parently land-abundant Botswana this is true, suggesting that additional crop land (which is owned in common by the tribes and allocated by Tribal Land Board decrees) is not freely available (Lucas 1985).

### C. Estate Labor

Not only are all of the hypotheses listed with respect to estate labor in Eq. (10) and (12), for Malawi and Mozambique, respectively, supported by the results in Table 4, but one can be more than 95 percent confident that strict inequalities hold in each case. (The solitary exception is the term for the current price of tea in the Malawi wage equation.)

The most important terms, from the present perspective, relate to mine labor. In Mozambique, recruiting of labor for the Rand mines is shown to have made plantation labor significantly more expensive, and in turn higher wages resulted in significantly diminished employment. In the second variant on the wage equation in Table 4, workers abroad more generally are estimated to have had a similar consequence.<sup>23</sup>

This raises the question of why the Portuguese colonial authorities would allow such recruiting, imposing increased costs on the European plantation owners, diminishing plantation employment, and hence presumably reducing crop production and export. The answers are essentially twofold. First, a gap existed between the authorities and plantation owners in regard to their concerns in running the colony. "[T]he specifically anti-capitalist and pro-nationalist ethic of the *Estado Novo* . . . predisposed the Administrators to attack the foreign-capitalized companies" (Vail and White 1980, p. 299). Second, Portugal managed to gain directly from South African mine recruitment through at least three provisions of various agreements negotiated with the South African state:

1. The South Africans agreed to ship specified minimum amounts through the port of Lourenco Marques in return for the right to recruit, with the port duties going to Portuguese coffers.
2. A recruiting tax was collected by the Portuguese.
3. By far the most lucrative for the Portuguese was a secret clause whereby compulsory deferred pay, kept until the miners returned to Mozambique, was retained by Portugal in the form of gold at a premium price.

Table 4. Estate Labor

	Malawi		Mozambique	
	Number of Employees	Wage	Log Employees	Log Wage
Intercept	-144710 (10.27)	303 (5.20)	-1.32 (1.04)	1.85 (2.04)
Price of tea	598 (2.34)	-.909 (0.86)	-.386 (8.00)	.951 (3.37)
Price of tea lagged	1178 (5.20)	3.76 (4.00)	1.00 (7.41)	.198 (4.11)
Population	59.6 (20.57)	-.033 (2.73)	.218 (2.21)	.330 (2.25)
Mine labor (000's)	-97.9 (1.95)	.434 (2.09)	Logarithm Nonagricultural Wage	.206 (1.55)
Nonagricultural wage	-1996 (7.22)	15.2 (13.28)	Period of Forced registration	-.634 (6.20)
Price of customary crops	-19969 (2.11)	73.7 (1.88)		-.584 (5.36)
Estimation method	3S	3S	IV	ARF
Durbin-Watson statistic	1.31	1.26	0.63	
Durbin's h statistic				
Rho				-.44
Standard error rho				.21
Number of observations	31	31	21	21

In Malawi, too, recruiting by TEBA is seen in Table 4 to have significantly raised the wage and lowered employment on estates. Before independence, the colonial authorities imposed quotas on recruiting precisely to hold down such wages, though no doubt this was mitigated by the fact that Nyasaland and South Africa were both British, as protectorate and dominion territory, respectively. In the aftermath of independence, a Malawian government was understandably reluctant to constrain its own people from electing to migrate to the mines. But as estates passed increasingly into Malawian hands, this strategy gathered opponents, until recruiting was suspended entirely in 1974. The result was almost an 80 percent rise in estate employment by 1978 and a 15 percent drop in the real wage of estate workers in the first two years after the cutoff. But the additional employment on estates amounted to exactly half the decline in numbers previously at the Rand mines and the slight increase in nonagricultural employment accounted for less than 9 percent extra. The Customary Lands had to absorb many of the displaced workers. In general, Table 4 shows that the estates have had to compete for their labor against prices of crops grown on these Customary Lands as well as with nonagricultural employers. Yet with this massive infusion of labor, ADMARC (the state marketing board) could increase its intake while employment rose and wages fell on the estates. From the Customary Lands, ADMARC purchases of tobacco, cotton, maize, groundnuts, and coffee were nearly 60 percent higher in 1978 than in 1974 (measured in constant 1974 prices). Tobacco purchases alone more than doubled, in part because the number of licensed growers on Customary Lands were permitted to rise sharply. Nonetheless, discontent resulted and the ban on TEBA recruiting was lifted in June 1977, but by then South Africa no longer trusted Malawi as a source and the number of mine workers from Malawi has never recovered (Christiansen and Kydd 1983).

Table 4 also shows the major role played by forced labor in holding down plantation wages in Mozambique prior to 1962. The subsequent rise in wage was indeed associated with an absolute decline in plantation employment thereafter, but the estimated coefficients in Table 4 indicate a rise in expected wage in agriculture, *ceteris paribus*. Such a rise would in itself serve to discourage mine migration, but according to Table 1 the ending of forced labor reduced such migration beyond any effect on expected wage alone.



#### IV. CLOSING REMARKS

Three themes were introduced in this paper: determinants of international migration, consequences of out-migration for capital accumulation, and emigration-induced domestic wage and employment adjustments. Three decades of evidence from southern Africa indicate that whereas in the short run the removal of men for wage employment has reduced traditional crop production, in the long run injections of cash from their earnings has been a significant factor in enhancing productivity in cultivation and significantly accelerated cattle accumulation. The conventional, exclusive focus on short-run marginal product of labor in agriculture alone is clearly inadequate for viewing the implications of urbanization on rural development. But the process of enhancing productivity from outside earnings tends to be self-limiting, and in particular the simultaneous framework of this paper shows that improved crop production in tribal areas has significantly reduced the supply of recruits to the South African mines, *ceteris paribus*.

More generally, the supply of miners from each country is shown to have been upward sloping with respect to the difference between the mine wage and expected pay at home, of which returns to crop cultivation are a part. In this sense, the region has not been an unlimited surplus labor reserve serving the Rand mines, and the mining houses have accordingly centralized recruiting efforts to exploit their monopsony power. Thus, for much of the period, migration to the mines is shown to be consistent with a market operating on its supply of labor function. But unlike most internal migrations, international migration may be directly controlled by states with the capacity to police clandestine movement. South Africa is well policed. Particularly, recently, political factors must enter the list of determinants of mine migration: The emergence of a Marxist state in Mozambique has curtailed Mozambican recruiting; the creation of the so-called Black States within South Africa, and forced relocation of 3.5 million people within this poverty-stricken archipelago, has contributed to the decision of the mines to prefer South African workers; at least one secret interstate accord on the minimum number of miners South Africa will recruit from that country has been leaked quite recently, though whether political acquiescence was promised in return is unknown.

But underlying at least some of the quotas on migration are economic factors. In both Malawi and Mozambique, expansions in mine labor recruitment are estimated to have significantly inflated real wages

and diminished employment in the plantation sectors. Policy reactions in the two countries have differed, depending critically on the alignment of interest groups. In Portuguese Mozambique, the interests of European plantation owners were subordinate to those of Portugal, and Dr. Salazar's regime negotiated terms with South Africa that made recruitment of miners extremely lucrative for Portugal. On the other hand, the Portuguese authorities were reluctant to enforce their own laws and effectively to prohibit the use of forced labor. When eventually forced labor was substantially diminished after 1961, following severe international criticism, the plantation wage rose significantly and migration to the Rand fell, both because the home wage had risen and because the need to escape forced labor was relaxed. In colonial Nyasaland (Malawi), quotas occasionally were effectively imposed on mine recruitment, precisely to protect the European estate owners. Limited pressure on estate wages was permitted, however, probably in part because until 1960 Nyasaland and South Africa were both within the British Commonwealth, and there is a long history of British colonial authorities cooperating with the Rand mines. After independence in 1964, Malawi relaxed the quota system. But by the early 1970s, concern to protect the now-Malawian estate owners had risen. In 1974, Dr. Hastings Banda's government suspended all mine recruiting in Malawi. The real wage on estates fell and employment increased, but not sufficiently to absorb the disaffected miners. By 1977, Malawi reversed its decision, but South Africa is no longer willing to take a substantial number of Malawians.

After a century of mutual dependence on the massive, circular migration of miners, the labor market of the southern African region is being profoundly reshaped. From Malawi and Mozambique, migration is already very sharply curtailed; from Botswana it has fallen recently as mineral prices have sunk; Lesotho may receive different treatment, for the South Africans view (and often refer to) Lesotho as one of the homelands, and there is fear the homelands may prove explosive if they are not economically viable. With the demise of the migratory system, associated external costs to health, family structure, and political stance should certainly lessen, though some derivatives may prove irreversible. But the adjustment costs to the labor-supplying countries of providing employment for those displaced and hence replenishing this source of long-run improvement in traditional agriculture will be immense.

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## NOTES

1. Byrlee (1972), Greenwood (1975), Schultz (1982) and Todaro (1976) survey portions of the estimated internal migration equations. Psacharopoulos (1976) and Lucas (1976) present estimates of international migration parameters.

2. See, however, Collier and Lal (1980), Rempel and Lobdell (1978), and Stark (1978, 1980).

3. See, for example, de Vletter (1981), Elkan (1980), Gordon (1981), Halpern (1965), Kowett (1978), Murray (1981), Schapera (1947), Stahl and Böhning (1981) and Wilson (1976).

4. Until the mid-1970s, miners could not legally "desert" from a fixed-period contract. See Lipton (1980).

5. No time-series data exist on the nonagricultural self-employment of men. This is less of an issue, at least in parts of this region, than elsewhere in the Third World, for much of the beer brewing and other forms of nonfarm self-employment are undertaken by women, though this may itself be a consequence of the long history of male absence. The six- and nine-month mine contracts traditional in Botswana, Lesotho, and Swaziland are designed to enable men to plough, then sign on for the mines. Nonetheless, mine and crop work are conflicting alternatives, if only because the arrival date of the rains is quite uncertain in many areas and it is essential to plough immediately. Many men sign on only to find ample rains arriving thereafter.

6. For example, if:

$$\begin{aligned} g(q, \ell) &= \gamma \cdot q/\ell \\ \ell &= (n - m - c)/\lambda_1 \\ n &= \lambda_2 \cdot N \\ m &= \mu_0 + \mu_1 \cdot (w_m' - \bar{w}) + \mu_4 \cdot n \end{aligned}$$

then

$$\mu_2 = -\gamma \cdot \mu_1 \cdot \lambda_1 \text{ and } \mu_3 = \mu_4 \cdot \lambda_2.$$

7. This omits the explicit treatment of female employment on which data are very limited. In fact, in much of the region, apart from low-wage domestic service, wage employment for women remains quite restricted in scope.

8. The mechanism of investment does not necessarily require the migrant or

even the migrant's family to buy capital goods. More generally, the issue is whether the capital markets are improved, leading to a net incidence of greater investment.

9. Initial stocks for both series are set by assuming a constant prior stream of earnings equal to that in the first period for  $k_w$  and equal to the first five-year average (to adjust for weather fluctuations) for  $k_q$ .

10. Indeed, at least in Botswana, limited capacity in organized sector slaughtering has constrained even downward adjustments in herd size at certain peak times.

11. I am particularly grateful to the following institutions for help in locating data: Botswana—National Archives, Central Statistics Office, Ministry of Agriculture, The University Library; Lesotho—National Archives, Bureau of Statistics; Malawi—National Archive Library, National Statistical Office, The University Library at Zomba; South Africa—Department of Statistics, Meteorological Office.

12. A linear form, rather than logarithmic, is adopted since in earlier years these sales were zero.

13. Labor from Nyasaland also migrated to Northern Rhodesia and Southern Rhodesia prior to independence of the former as Zambia in 1964 and the unilateral declaration of independence in Rhodesia. However, the numbers involved were comparatively small and curtailed after the mid-1960s (Boeder 1974).

14. In addition, workers did "escape" over the border to Nyasaland (Malawi) but no reliable estimates seem to exist on the extent of this.

15. Reporting of earnings for casual farm employees is too sporadic to permit inclusion, and also includes an unknown amount paid to foreign workers.

16. In earlier years, the South African government discouraged South African companies from opening plants in Lesotho, apparently partially to ensure a continued labor supply for the mines and white farms.

17. Annual data on wages and employment in Lesotho could not be located for the earlier years. The expected wage difference through the 1950s thus actually reflects variations in the mine wage around an intercensus trend.

18. The following acronyms indicate the respective estimation techniques:

OL = Ordinary least squares

IV = Instrumental variables

AR = Autoregressive correction by Beach-Mackinnon method

ARF = AR method with Fair's extension of instrumental variables

COF = Cochrane-Orcutt autoregressive correction for discontinuous samples, with Fair's extension of instrumental variables

3S = Three-stage least squares.

19. If included, the population variable for Mozambique does not prove positive; it apparently is spuriously associated with some of the included variables and is therefore omitted from Table 1.

20. The capitalized wage and crop incomes are highly correlated for Malawi. Tables 2 and 3 therefore report variants in which each appears separately and a third variant in which logarithm of their sum appears.

21. In the formulation of the crop-production-function Eq. (6), if the capitalized wage bill ( $k_w$ ) is zero and its exponent ( $\gamma_3$ ) positive, then  $dq/d(e + m) > 0$  at  $e + m = 0$  and minimal outside employment is essential to positive output. As such employment expands, diminishing marginal products ensure that the returns from capitalized wages are eventually offset by increasing scarcity of peasant labor. One depiction of

the Lestho circumstance is that it has long since entered this range in which increments of crop output with respect to emigration have become negative (though the propensity to invest in cultivation out of earnings has probably also declined both with labor withdrawal and with—or as a partial cause of—erosion). Quite obviously, this alone does not render emigration an irrational development strategy for Lesotho, being only one element in the social calculus.

22. In addition, fertilizer inputs have clearly raised crop production in Malawi, and the importance of adequate rains to both crops and cattle in Botswana and South Africa is apparent. It is not clear why the rainfall term in the cattle equations for Malawi is negative, but omitting this term has no significant effect on other coefficients.

23. If workers abroad are decomposed into mine labor and others, a hypothesis of equal effects on wage cannot be rejected.

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## DISCUSSION PAPERS

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1. Oded Stark. RURAL-TO-URBAN MIGRATION IN LDCs: A RELATIVE DEPRIVATION APPROACH (October).
2. Oded Stark. MIGRATION DECISION MAKING: A REVIEW ESSAY (October).
3. Eliakim Katz and Oded Stark. ON MIGRATION IN THE PRESENCE OF ASYMMETRIC INFORMATION (November).
4. Robert E. B. Lucas. EMIGRATION, EMPLOYMENT, AND ACCUMULATION: THE MINERS OF SOUTHERN AFRICA (December).

# URBAN EXTERNAL ECONOMIES AND OPTIMAL MIGRATION

Vibhooti Shukla and Oded Stark

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## ABSTRACT

In this paper we utilize urban economics to identify socially optimal levels of urbanization and, by implication, optimal levels of rural-to-urban migration. Our analysis addresses, first, the case where there is only one urban center (region) in the economy and, second, where there are two. Since in this latter case inter-urban migration flows are possible as well, we examine the rationale underlying dispersal from the larger urban center to the smaller one.

After identifying the reason that private actions do not add up to the social optimum, we offer an analysis of instruments that could confer efficiency gains by closing the gap(s) between the privately efficient and socially optimal urban concentrations.

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## I. INTRODUCTION

Hitherto, urban economics does not seem to have significantly contributed to migration economics, although there are reasons to believe that such a contribution can be made. As our note demonstrates, it is possible to utilize urban economics to identify socially optimal levels of urbanization and, by implication, optimal levels of rural-to-urban migration. Our analysis addresses, first, the case where there is only one urban center (region) in the economy and, second, where there are two. Since in this latter case the possibility of additional, that is, inter-urban, migration flows opens up, we examine the rationale underlying dispersal from the larger urban center to the smaller one.

After identifying the reason that private actions do not add up to the social optimum, we offer analysis of instruments that could confer efficiency gains by closing the gap(s) between the privately efficient and socially optimal urban concentrations. On the basis of theoretical considerations and permissible parameter values, for the log-linear case, we are able to rank these instruments and thereby to suggest policy implications. The private decisions identified by us in this note are responsible for a smaller city size, or a smaller urban sector, than is socially optimal. We compare this outcome with another policy-related observation. A 1983 United Nations survey of 126 governments of less-developed countries (LDCs) found that all but three small island nations did not consider the distribution of their populations "appropriate" and that more than three-quarters stated they were pursuing policies to slow down or reverse internal migration, almost always rural-to-urban migration. These policies do not have a tantalizing success record. Might this lack of success be due to the fact that alongside the problems of congestion and pollution usually associated with rapid urban growth there are, over a significant range, powerful agglomeration *economies* conferred by urban concentration? This may help to explain why policies aimed at stemming rural-to-urban migration have a dismal success record (Stark 1980).

## II. EXTERNAL AGGLOMERATION ECONOMIES AND OPTIMAL MIGRATION: THE CASE OF ONE URBAN SECTOR

We start by focusing on the role of external agglomeration economies. Urban output  $Q$  which is homogeneous and internationally traded at a given unit price is produced by many small, identical firms employing

labor  $N$  and capital  $K$  with decreasing returns to internal scale and increasing returns to external scale

$$Q = G(N)F(N,K) \quad (1)$$

where  $G' > 0$  and

$$\begin{bmatrix} F_{NN} & F_{NK} \\ F_{KN} & F_{KK} \end{bmatrix}$$

is negative definite. Firms do not see themselves as influencing city size which is given by the aggregation of their profit-maximizing labor demands. With a perfectly elastic supply of private capital and labor at the going interest and wage rates  $r$  and  $w$  respectively, the firm's maximization problem is

$$\text{Max } G(N) F(N,K) - wN - rK$$

which renders the first-order conditions

$$G(N^e) F_N(N^e, K^e) - w = 0 \quad (2)$$

$$G(N^e) F_K(N^e, K^e) - r = 0 \quad (3)$$

and the second-order conditions

$$GF_{NN} < 0 \quad (4)$$

$$(GF_{KK})(GF_{NN}) - (GF_{NK})^2 > 0 \quad (5)$$

where  $N^e$  and  $K^e$  are the equilibrium levels of the employed labor and capital.<sup>2</sup>

Since firms do not incorporate the agglomeration effect in their employment decisions, the pair  $(N^e, K^e)$  differs from the social optima  $(N^*, K^*)$  that fulfill the following first-order conditions

$$G(N^*) F_N(N^*, K^*) + G'(N^*) F(N^*, K^*) - w = 0 \quad (6)$$

$$G(N^*) F_K(N^*, K^*) - r = 0 \quad (7)$$

and the second-order conditions

$$GF_{NN} + 2G'F_N + G''F < 0 \quad (8)$$

$$(GF_{KK})(GF_{NN} + 2G'F_N + G''F) - (GF_{NK})^2 > 0, \quad (9)$$

requiring that at the optimal level  $N^*$ , output increases with employment at a decreasing rate.

In order for (2) to entail a stable equilibrium,  $G(N) F_N(N,K)$  must cut  $w$  from above. Likewise for (6). Hence, over the relevant range,  $d[G(N) F_N(N,K)]/dN < 0$ . Therefore, a comparison of (6) with (2) implies that  $N^c < N^*$ . Thus, if the externality were to be internalized, urban employment and urban size would be larger and more rural-to-urban migration would be called for. The level of this socially optimal migration is  $N^* - N^c > 0$ .

### III. EXTERNAL AGGLOMERATION ECONOMIES AND OPTIMAL MIGRATION: THE CASE OF TWO URBAN SECTORS

Assume now an economy with two urban regions, each small relative to the rest of the economy. Due to historical, topographical, geographical, or other exogenous reasons one urban region, B, is backward, that is, with relatively little productive infrastructure which we denote by  $I_B$ , whereas the other, A, is advanced with  $I_A > I_B$ . The contribution of economic infrastructure,  $H(I)$  to production is captured by

$$Q = H(I) G(N) F(N,K) \quad (10)$$

where  $H' > 0$ . To simplify, we assume  $H(I) = I$ . The equilibrium employment levels in the two regions,  $N_A^c$  and  $N_B^c$ , are given by the solutions to the private maximization problems that entail the following first-order conditions for labor:

$$G(N_A^c) F_N(N_A^c, K_A^c) = w/I_A \quad (11)$$

$$G(N_B^c) F_N(N_B^c, K_B^c) = w/I_B. \quad (12)$$

Since  $w/I_A < w/I_B$ , we obtain

$$G(N_A^c) F_N(N_A^c, K_A^c) < G(N_B^c) F_N(N_B^c, K_B^c), \quad (13)$$

which implies (as  $d[G(N) F_N(N,K)]/dN < 0$ ) that  $N_A^c > N_B^c$ .

By solving the corresponding social optimization problem, we obtain the following first-order conditions:

$$G(N_A^*) F_N(N_A^*, K_A^*) + G'(N_A^*) F(N_A^*, K_A^*) = w/I_A \quad (14)$$

$$G(N_B^*) F_N(N_B^*, K_B^*) + G'(N_B^*) F(N_B^*, K_B^*) = w/I_B. \quad (15)$$

From comparisons of (14) with (11) and (15) with (12), we obtain that  $N_B^* - N_B^c > 0$ ,  $N_A^* - N_A^c > 0$  and that  $N_B^* - N_B^c > N_A^* - N_A^c$ , or that  $N_A^* - N_B^* < N_A^c - N_B^c$  provided (see (4) and (8)) that

$$GF_{NN} + 2G'F_N + G''F < GF_{NN},$$

which reduces to

$$2F_N/F < -G''/G', \quad (16)$$

that is, that agglomeration economies rise at a sufficiently rapidly diminishing rate; since the left-hand side of (16) is positive, only a sufficiently large absolute value of a negative  $G''$  can entail a *larger* social gain associated with removal of the backward region allocation inefficiency than with removal of the advanced region allocation inefficiency. Then, at a given social outlay, inducing rural-to-urban region B migration dominates inducing rural-to-urban region A migration since it is in the former where the agglomeration externality is *more* powerful. Or, urban dispersal from A to B entailing labor migration in this direction is socially superior to migration in the reverse direction, that is, migration making for a larger degree of urban concentration. Empirical evidence leads us to believe that at least for the case of India and for quite a large range of city sizes, condition (16) *does not hold*.<sup>3</sup> Productive efficiency may thus be hindered, not fostered, by labor population dispersal from larger to smaller cities.

#### IV. RANKING POLICY INSTRUMENTS

Having pointed out that the size of an urban area ought to be increased in order to enhance productive efficiency, we need to rank the instruments that a government may use for the purpose of externality correction. We shall address a Section I-type economy with only single urban region for which  $N^* - N^c > 0$ . In order to induce socially optimal urban growth and creation of additional employment, we assume the government considers recourse to output, capital, or labor subsidies.

Assume that (1) takes the form

$$Q = G(N) F(N,K) = BN^\gamma AN^\alpha K^\beta \quad 0 < \gamma < 1, \alpha + \beta = 1 \quad (17)$$

and that

$$w = w(N) = bN \quad b > 0. \quad (18)$$

That is, assume a positive agglomeration elasticity with the amount of output "shift" due to external economies increasing at a declining rate, a constant return to scale internal technology, and a unitary elastic labor supply. The private problem then is given by

$$\text{Max } ABN^\gamma N^\alpha K^\beta - (bN)N - rK.$$

However, if the government were to award a wage subsidy, the firm's decision problem would be

$$\text{Max } ABN^\gamma N^\alpha K^\beta - (1 - S_L)(bN)N - rK$$

where  $S_L$  is the proportion of the wage bill paid by the government. Solving the last problem renders

$$N^c = [\alpha/b(1 - S_L)]^{(1-\beta)/(2-2\beta-\alpha-\gamma)} [AB\beta^\beta r^{-\beta}]^{1/(2-2\beta-\alpha-\gamma)}. \quad (19)$$

This can be compared with  $N^*$ —the socially optimal city size given by incorporating the variability of city size in the agglomeration component of the production specification where

$$N^* = [(\alpha + \gamma)/b]^{(1-\beta)/(2-2\beta-\alpha-\gamma)} [AB\beta^\beta r^{-\beta}]^{1/(2-2\beta-\alpha-\gamma)}. \quad (20)$$

By equating (19) to (20), that is, capturing that amount of subsidy that will sustain the social optimum, we obtain

$$S_L = \gamma/(\alpha + \gamma). \quad (21)$$

We employ a similar procedure in order to derive the optimal capital subsidy, that is, solving

$$\text{Max } ABN^\gamma N^\alpha aK^\beta - (bN)N - (1 - S_K)rK$$

and obtain

$$S_K = 1 - [\alpha/(\alpha + \gamma)]^{(1-\beta)/\beta} \quad (22)$$

and derive the optimal output subsidy (for example, a sales tax concession) through solving

$$\text{Max } (1 + S_p)ABN^\gamma N^\alpha K^\beta - (bN)N - rK,$$

obtaining

$$S_p = [(\alpha + \gamma)/\alpha]^{(1-\beta)/\beta} - 1. \quad (23)$$

Since from the first-order conditions of the social maximization, that is, from the equivalents of (6) and (7) under (17) and (18), we obtain

$$(N^*)^2 = [(\alpha + \gamma)/b]Q^* \quad (24)$$

$$K^* = [\beta/r]Q^*, \quad (25)$$

we can rewrite (21), (22), and (23) as

$$S_L w N^* = \gamma Q^* \quad (26)$$

$$S_K r K^* = \beta [1 - (\alpha/(\alpha + \gamma))^{(1-\beta)/\beta}] Q^* \quad (27)$$

$$S_p Q^* = [(\alpha + \gamma)/\alpha]^{(1-\beta)/\beta} - 1] Q^*. \quad (28)$$

Whereas the capital subsidy is cheaper than the output subsidy,<sup>4</sup> the difference between the capital subsidy and the labor subsidy cannot be signed analytically. Fortunately, simulation experimentation<sup>5</sup> subject to  $\gamma < \alpha$  (the condition that the external labor efficiency or agglomeration parameter is lower than the internal one) reveals that the capital subsidy is consistently cheaper than the labor subsidy; for plausible ranges of the parameters  $\gamma$  and  $\alpha$ , say .10–.20 for  $\gamma$  and .60–.70 for  $\alpha$ , the capital subsidy is 20%–35% cheaper than the labor subsidy.

Our conclusion that subsidizing capital utilization might be the more efficient means to bring about socially optimal levels of industrial production, urban concentration, and rural-to-urban migration relates to earlier research<sup>6</sup> where we pointed out that although migration is a labor market phenomenon, modifying its patterns could optimally assume the form of intervention in capital markets. There it was argued that it is imperfections in the latter that are manifested through and corrected by migratory behavior. Interestingly, while it approaches migration from the production end, this note also suggests that intervention in the capital market could be the appropriate tool for bringing about the desirable level of migration.

## NOTES

1. These have been empirically confirmed in the United States by a number of studies, for example, Sveikauskas (1975) and Segal (1976) and for India by Shukla (1984).

2. In fact, the maximization problem renders an optimal employment level for the individual firm which we should have designated by a symbol different from  $N^c$ —say  $n^c$ . (Likewise, for  $K^c$ .) If there are  $m$  identical firms, then  $N^c = mn^c$ . Since  $N^c$  differs from  $n^c$  merely by a constant factor, we adopt a shortcut and refer to  $N^c$  from the start of the maximization process.

3. See Shukla (1984). One plausible suggestion offered by the empirical evidence is that dispersal should not be encouraged in the context of city sizes below 100,000.

4.  $S_F - \beta S_K = (d^c - 1) - \beta[1 - (1/d)^c] = (d^c - 1)(d^c - \beta)/d^c > 0$  since  $d^c > 1 > \beta$  where  $d = (\alpha + \gamma)/\alpha > 1$  and  $e = (1 - \beta)/\beta > 0$ .

5. See Shukla (1984).

6. See, for example, Stark and Levhari (1982).

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# DIFFERENTIAL MIGRATION, NETWORKS, INFORMATION AND RISK

J. Edward Taylor

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## ABSTRACT

The present study seeks to forge a link between risk and migration kinship networks. It is argued that contacts with family members in prospective migrant destinations play a crucial role in village household labor decisions primarily by providing the household with the information needed to formulate an effective strategy to reduce the risks associated with migration. A model of household labor decisions under uncertainty is presented as an analytical framework for exploring the effect of kinship networks, household characteristics, and attributes of household members upon the choice of alternative destinations. Empirical findings using Mexican village household data confirm that, consistent with

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a "migration insurance" function of kinship networks, the impact of networks is greatest in international migration, where migration risks are highest, labor market information is most costly and scarce, and the penalty for making bad forecasts is most severe. The importance of kinship networks and individual and household characteristics in explaining and predicting both internal and international migration is examined, and the dynamic role of migration kinship networks in rural out-migration is assessed. Included are some implications of kinship networks for the stability of migration flows and the evolution of international and domestic migration over time.

Efficiency in the allocation of productive resources depends crucially on decision makers' information concerning the expected return and variability of returns associated with each possible allocation. Information can improve allocative efficiency by permitting a decision maker to adjust his perception of the distribution of returns (that is, the "subjective distribution") to more accurately reflect the true ("objective") distribution. If the returns to an allocation depend directly on the information at the decision maker's disposal, it may also help him devise a better strategy aimed at altering the relevant distribution of returns in his favor, by either increasing the expected return or reducing the spread of returns to his different allocations—or both. Information, however, is ordinarily costly and scarce, and its distribution uneven. The distribution of information may be determined by chance, or it may result from a history of allocations which, while responding to given informational regimes at the time they occurred, shaped the distribution of information upon which subsequent allocations were made.

It thus should come as no surprise that migrant networks with contacts in prospective migrant destinations play a fundamental role in village household labor allocation decisions in less-developed countries (LDCs). Migrant contacts in urban areas have been observed as significant positive determinants of migration by empirical studies based on individual decision models of the Todaro type (Todaro 1980). At the household level, it has often been shown that household members are more likely to migrate to destinations where other members already reside. (For a recent example from the Philippines, see Caces et al. 1985.)

A particularly important role that migration networks seem to play in household labor decisions is in regard to risk. The household, when

it makes its labor allocation plan, does not know with certainty what its rewards from investing in migration and other economic activities will be. The level and variability of the returns to migration (that is, migrant remittances) can be influenced to the extent the migrant has a support structure at the destination that enables him to respond effectively to the uncertainties around him. Migration networks can provide the migrant with information vital to his success in reaching his destination and in finding and retaining advantageous employment once he is there. They therefore furnish the migrant household with "migration insurance" and facilitate a fuller realization of the insurance effect which migration itself can provide, at least after a time (see Stark and Levhari 1982).

If migration networks influence household labor decisions primarily by providing the household with migration risk-reducing information, then the impact of networks will generally be greatest if they lead to destinations where migration risks are highest, where the penalty for making bad forecasts is greatest, and for which information is scarcest and most costly to obtain. Compared with internal migration, international migration is generally characterized by a high-risk environment, larger and more specialized sunk costs, and a scarcity of information. Along with the risks normally associated with job search, international migration often entails risks specific to traversing international borders and finding and retaining employment in a clandestine foreign labor market. The sunk costs implicit in international migration include international travel costs and (for example, in the case of Mexican migration to the United States) costs associated with the border crossing (for example, smugglers' fees). Furthermore, labor market information with respect to markets far away is generally scarcer and more costly to attain than information with respect to local (home-country) labor markets. These considerations indicate that both the probability of making bad forecasts and the penalty for doing so are greater, on average, for international migration than for internal migration. This, in turn, implies that the need to insure (and in the absence of insurance markets, to self-insure) is greater for international migration. For village households, which are frequently at or near the subsistence margin, the self-insurance needed to counter at least the initial high risks associated with international migration in general is available only through the high levels of mutual concern and trust that are implicit in

kinship ties with individuals at the migrant destination. Past migration by family members can therefore be expected to play a greater role in international than in internal migration. Migration kinship networks are likely to be one of the major factors influencing the choice of foreign destinations over domestic ones by village migrant households.

The present study explores, theoretically and empirically for the case of two Mexican villages, the role of migration networks and risk in village household labor decisions, including both internal and international migration. The effect of selected characteristics of households and of individual household members on these decisions will be explored. Migration decisions are analyzed in the context of the set of economic activities in which household members may participate. These activities can include household-farm work, wage work within the village, or work at alternative destinations outside the village. The analysis is based on the view that household labor decisions are guided by weighing the expected returns and risks associated with alternative work activities. In particular, the labor time of household members as a group is allocated among migration and nonmigration work in an effort to provide the household, assumed to be risk-averse, with the largest economic gain at the smallest economic risk.

Considerations of risk, on the one hand, and the importance of contacts in migrant destinations, on the other, have been dealt with separately in past migration studies. The present study seeks to forge a link between risk and migrant kinship networks by arguing that the latter are crucial for enabling a risk-averse household to formulate an effective strategy in response to uncertainty at risky migrant destinations. A second novel feature of this study is its focus on explaining and predicting both internal and international migration within the same household labor decision framework.

This paper consists of three parts. Section I presents a household labor allocation model, which takes into account the role of migration kinship networks and uncertainty in household labor decisions. The model provides an analytical framework for exploring the effect of kinship networks on alternative destination choices. It leads to a number of testable hypotheses concerning the effect of changes in these, as well as in several other characteristics of the household and of individual household members, on migration decisions. In Section II, data from a household survey carried out in two Mexican villages used to estimate a multinomial, logit model corresponding to the household decision model. The estimation results make it possible to test the

hypotheses formulated in Section I. Section III offers a discussion of the dynamic role of migration networks in rural out-migration, including some implications of migration kinship networks for the stability of migrant flows and the evolution of international and domestic migration patterns over time.

## I. MODELING HOUSEHOLD LABOR DECISIONS UNDER UNCERTAINTY

Considerable attention has been given in recent years to the role of risk and risk-avoidance in various peasant resource-allocation decisions, particularly with regard to technological change in agriculture. (See, for example, Roumasset, Boussard, and Singh 1979; Feder, Just, and Zilberman (1985).) Surprisingly, there has been little consideration of the effects of risk on household labor allocation decisions including migration. David (1974) has illustrated how to incorporate risk into a general model of migration. Stark (1978) and Stark and Levhari (1982) argue that aversion to risk is a major *cause* of rural-to-urban migration in less-developed countries.

Methods of incorporating risk into utility analysis without positing a specific form of the utility function are discussed in Levy and Markowitz (1979) and in Just and Zilberman (1983). The approach used here draws upon the one proposed by David (1974), since it is most appropriate for cases involving discrete decisions, such as the decision of where a household member's labor time should be allocated.

Consider a peasant household at some point in time consisting of  $J$  individuals and possessing assets whose combined value will be represented by  $A$ . The household's assets include land, any animals and machinery that the household owns, and nondirectly productive assets (for example, housing). The household also possesses "intangible" capital which affects household income particularly through its influence on returns to family labor. The intangible capital includes migration capital, or migrant kinship networks with family members at potential migrant destinations.

The household's labor decision problem is represented by a two-period problem. Let  $Z$  represent the discounted future stream of expected household utility of wealth evaluated at time 0:

$$Z = \sum_{t=1}^2 \delta^{t-1} EU(W_t), \quad (1)$$

where  $\delta$  is the discount factor,  $U(\cdot)$  is household utility, and  $W_t$  is household wealth at the end of period  $t$ , consisting of the value of the household's assets  $A_t$ , assumed to be known, plus household income at time  $t$ ,  $Y_t$ :

$$W_t = A_t + Y_t. \quad (2)$$

Income  $Y_t$  consists of remittance income from household members who have migrated and income contributed to the household by household members in the village (for example, through household-farm or village wage work). It is assumed that wealth is desirable ( $EU'(W) > 0$ ) and that the household is not a risk seeker ( $EU''(W) \leq 0$ ).

The household labor decision variables include the allocation of each household member's labor time to economic activities within the village, to migration to destinations in the home country, or to international migration. Each of these activities requires an investment of time and/or capital by the household. This investment can be relatively small, as in the case of purchasing essential inputs for farm production under a constant technology; or it may be relatively large, as in the case of investing in international migration. The returns to the household from each activity, however, are not known with certainty by the household at the time the labor decisions are made. Income from farm production is influenced by variables outside the household's control that affect harvests (for example, weather and pests) and input and output prices (for example, changing market conditions and government policies). Income from village work besides household farm work can vary with the availability of employment opportunities, particularly in agriculture, and with swings in the market demand for nonagricultural goods produced by the household (for example, handicrafts). Remittances to the household from a member who migrates vary with the migrant's success in finding and retaining work at the destination (and, if an undocumented international migrant, his success in evading the immigration authorities). They also depend on the migrant's remittance behavior. The latter is closely affected by the terms of the migrant's implicit contractual arrangement—including the remittance clauses—with his household. These terms too may be affected by the

degree of tightness of urban labor markets which, in turn, is subject to stochastic changes (see Stark 1983).

Given these multiple sources of uncertainty, the household cannot act as an expected income maximizer in the manner traditional migration models assume. Instead, it must follow an expected income-maximizing, risk-minimizing strategy, similar in many ways to that of an investment portfolio problem. Consideration of risk provides one very logical explanation for the pattern, evident in peasant households in many parts of the world, whereby the labor of household members is allocated to a diversity of income-generating activities, both inside and outside the village. The peasant household that allocates its labor in this manner spreads and hence ordinarily lowers the risk associated with its "labor investment" decisions.

The effects of uncertainty on household utility can be incorporated into Eq. (1) by replacing  $EU(\cdot)$  by its second-order Taylor series approximation around mean wealth. Letting  $\bar{U}''$  denote the second derivative of household utility evaluated at mean wealth, we have:

$$Z = \sum_{t=1}^2 \delta^{t-1} [U(\bar{W}_t) + .5\bar{U}''\text{Var}(Y_t)]. \quad (3)$$

Household utility at each point in time can be seen to have two components: a mean wealth component  $U(\bar{W}_t)$  and a risk component, consisting of the variability of household income weighted by the household's risk aversion at mean wealth. Let  $d = 1, \dots, D$  designate the labor activities available to the household. The activity  $d^*$  chosen for household member  $j$  at time  $t$  is that which maximizes the future stream of household utility considering the characteristics of the household and of the individual, including the individual's allegiance to the household. We let  $Z_d^j$  denote the future stream of expected household utility if member  $j$ 's period 1 labor time is allocated to activity  $d$ . The household labor allocation problem can be represented by the following decision rule:

$$d^{*j} = \begin{cases} 1 & \text{if } Z_{d^*}^j > Z_d^j \text{ for all } d \neq d^* \\ 0 & \text{otherwise.} \end{cases} \quad (4)$$

The household's decisions in each period have a long-term as well as a

short-term effect on household utility. First, they influence the level and variability of income in the period in which the decision is made. Second, they affect the level of household assets, and thus the returns to household assets and labor and household attitudes toward risk in future periods. A decision for member  $j$  to migrate to destination  $d$ , for example, could result in a change in household income through net remittances from member  $j$  during each period he is away. It also contributes to the individual's migration experience and to the household's migration network to destination  $d$ , and it affects household income also by changing the risk environment that impinges on other allocative decisions. The fact that not all household income and labor time is always used for the household's immediate ends (and that decisions are taken for which rewards may not accrue to the household until future time periods) is evidence that an intertemporal decision process is at work. The effect of period 1 decisions on migration networks and individual characteristics (for example, migration experience) in the second period can be represented by equations of movement of the form:

$$\begin{aligned}mk_{d,2} &= f(mk_{d,1}, X_1) \\ s^j_2 &= g(s^j_1, X_1)\end{aligned}$$

where  $X_1$  represents the decisions taken in period 1,  $mk_{d,t}$  denotes the household migration kinship network to place  $d$  at time  $t$ , and  $s^j_t$  is a vector of characteristics of household member  $j$ .

The Todaro model (Todaro, 1969) is a special case of the decision criterion given by Eq. (4), in which the individual, rather than the household, is both the decision unit and the migration unit, and the decision to migrate depends only on expected income over a given time period.

#### A. Stochastic Modeling of Returns to Household Decisions

Returns to household decisions are uncertain and may be influenced by individual characteristics  $s$ , by household characteristics  $h$ , and by household migration capital  $mk$ . The effects of these variables can be introduced into the analysis by modeling returns with a stochastic specification similar to the one proposed by Just and Pope (1977) for

examining the effects of modern inputs on risk in agriculture. According to this specification, net household income from village work has the form

$$y = \bar{y}(h) + v_0(h) \epsilon_0. \quad (5)$$

where the vector of household characteristics  $h$  includes assets  $A$ , which influence income; and  $\epsilon_0$  is a stochastic error term whose expected value is zero.  $\bar{y}(h)$  and  $v_0(h)$  are functions representing the effect of household characteristics on the mean and variability, respectively, of village-based income. Under a given farming technology, the household's income on the farm depends, in part, on the household's ownership of physical assets (for example, land, machinery and animals) and on household labor, especially adult labor, available to perform household-farm work.

Returns to the household from the labor of household member  $j$  in activity  $d$  are modeled as

$$r_d^j = \bar{r}_d(s^j, h) + v_d(s^j, h, mk_d) \epsilon_d. \quad (6)$$

Returns to village work by household members are influenced by individual characteristics (primarily age and sex), as well as by the variables mentioned previously that are outside the household's control. A migrant's expected income at a particular destination is likely to be affected by characteristics of the individual (migration experience, education, skills, age, sex) along with other, stochastic variables. His commitment to remit, if any, generally will depend on the degree to which the individual identifies with the household, expects to reap various gains from remitting, and cares about the household's needs at each point in time. Household needs are determined by the household's income from other sources, including farm income and remittances by other household members, by the prevalence and efficiency of rural capital markets, and by other, stochastic variables.

The variability of remittances from household migrants may be influenced to the extent the migrant can respond effectively to the uncertainties inherent in migration. As already pointed out, these include uncertainties with respect to employment and, for undocumented, international migrants, the risks of being apprehended by the immigration authorities. Migration kinship networks, along



with characteristics of the migrant himself, can play an important role in this regard.<sup>1</sup>

The error terms  $\epsilon_0$  and  $\epsilon_d$   $d = 1, \dots, D$  in Eqs. (5) and (6) are assumed to be jointly normally distributed, with zero mean and a variance-covariance matrix represented by

$$\Omega = (\sigma_{dd'}). \quad (7)$$

If net returns to migration are independent of village agricultural production, the covariance terms corresponding to these activities will, of course, be zero.

Variables affecting the distribution of returns to alternative labor allocations can now be incorporated directly into the period 1 decision rule. Let  $V_{d,t}^j$  denote the  $(2 \times 1)$  vector whose components are  $v_0(h)$  and the function  $v_d(s^j, h, mk_d)$  corresponding to member  $j$  in activity  $d$ :

$$V_{d,t}^j = \begin{pmatrix} v(h) \\ v_d(s^j, h, mk_d) \end{pmatrix}.$$

The variance-covariance matrix of the stochastic error terms  $\epsilon_0, \epsilon_d$  will be represented by

$$\Omega_d = \begin{pmatrix} \sigma_0^2 & \sigma_{0,d} \\ \sigma_{0,d} & \sigma_d^2 \end{pmatrix}.$$

Let  $d^*_2/d^*_1$  denote the optimal activity choice in period 2 conditional upon the household's period 1 decision. The period 1 decision can be represented by

$$d^*_1 = \begin{cases} 1 & \text{if } U(W_{d^*_1}^j) + U(W_{d^*_1 d^*_1}^j) > \\ & U(W_d^j) + U(W_{d^*_1 d}^j), \text{ for all } d \neq d^*_1 \\ 0 & \text{otherwise.} \end{cases} \quad (8)$$

Utility in period  $t$  can be rewritten using vector notation as:

$$U(W_{d,t}^j) = U(\bar{W}_{d,t}^j) + .5\bar{U}''V_{d,t}^j' \Omega_d V_{d,t}^j. \quad (9)$$

It is convenient notationally to rewrite (8) in terms of differences in household utility under alternative destination choices:

$$d^{*j} = \begin{cases} 1 & \text{if } \Delta_{d^*,d_1}^j + \Delta_{d^*,d_2}^j > 0 \\ & \text{for all } d_1 \neq d^* \\ 0 & \text{otherwise} \end{cases} \quad (10)$$

where

$$\Delta_{d^*,d_1}^j = U(W_{d^*}^j) - U(W_{d_1}^j) \quad (11)$$

and

$$\Delta_{d^*,d_2}^j = \delta[U(W_{d^*}^j) - U(W_{d_2}^j)].$$

The impact of changes in explanatory variables on household labor decisions can now be assessed by considering their effect on the differences  $\Delta^j$  in (10).

## B. Comparative Statics Using the Household Decision Model

By placing some very general restrictions on the form of the utility function, a number of hypotheses concerning the effect of changes in explanatory variables on migration decisions can be formulated on the basis of decision rule (10). Any change in an explanatory variable that increases expected returns to the household from some activity  $d^*$  or that reduces the variability of these returns, relative to some other activity, increases the difference  $\Delta_{d^*,d}$  in favor of destination  $d^*$ . Conversely, any change that reduces expected returns or that increases the variability of returns from  $d^*$ , relative to some other  $d \neq d^*$ , reduces this difference.

### 1. Migration Networks and the Decision to Migrate

Possession of a migration network to a particular destination, on average, reduces the risk component of the returns to the household from migration to that destination. This increases the weight in favor of migration to the destination to which the network leads, while decreasing the probability of migrating to other locales or of staying in the village. The magnitude of these probability changes depends on the magnitude

of the decrease in risk associated with having a migration network, as well as, on the extent to which the household is a risk-avoider (that is, the size of  $\bar{U}''$  in (3)). If migration kinship networks influence household labor decisions primarily through their migration insurance function, then *ceteris paribus* the effect of migrant kinship networks on migration will generally be greater for illegal migration across national borders, which entails a high element of risk, than for migration within an individual's home country, which is generally less risky and associated with a relative availability of labor market information. That is, we can expect kinship networks to be a significant variable explaining differential migration.

## 2. *Individual and Household Characteristics*

The model produces a number of hypotheses concerning the effect of individual and household characteristics on labor decisions. Both the direction and the magnitude of these effects can vary greatly with migration destinations (domestic or foreign) and also with cultural patterns in the home country. Four of the most interesting hypotheses, particularly in regard to explaining differential migration, concern the influence of education, status in the household, household size, and household income on the decision to migrate and the choice of migrant destinations.

Education has long been cited as an important factor encouraging migration out of rural areas in LDCs. This does not necessarily mean, however, that schooling has a positive effect on migration to all types of destinations. Education is likely to produce significant returns in places where this education is recognized, valued, and can be utilized productively. Beyond basic literacy, general education of the type ordinarily offered in rural areas in LDCs does not offer a notable advantage to an individual inside the village. Higher levels of schooling, on average, will have a positive effect on earnings in urban areas in the individual's home country and a stronger effect on earnings in these areas than in rural areas. Thus, all things being equal, remittances to the household from migrants in the home country are likely to be positively related to education.

Whereas within a country a great deal of schooling-generated human capital is locationally transferable, between countries it is often less so. When the relevant employment alternatives in another country are in undocumented labor markets, the economic value of schooling may be

quite low. We hypothesize, therefore, that education is positively related to migration in an individual's home country, but not to migration into foreign labor markets where undocumented migrants predominate.

Empirical studies of migration have identified a widespread pattern, consistent with basic comparative advantage considerations, of sons and daughters migrating while parents remain in the village. (See Stark 1978.) The household decision model provides some insights into why this would be so. Domestic destinations, because of their relative proximity to the village and their relative ease of entry, are generally better suited for short-term, seasonal migration work than are foreign destinations. For a village household, particularly if it is a farming household, the opportunity cost of domestic migration is thus small compared with that of international migration which, as pointed out earlier, generally requires a large commitment of both time and capital. This large opportunity cost would be reflected in the differences between expected returns from each destination choice.<sup>2</sup> A household head's prolonged absence may increase the variability of returns from village farm production if the head's administrative services and experience are needed on the farm. There may be other considerations as well that discourage household heads from migrating, especially over long distances. In Mexico, *ejidatarios* (or holders of state-owned, reform sector lands) are required to work their land or else run the risk of having their plots reapportioned to other village households. Village obligations (for example, communal work efforts) may also require the household head's presence in the village at certain times of year. We can expect, therefore, that household heads are less likely to migrate than are other household members, particularly to foreign destinations.

The larger the adult household size, in general, the lower the opportunity cost of sending a particular household member to a destination outside the village. When other adult household members are present in the village, they can absorb a large share of the household-farm duties of those who migrate, presumably at a disutility cost associated with the additional work burden. Moreover, a household's size and composition may place a strain on its land and other physical capital holdings in the village (and, more generally, income from village sources may not be able to keep up with the household's consumption needs). Thus, a consumption- (or population-) push incentive for migration may also be evident.<sup>3</sup> Both these considerations—the relatively low opportunity cost of migration for large families and the consump-

tion strain that large household size can place on household resources—have a similar predicted effect on migration decisions. They produce the hypotheses that household size and the number of adult members available to work on the household-farm are both positively related to the propensity to migrate. Considering the differences in opportunity costs outlined in the preceding paragraph, it would not be surprising if household size had a stronger effect on international migration than on internal migration, since the size constraint is most binding where opportunity costs are highest.

The effects of household size on labor decisions should not, though, be viewed independently of household income. Large households, while having greater consumption demands, may also be better able to generate income than may households that are relatively lacking in human labor power. A household's level of income from sources other than member *j*, in turn, is likely to have a strong effect on decisions concerning the allocation of member *j*'s labor time. The direction of this income effect is blurred, especially due to imperfection in rural capital markets. On the one hand, an increase in income from other sources, with its consequent wealth effect, can make a household less likely to engage in rural-to-urban migration but more willing and able to finance a more costly and possibly temporarily riskier labor activity such as international migration. On the other hand, higher incomes may also enable the household to afford initially costlier alternatives to migrant work (for example, schooling, or helping a member to establish a new source of livelihood or simply be supported in the village).

## II. ESTIMATION OF THE HOUSEHOLD LABOR DECISION MODEL

Household data from two Mexican villages were used to estimate the household labor decision model. The first part of this section describes the data, which include observations on labor activity choices, migration networks, and individual and household characteristics. In the second part, the estimation results are presented and used to test the hypotheses presented in Section I.

### A. The Data

Data for estimating the decision model were collected in a series of in-depth interviews carried out in two villages in the Pátzcuaro region

of the state of Michoacán, Mexico. This region is located in the highlands approximately 100 miles southeast of Guadalajara. The villages studied are in many ways typical of rural Mexico; they are characterized by small-scale rain-fed agricultural production on subsistence or sub-subsistence plots. In addition, there exist some possibilities for fishing, although the major lake in the area, Lake Pátzcuaro, has been seriously overfished in recent years, a classic "commons tragedy." Handicrafts, primarily basket weaving, are a major source of income for some households.

The sample consists of 60 randomly selected households comprising 423 adult individuals. Detailed data were collected on each household's assets and on each household member's socioeconomic characteristics at the end of 1981. Data were then gathered on all economic activities in which each household member participated during the following year. These activities include household production (farming, handicrafts, fishing, livestock) as well as wage work both inside and outside the village. The labor data consist of the period of time worked in each activity and the income (net of production, transportation, or migration costs paid by the household) that accrued to the household as a result of the labor.

On the basis of these data, individuals were assigned to category (1) if they were not labor migrants at any time during the year; (2) if they migrated to destinations in Mexico, or (3) if they migrated to the United States.

The vector of household characteristics  $h$  corresponding to the labor decision for household member  $j$  includes household size, the number of adult household members who were in the village during 1982, an instrument for total household income from all sources minus member  $j$ 's contribution, and the value of the household's primary physical assets (land, machinery and animals) at the start of the year.

The individual characteristics ( $s^j$ ) include the household member's sex, age, education, years of previous migration experience in Mexico and in the United States, and status in the household. Two of these are represented by 0-1 dummy variables. Sex is indicated by a 0-1 dummy where 1 indicates male. For household status, 1 indicates that the person is a household head.

Household "ownership" of U.S. and domestic migration networks is represented by dummy variables that assume a value of 1 if the household possesses a network and 0 otherwise. A network to destination  $d$  is considered to exist if a son, daughter, sibling, or parent of

either household head was living at  $d$  at the time the household's decision occurred:

Quadratic transformations of age and household income were included in order to capture potential nonlinearities between these and the decision variable. A summary of the explanatory variables appears in Table 1.

*Table 1.* Variables Used in the Empirical Analysis of Household Labor Decisions (Time Period: 1982)

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Group Variable: $d$	= 1 if the individual remained in the village 2 if the individual migrated to a destination in Mexico 3 if the individual migrated to the United States
Household Characteristics ( $h$ )	
size	= household size
adults	= number of household adult members in the village
income	= instruments for total household income from sources other than household member $j$ (see Appendix)
incomesq	= income squared
wealth	= total value of household's major physical assets (land, machinery and animals)
Individual Characteristics ( $s$ )	
sex	= 1 if male 0 if female
age	= age
agesq	= age squared
cd	= highest level of schooling completed
head	= 1 if the individual is a household head 0 otherwise
USexp	= number of years in which the person has worked at some time as a Mexico-U.S. migrant
MEXexp	= number of years in which the person has worked at some time as an internal migrant
Migration Networks	
Mexnet	= 1 if the household possesses a kinship network to a destination in Mexico 0 otherwise
USnet	= 1 if the household possesses a kinship network to the United States 0 otherwise

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## B. Estimation and Results

McFadden (1974) has shown that under general conditions the utility-maximization rule (4) corresponds to a multinomial logit, in which the probability that the labor time of household member  $j$  will be allocated to activity  $d^*$  at time  $t$ ,  $P_{d^*,t}^j$ , is given by:

$$P_{d^*,t}^j = \exp[z(W_{d^*,t}^j)] / \sum_{d=1}^D \exp[z(W_{d,t}^j)] \quad (19)$$

where

$$z(W_{d,t}^j) = \phi(X_t^j) \beta_d \quad (20)$$

and  $\phi(X_t^j)$  is a vector containing transformations of the explanatory variables appearing in Table 1.

The probability formulation given by (19) and (20) can be solved using maximum likelihood techniques to obtain consistent, asymptotically efficient estimates of the coefficient vectors  $\beta_d$  corresponding to alternative activities  $d$ . (See Amemiya 1981 and McFadden 1976 for surveys of discrete choice estimation techniques.) The method employed here uses the Davidon-Fletcher-Powell iteration procedure in the Qualitative Dependent Variable Program CRAWTRAN. In the estimation procedure, the coefficients on group 1 (the village "stayers") are normalized to zero; this sets the base group for each coefficient to group 1. The coefficients  $\beta_{d,k}$  can therefore be interpreted as representing "the effect of variable  $k$  on the probability that individual  $j$  is in group  $d$ , over the probability that he or she will remain in the village." Separate regressions of group  $d$  on group 1 are run for  $d = 2$  and 3. The resulting  $\bar{\beta}_{d,k}$  are used as starting values for maximizing the log likelihood function corresponding to (19).

The estimated coefficients  $\beta_{d,k}$ ,  $k = 1, \dots, K$  for choices  $d = 2$  and 3 appear in Table 2, together with the  $t$ -statistics corresponding to the null hypothesis that  $\beta_{d,k} = 0$ . A summary of the predictive accuracy of the estimated model is given in Table 3. The model is very good at predicting household labor choices overall and is particularly effective in distinguishing between international and internal migration.



Table 2. Results of the Multinomial Logit Analysis

Variable*	Internal Migrants Group (2)		Mexico-U.S. Migrants Group (3)	
	Estimated Coefficient	t-Statistic	Estimated Coefficient	t-Statistic
Constant	-7.511	-4.123	-13.653	-5.271
size	0.038	0.312	0.057	0.383
adults	0.176	0.983	0.333	1.547
income	-1.351	-1.938	1.451	1.190
incomesq	0.188	1.495	-0.293	-1.340
wealth	0.063	0.435	-0.020	-0.151
sex	0.110	0.315	0.793	1.928
age	0.328	3.143	0.525	3.903
agesq	-0.005	-3.081	-0.008	-3.701
ed	0.250	4.006	-0.116	-1.386
head	-0.101	-0.133	-3.084	-2.904
Mexnet	0.653	1.364	-0.436	-0.897
USnet	0.071	0.156	2.797	4.076
Mexexp	0.468	5.724	0.150	1.407
USexp	0.204	2.255	0.451	5.550

Log-Likelihood = -199.45

\*For definitions of variables, see Table 1.

The findings confirm that Mexico-United States migrant networks are significant in explaining differential migration from the households in the village sample. The group 3 coefficient on U.S. migration networks of 2.797, significant at the .001 level, makes this variable one of the most important positive influences on the decision to migrate to the United States. Migrant networks to Mexican destinations, on the other hand, have only a slight effect on internal migration. The relative weakness of domestic migrant kinship networks in explaining internal migration reflects the ease with which individuals are able to migrate successfully to Mexican destinations (primarily Mexico City)—often

Table 3. Predictive Accuracy of the Estimated Logit Model

Observed group	(a) Predicted group		
	[1]	[2]	[3]
	1.	250	13
2.	30	45	5
3.	21	2	47

with the assistance of friends and acquaintances outside the family—or the ability of households to bear the consequences associated with unsuccessful domestic migration.

The weak effect of internal networks does not necessarily contradict findings of past studies that show a strong positive relationship between contacts in urban areas and rural-to-urban migration in LDCs. The importance of a migration network derives from its ability to provide labor market information where such information is scarce and costly, where the labor market is characterized by a high degree of risk, and where the penalty for failure is large. Situations can easily be envisioned in Mexico and elsewhere in which a lack of experience at domestic destinations makes internal migration quite risky and information about domestic urban labor markets scarce and costly. In these cases, kinship networks to internal destinations may play a more significant role in explaining internal migration. In Mexico, for example, domestic kinship networks are likely to be more important in some culturally or physically secluded indigenous communities, where language and logistics have made migration to the city difficult in the past. In the households studied here, by contrast, domestic labor market information at present appears to be relatively easy to obtain, and the costs and risks associated with internal migration are relatively small.

Migration decisions appear to be strongly influenced by an individual's sex, education, age, and household status. Mexico-U.S. migrants are significantly more likely to be males than females, as shown by the group 3 coefficient of 0.793 (significant at the .05 level) on sex. In contrast, no significant sex bias is evident with regard to domestic migration. These findings suggest that the returns from migrating to the United States, relative to the returns from village work, traditionally have been greater for males than for females. They also may reflect cultural norms that limit the extent to which female household members have been spatially separated from their village households.

The coefficient on status in the household is negative and significant at the .005 level for Mexico-U.S. migrants. It is insignificant for domestic migrants, however. In combination, these results support the view that for household heads the opportunity cost of international migration, which implies a relatively long-term absence from the village, is large, while the opportunity cost of domestic migration is much smaller.

It was hypothesized that education has a positive effect on the

returns to domestic migration, while offering no apparent advantage to undocumented workers in the United States. The empirical findings support this hypothesis. They show a significant positive relationship between education and *domestic* migration. By contrast, a slight negative relationship is evident between schooling and Mexico-U.S. migration.

Age appears to be positively related to the probability of migrating up to a certain point (around 33 years). Older household members, however, are less likely to migrate, both to the United States and to Mexican destinations, than are their younger counterparts. This suggests a life-cycle pattern in which individuals who participate in intermittent or long-term migration during their prime working years have tended, in later years, to settle in the village. Such a pattern may be due to the expectation that the marginal returns from migration would tend to decrease, and the opportunity cost of absence from the village would tend to increase, during the later years of a person's lifetime. In addition, to the extent that international migration entails a large short-run sunk cost followed by a stream of future expected gains, a longer future tilts the benefit-cost ratio in favor of the household's young.

The number of adult members in the village is positively household related to Mexico-U.S. migration, but no significant pattern was found between this variable and migration within Mexico. The last result is not surprising when one considers the relative ease with which domestic migrants can return to the village during peak farm-labor seasons. Such short-term migration is more difficult and costly for Mexico-U.S. migrants.

There is evidence that higher household incomes discourage internal migration. However, there is only a weak negative relationship between income and Mexico-U.S. migration, and at only at the highest income levels. The second finding probably results from two counteracting effects of income on Mexico-U.S. migration. On the one hand, higher-income households are better able to afford the high cost and risks of sending migrants (usually illegally) to the United States. On the other hand, high household incomes reflect the availability of income opportunities without having to send family members illegally into U.S. labor markets.

### III. SUMMARY AND CONCLUSION

In this paper, micro-level village household data have been used to test several hypotheses concerning the effect of migration kinship networks

and selected household and individual characteristics on international and internal migration. These hypotheses follow from a microeconomic model of household labor decisions, in which migration kinship networks and uncertainty play important roles. For the case of Mexico, the statistical results provide a picture, grounded in a microeconomic theory of the household, of what types of household members tend to migrate to foreign versus domestic destinations. The variables explored include ones that influence migration decisions primarily by affecting the risks associated with migrant work.

Kinship networks are among the most significant variables explaining differential migration. The statistical analysis highlights the significant positive effect that migration kinship networks play in Mexico-U.S. migration vis-à-vis other destination choices. Migration networks influence both the direction and the magnitude of village out-migration over time, thereby creating a diffusion process. In the case of international migration, once one member of a household succeeds in establishing himself at a particular destination, there is a high probability that other household members will follow. If household labor decisions are also influenced to some degree by the migration networks of other households, then the possibility arises for entire village-specific migrant communities to form in selected migration destinations.

The existence of migration networks can have important implications from the point of view of international migration policy. Migrant sending households—and indeed villages—that have long histories of migration and well-established migrant support networks in the United States are likely to be more resilient to U.S. immigration reforms than households where these networks are less developed. On the other hand, any reform that succeeds in dismantling high-value network assets will have a severe adverse wealth and income effect on many village households, with a possibly dramatic impact on productive allocations and risk taking in *other* economic spheres.<sup>4</sup>

As long as the propensity for international migration is a positive function of past migration, the population exodus from rural areas will continue and the role of Mexico-U.S. migration in household labor portfolios will increase, unless checked by other counteracting influences. Few variables opposing have been continued migration were identified in this study. The propensity to migrate tends generally to decline in the later stages of a person's life cycle. There is some evidence that household income is negatively related to Mexico-U.S. migration beyond a certain point. This second counteracting influence

on Mexico-U.S. migration, however, operates only at the higher village income levels, which not too many households are likely to reach in the near future given the current pace of rural development and the absence of major agricultural efforts directed at low-income households in Mexico. Finally, schooling clearly discourages household members from migrating to the United States.

At the same time, two variables stand out as potentially reinforcing the disequilibrating effect of migration networks on village out-migration. Past work experience in the United States has a strong positive effect on Mexico-U.S. migration, indicating that migrants' economic and social ties with the United States strengthen significantly over time. In addition, the adult household size is positively related to the propensity to migrate to the United States. The relationship between adult household size and Mexico-U.S. migration leads to another question, which represents the crossroads between migration and human fertility. This is the relationship of village out-migration with family size over time. If opportunities for migration increase the asset demand for children in poor peasant households, a possibility that Stark (1981) and Katz and Stark (1985) have explored, then this interaction would constitute an additional disequilibrating influence on village out-migration. Empirical studies on migration and fertility decisions over time are needed in order to shed additional light on this question and address it with a greater degree of confidence.

## APPENDIX

### Derivation of the Household Income Instrument

Estimates of total household income from sources besides person *j* (YHAT) were obtained by regressing observed 1982 income from other sources on household holdings of income-producing assets at the start of the year, and then using the estimated equation to predict household income from other sources for each person in the sample. The assets include the value of households' primary physical assets (land, animals and machinery) in thousands, denoted *A*; human capital assets (the number of adults in the household (NADS) and the number of household members with post-primary schooling (TED)); and household migration capital, represented by whether or not the household had a family contact in the United States (USNET = 1) or at an

internal migrant destination (MEXNET=1). The estimated income equation is:

$$\begin{aligned} \text{YHAT} = & 1376.8 + 0.29\text{A} + 821.92\text{TED} - 96.27\text{NADS} \\ & (4.94) \quad (5.59) \quad (8.87) \quad (-1.98) \\ & + 558.08\text{USNET} - 397.96\text{MEXNET} \\ & (2.81) \quad (-1.85) \\ \text{R}^2 = & 0.28 \end{aligned}$$

Numbers in parentheses are t-statistics.

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### NOTES

1. An increase in the likelihood of migration success may in principle increase the expected returns to the household from migration as well as the variability of these returns. If expected migrant-to-household remittances are a proxy for the expected returns from migration, then there is no evidence for a significant effect of kinship networks on expected returns in the households studied here. This implies that, if kinship networks have a significant positive influence on migration decisions, this influence will be attributable primarily to the effect of networks on reducing the perceived risks associated with migration for village households.

2. Note that, while international migration may well preclude a household head from raising crops in the village, both farming and migration work may be possible if the household head migrates to a domestic destination. In the second case, the distribution of returns to the household from international migration would have to be compared with the distribution of returns from domestic migration *plus* village work (for the time the individual is in the village).

3. In a related paper, migration and fertility decisions are endogenized and the asset demand for children as migrants is analyzed. See Katz and Stark (1985).

4. Illegal migrants who have access to a migration network, if apprehended by the immigration authorities, can immediately enlist their network's assistance to repeat the border crossing.

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