# Rural-Urban Migration
# In Less Developed Countries:
# A Dynamic View

by

Thomas Hoopengardner

33

Discussion Paper 33
January 1974

Center for Research on Economic Development
University of Michigan
Ann Arbor, Michigan 48108

# Rural-Urban Migration in Less Developed Countries: A Dynamic View

Thomas Hoopengardner

## I. Introduction

The rapid rates of rural-urban migration typifying many less developed countries have been of growing concern for two reasons. In some cases, in East Africa for example, opportunities have not kept pace with the growth of the urban labor force, resulting in high rates of urban unemployment. In other cases, the Ivory Coast, for example, rapid, sustained economic growth in the urban sector has been capable of absorbing a very high rate of rural-urban migration without high unemployment rates developing. Even where unemployment has not emerged, the rapid population growth caused by high migration rates to cities has put serious strains on social services such as public health, water supplies, and schools.

Models of the Todaro type (3)(6)(7)(8) relating the rate of rural-urban migration to the difference between the urban and rural real wage rates and to the urban unemployment rate provide insight into continuing migration in the face of growing unemployment. In these models the real urban wage is prevented from falling into equality with the real rural wage by institutional factors and unemployment becomes the equilibrating force. Models in this family are essentially exercises in comparative statics. Migration is a temporary disequilibrium phenomenon described by a stock-adjustment rule (3, p. 129; 6, p. 141). If wage rigidities did not exist, rural and urban wages would equalize and migration would stop.

But rapid rural-urban migration also occurs in the absence of wage rigidities and without unemployment developing. It is the purpose of this paper to place rural-urban migration in a truly dynamic context, one broad enough to include flexible or rigid wages as special cases.

Placing migration in a dynamic context reinforces some conclusions suggested by earlier models and substantially alters others. In the Todaro models, migration would cease if the urban wage floor were eliminated. It will be shown using the dynamic model presented here that rescinding the urban wage floor actually leads to an increase in the rate of rural-urban migration. In both models an urban wage subsidy can reduce the urban unemployment rate. In the Harris-Todaro context, restricting migration also reduces unemployment. The present model, on the other hand, demonstrates that policies restricting migration may temporarily reduce unemployment but that they cannot be expected to change the rate of unemployment in dynamic equilibrium.

## II. A Dynamic Model of Rural-Urban Migration

To be complete, a rural-urban migration model applicable to LDC's would have to consider at least four sectors: (1) traditional agriculture, characterized by low productivity and limited participation in the money economy; (2) commercial agriculture, involving cash-crop production, usually on a large scale using wage labor; (3) the modern urban sector, typified by highly paid urban manufacturing and government services employment; and (4) a traditional urban sector with small-scale businesses, urban job-seekers, and all other urban individuals not in the modern sector. Even this sectoral breakdown leaves much to be desired, since small-holders account for much commercial agricultural production in some countries, modern industry is not always urban (especially in the case of extractive industries), and so on. But even the level of complication provided by a four sector model is beyond the scope of this paper.

We choose instead, following the example set by the theory of international trade, the dual-economy literature, and Harris and Todaro, to assume only two sectors, urban and rural. The urban sector might be thought of as modern, dynamic, and characterized by wage employment in manufacturing, and the rural as backward, static, and agricultural. These stylizations, while a convenient simplification, fall far short of the complexity found in the real world.

Assume that agricultural production requires labor and land, that manufacturing requires labor and capital, that only the rural sector uses land, and that only the urban sector requires capital. The supply of land is fixed but labor and capital vary over time. We assume commodity prices to be determined in world markets.

Assume that urban output $Y_u$ is a linear homogeneous function of capital K and employed urban labor L with positive but diminishing marginal products and isoquants convex to the origin. Then

$$\frac{Y_u}{K} = f\left(\frac{L}{K}\right) \qquad f' > 0,\ f'' < 0 \quad . \tag{1}$$

The marginal product of labor is a decreasing function of the labor/capital ratio alone, viz.,

$$MPL = f'\left(\frac{L}{K}\right) \quad . \tag{2}$$

Assume further that the rural wage $W_r$ remains constant at $\overline{W}_r$ despite an exodus of labor. In addition to the simplicity afforded there are three consistent justifications for this assumption: 1) if the rural sector is very large relative to the urban sector, labor movements having a significant impact on the urban job market may nevertheless have a negligible effect in the rural sector; 2) rural-urban migrants within a country may be replaced by rural-urban migrants from neighboring countries and by natural population growth in the rural sector; and 3) labor may be in surplus in the Fei-Ranis sense (2). Under any of these circumstances the rural sector may be viewed as a passive provider of laborers.

There are several possible specifications for the investment function of the urban sector. We could assume for example that wage earners save a different percentage of their income than capitalists--at the extreme, that workers save nothing and capitalists save everything. For simplicity assume instead that saving is the same fraction of urban income whatever its source and that all savings are invested. Assume that depreciation is zero so that investment is the rate of change in the capital stock.

$$\dot{K} = I = S = sY_u \quad . \tag{3}$$

Specification of the urban labor market completes the model. We wish to consider two possibilities: 1) that unemployment is prevented by a perfectly flexible urban wage (Section III), and 2) that institutional factors maintain the urban wage above its equilibrium level, with the result that unemployment arises (Section IV).

## III. Flexible wages: dynamic equilibrium

On the demand side of the urban labor market, laborers will be hired up to the point where the marginal product of labor (MPL) equals the urban real wage $W_u$. Assume that the wage and quantity of labor demanded adjust instantly to eliminate labor shortages or surpluses. Then

$$W_u = MPL \quad . \tag{4}$$

On the supply side we assume perfect inelasticity at any point in time. The inelastic urban labor supply (N) increases over time because of natural growth at rate $\bar{r}_u$ and because of migration from the rural sector at rate m, measured as a percentage of the urban labor force.[1] That is,

$$\frac{\dot{N}}{N} = n = m + \bar{r}_u \quad . \tag{5}$$

The rate of rural-urban migration is an increasing function of both the wage ratio between the rural and urban sectors and the employment rate, after Todaro (6, p. 141).

$$m = m\left(\frac{W_u}{W_r}, \frac{L}{N}\right) \qquad m_1 > 0 \qquad m_2 > 0 \quad . \tag{6}$$

If the wages are equal and full employment prevails, migration stops and the rate of urban labor force growth equals the natural growth rate $\bar{r}_u$.

The assumption in this section is that a flexible wage and instantaneous adjustment prevent unemployment so the rate of migration may be considered a function of the wage ratio alone:

$$m = M\left(\frac{W_u}{W_r}\right) \quad . \tag{6'}$$

Combining equations (2),(4),(5), and (6') yields the growth rate of the urban labor force (and of urban employment) as a function of the labor/capital ratio.

$$\frac{\dot{L}}{L} = \frac{\dot{N}}{N} = n = m\left(\frac{f'(\frac{L}{K})}{\bar{W}_r}\right) + \bar{r}_u = n\left(\frac{L}{K}\right) \quad . \tag{7}$$

where $n' < 0$ by the chain rule for derivatives of composite functions.

---

[1]Whether the migration rate should be calculated using the urban or rural labor force as base has been discussed (8),(7). In fact, a "gravity model" base depending on both labor forces might be best if attention is focused on both sectors at once. We chose the simplest alternative; qualitative results would be unaffected by the other possibilities.

Graphically,

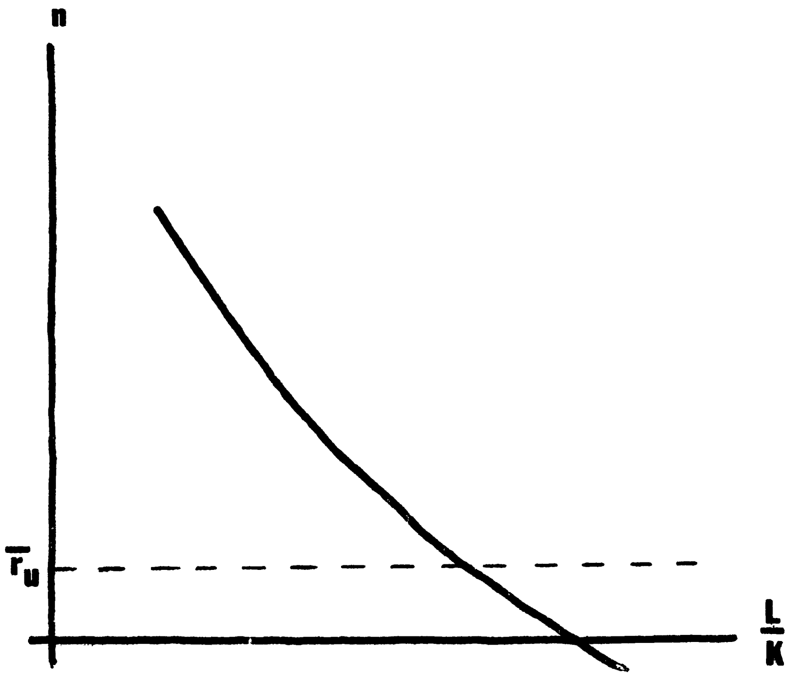



**figure 1**

As demonstrated in figure 1, at low labor/capital ratios the marginal product of urban labor and urban real wage are greater than the rural wage and rural-to-urban migration occurs. At high labor/capital ratios labor is so abundant relative to capital that the real urban wage falls below the real rural wage and urban-to-rural migration occurs. This paper focuses on rural-to-urban migration.

Combining equations (1) and (3) yields the rate of growth of the capital stock as an increasing function of the labor/capital ratio:

$$k = \frac{\dot{K}}{K} = \frac{I}{K} = \frac{sY_u}{K} = s \cdot f\left(\frac{L}{K}\right) \quad , \tag{8}$$

Figure 2 illustrates equations (1) and (8) on the same axes.

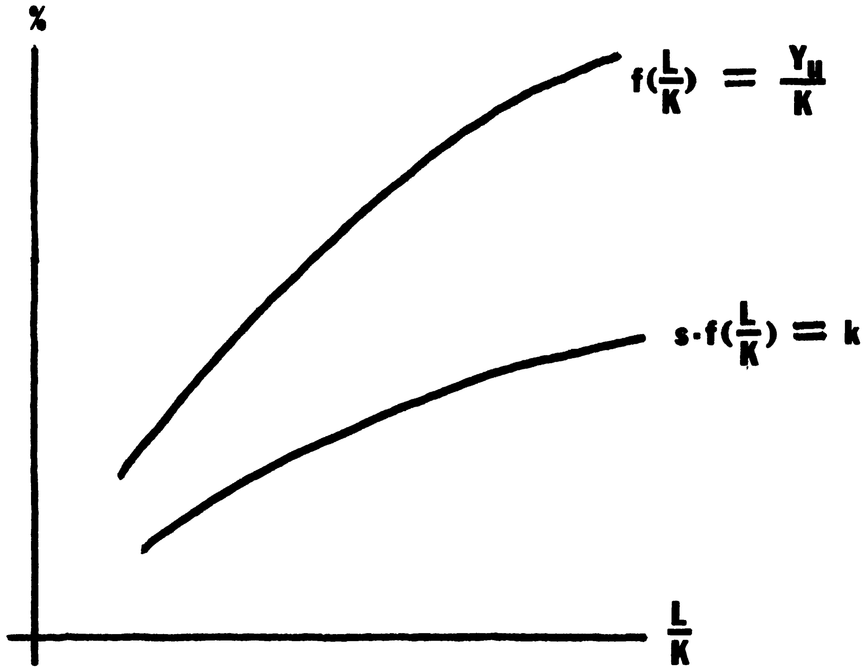



figure 2

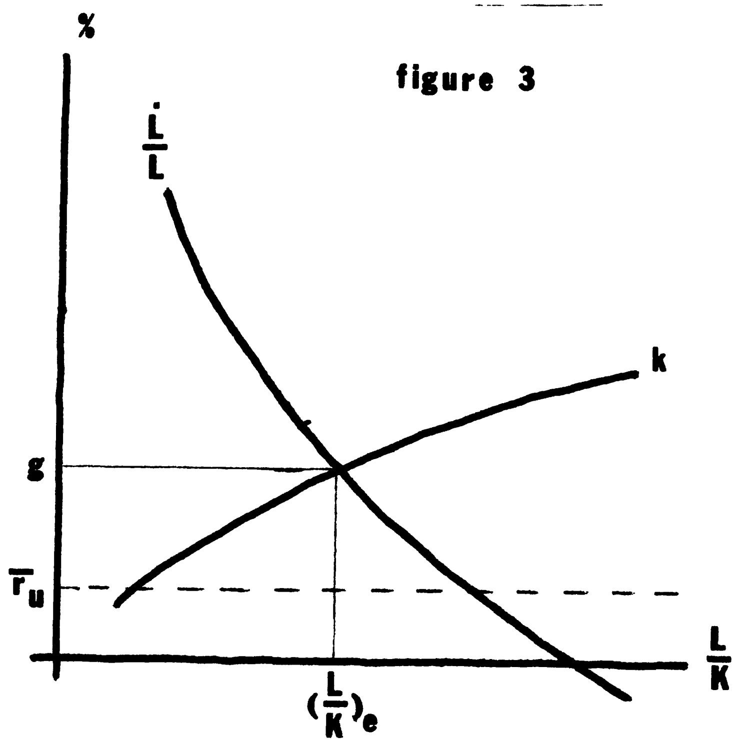
For equilibrium growth in the urban sector, the capital stock and urban employment must grow at the same rate. If $\frac{\dot{L}}{L} > \frac{\dot{K}}{K}$, $\frac{L}{K}$ increases and, from equation (8), $\frac{\dot{K}}{K}$ increases. If on the other hand $\frac{\dot{L}}{L} < \frac{\dot{K}}{K}$, $\frac{L}{K}$ declines and $\frac{\dot{K}}{K}$ falls. Thus the following equilibrium condition follows from equations (7) and (8):

$$\frac{\dot{K}}{K} = sf(\frac{L}{K}) = M(\frac{f'(\frac{L}{K})}{\bar{W}_r}) + \bar{r}_u = \frac{\dot{L}}{L} \tag{9}$$

Equation (9) may be solved for the equilibrium labor/capital ratio $(\frac{L}{K})_e$ and the equilibrium growth rate g of capital, the urban labor force, urban employment, and urban output.

Graphically, this solution corresponds to the intersection of the curves in figures 1 and 2:

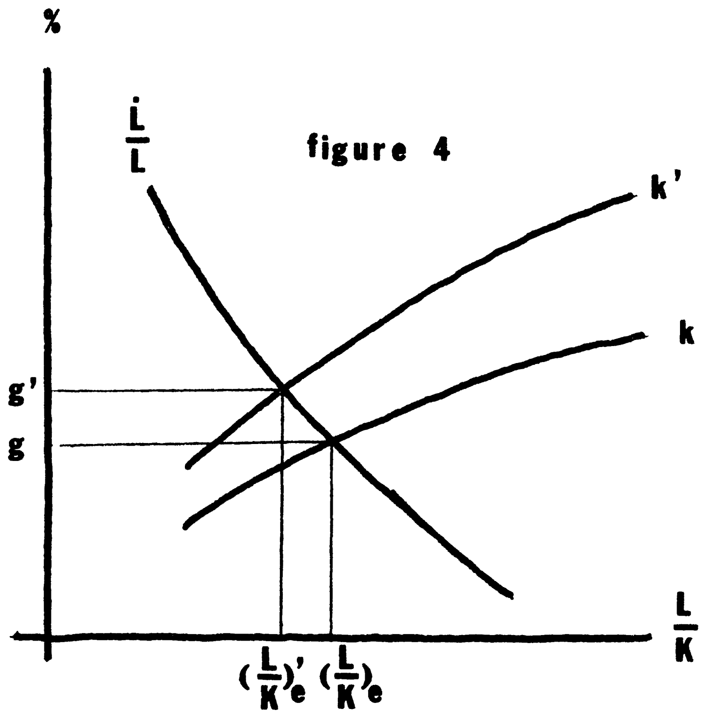
**figure 3**




At labor/capital ratios above $(\frac{L}{K})_e$, employment will grow only as fast as the labor force, less rapidly than the capital stock. The $(\frac{L}{K})$ ratio will fall. Similarly, for labor/capital ratios below $(\frac{L}{K})_e$, the labor force and hence employment grow faster than the capital stock and the $\frac{L}{K}$ ratio will rise. Only the ratio $(\frac{L}{K})_e$ causes rates of growth of labor and capital consistent with each other.

Note that an urban/rural wage ratio sufficient to stimulate migration at rate $m = g - \bar{r}_u$ is a persistent feature of equilibrium growth. The wage disparity is a consequence of growth in the urban sector and less than instantaneous migration in response to the wage gap.

There is an important difference between equilibrium growth in the neo-classical growth model and in the present model. In the usual neo-classical growth model, the saving ratio determines the labor/capital ratio but not the equilibrium growth rate of labor, capital, or output. But in the model presented here, the saving ratio determines not only the equilibrium labor/capital ratio but also the rate of migration, capital stock growth, and growth of output.[1] This is demonstrated in figure 4.




An increase in the saving ratio results in a proportional upward shift in the capital growth curve. At the old labor/capital ratio, capital grows faster than labor and the $(\frac{L}{K})$ ratio falls. A declining $(\frac{L}{K})$ ratio increases the marginal product of urban labor, opening a wider gap and stimulating migration from the rural sector at a faster rate. The new equilibrium will be characterized by more rapid growth, a higher urban wage, and a lower $(\frac{L}{K})$ ratio.

## IV. Rigid wages: stable dynamic disequilibrium

If we now replace the assumption of a perfectly flexible urban wage by the assumption that the urban wage is prevented from falling below a certain floor by such institutional factors as deliberate government policy, the existence of foreign firms, or the bargaining strength of labor unions, the nature of the urban labor market changes drastically.

---

[1] This conclusion also follows under slightly different assumptions. See Neher (5, p. 313) and Davis (1, p. 179).

At any point in time, employers will hire more workers only if the marginal product of labor is higher than the real wage. This means that no further workers will be hired after the labor/capital ratio is so large that the marginal product of labor falls to the real wage floor. Let $(\frac{L}{K})^*$ be the labor/capital ratio at which the marginal product of labor just equals the minimum wage. To hire beyond this point would mean that the marginal product of labor were less than the real wage, a losing proposition for employers. Imposing a real wage minimum amounts to imposing a maximum $(\frac{L}{K})^*$ on the labor/capital ratio.

Because not all workers who present themselves will necessarily find work, unemployment can arise and persist. It is necessary to revert to migration equation (6). Combining equations (2), (4), (5), and (6) yields the urban labor force growth rate as a function of the labor/capital ratio and employment rate:

$$\frac{\dot{N}}{N} = n = m\left(\frac{f'(\frac{L}{K})}{\bar{W}_r}, \frac{L}{N}\right) + \bar{r}_u \quad . \tag{10}$$

Graphically, equation (10) is a family of downward sloping curves in the $\frac{\dot{N}}{N}$, $\frac{L}{K}$ plane with curves closer to the origin corresponding to lower employment rates.

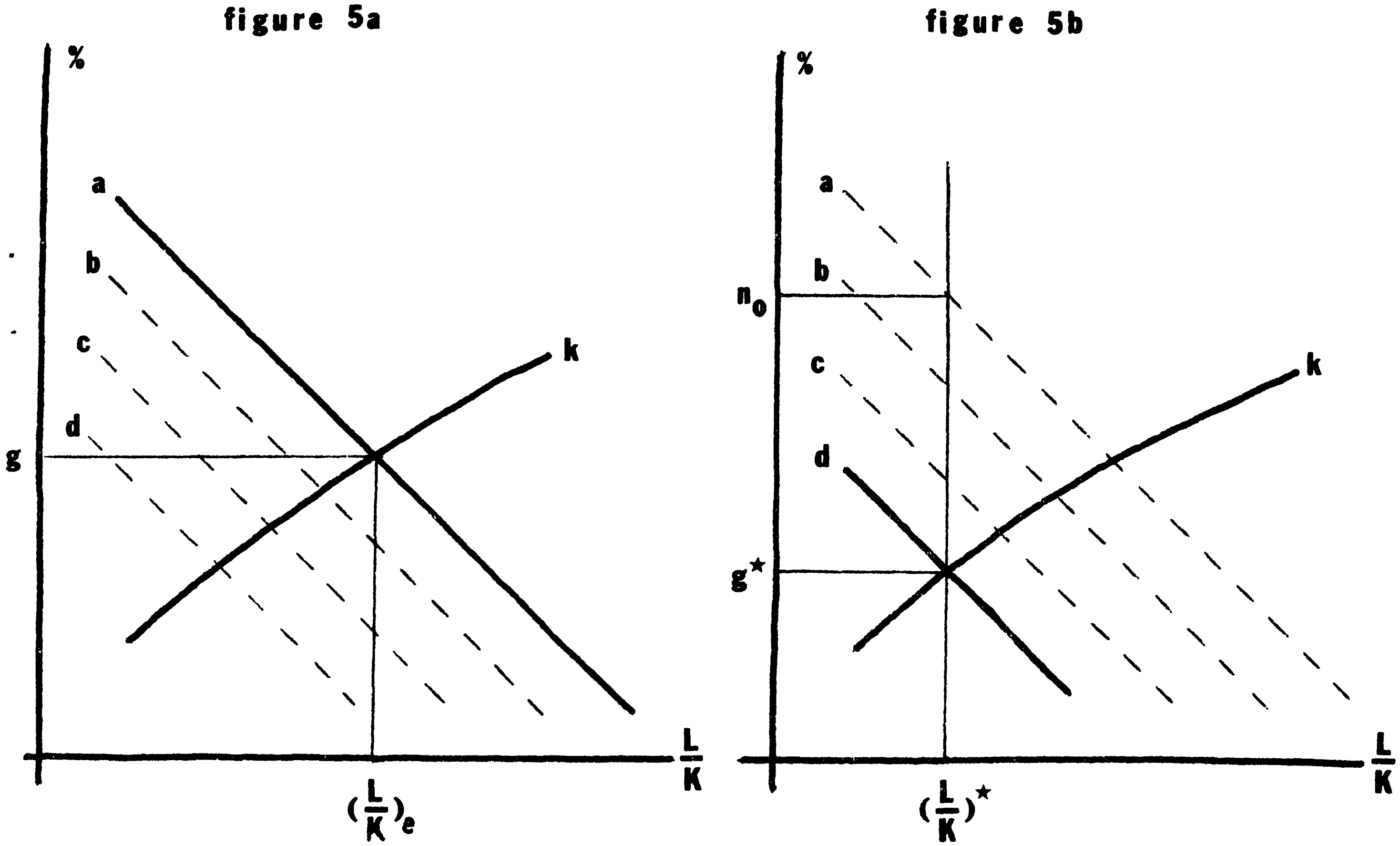
If the labor/capital ratio is below its ceiling $(\frac{L}{K})^*$, employment growth is described by equation (7). But when the labor/capital ratio hits $(\frac{L}{K})^*$, employment grows no faster than capital no matter how quickly the labor force increases:

$$\frac{\dot{L}}{L} = \begin{cases} \frac{\dot{N}}{N} = m\left(\frac{f'(\frac{L}{K})}{\bar{W}_r}\right) + \bar{r}_u = n & \text{if } \frac{L}{K} < (\frac{L}{K})^* \text{ (minimum wage ineffective)} \\ \frac{\dot{K}}{K} = sf(\frac{L}{K}) = g^* & \text{if } \frac{L}{K} = (\frac{L}{K})^* \text{ (minimum wage effective)} \end{cases} \tag{11}$$

Thus if the wage floor is effective, $\frac{\dot{N}}{N} > \frac{\dot{L}}{L}$ and the employment rate $\frac{L}{N}$ will continue to fall until migration is discouraged to the point where $\frac{\dot{L}}{L} = \frac{\dot{N}}{N}$ once again. In this situation, a stable dynamic disequilibrium, the employment rate remains constant but the absolute level of unemployment continues to grow.

This is shown graphically in figures 5a and 5b.

When the full employment equilibrium in figure 5a is disturbed by the imposition of a minimum wage, the $\frac{L}{K}$ ratio is forced down from its full employment equilibrium $(\frac{L}{K})_e$ to the ceiling $(\frac{L}{K})^*$. At this new labor/capital ratio the capital stock will grow only at rate g*, and this rate will be matched by the growth in employment $(\frac{\dot{L}}{L})$. But in the absence of unemployment the minimum wage would attract more migrants; the labor force growth rate would be $n_o$ in figure 5b. N grows faster than L, the employment rate drops, and the relevant curve in the family of labor force growth curves becomes closer and closer to the origin. In the stable dynamic disequilibrium resulting, the capital stock, the labor force, and employment all grow at rate g*. The employment rate corresponds to curve d in figure 5b.




Two important points are clear from examination of figures 5.

First, an increase in the saving ratio s can reduce or even eliminate unemployment. An increase in the saving ratio increases the rate of capital accumulation at every labor/capital ratio, hence increasing the rate at which labor can be absorbed. If the saving ratio is great enough, the equilibrium urban/rural wage ratio resulting from less than perfect response by migrants becomes greater than the artificial wage ratio caused by the urban wage floor. That is, a high enough saving ratio permits the urban sector to outgrow any minimum wage. (See figures 6a and 6b below.) Note that the decrease in the unemployment rate is accompanied by an increase in the rate of migration.

Second, a decrease in the minimum wage reduces its effectiveness and decreases the unemployment rate as expected. But this allows the labor/capital ratio to increase, increasing the growth rate of capital and hence the rate at which new arrivals can be absorbed. The rate of labor migration actually increases. This is illustrated in figures 7a and 7b.

Both of these points suggest that the goals of reducing unemployment and reducing migration are not necessarily consistent. Policies designed to decrease unemployment by increasing the demand for urban labor also figure 6a

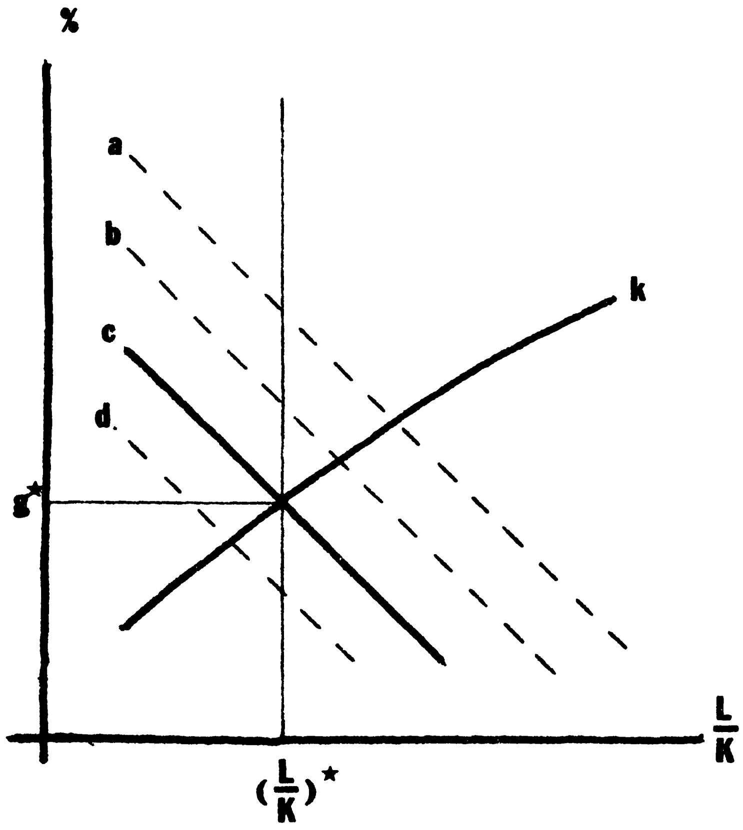



figure 6b

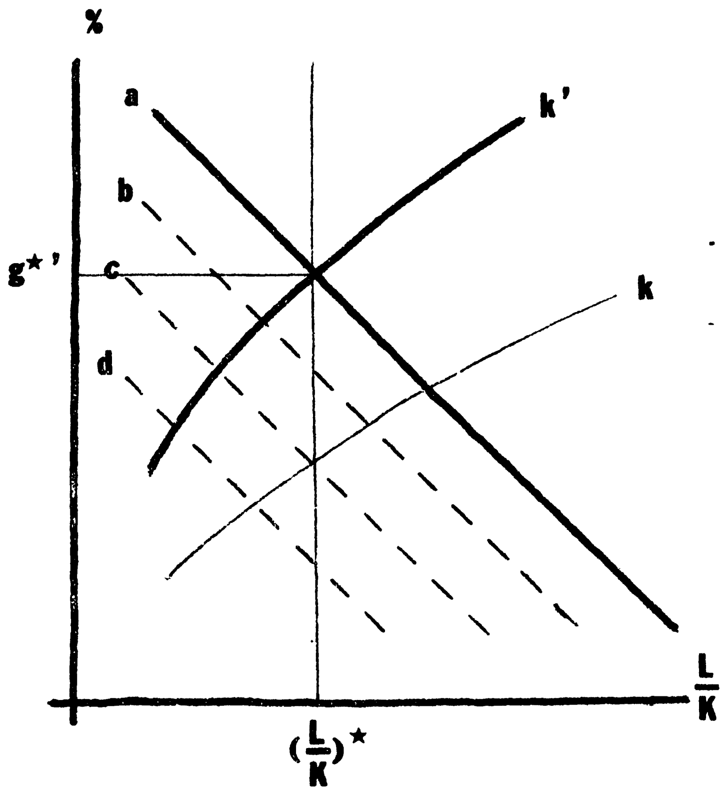



figure 7a

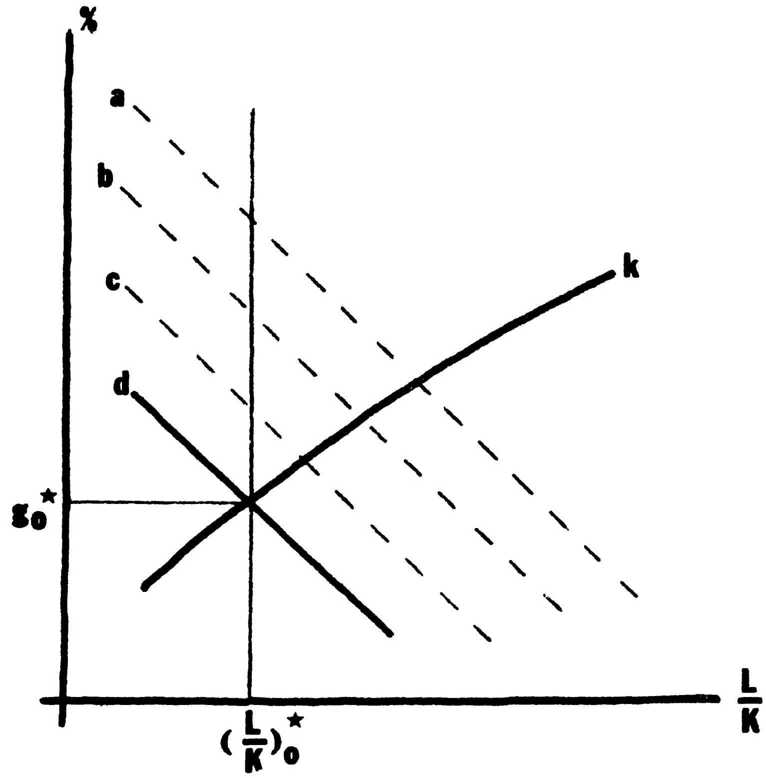
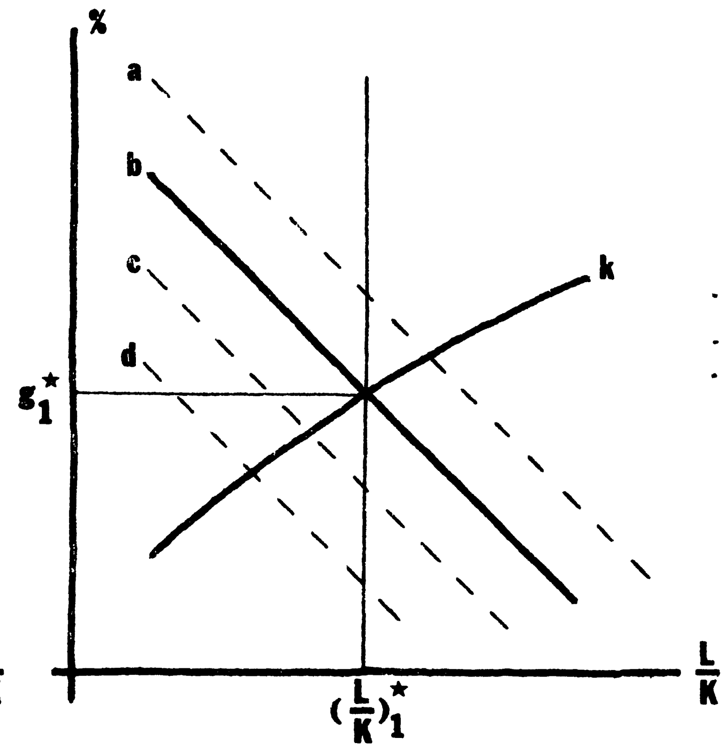



figure 7b



increase the rate of rural-urban migration, further exacerbating the strains of rapid urban population growth.

A possible solution to the problem of a minimum urban wage in a static context is an urban wage subsidy combined with measures restricting migration. We turn next to a consideration of these policies in the present dynamic context.

The imposition of a wage subsidy alters the relationship among the rate of migration, the marginal product of urban labor, and the employment rate given in equation (10). The wage is now the sum of the marginal product of labor and the subsidy, so the migration equation becomes

$$\frac{\dot{N}}{N} = n = m\left(\frac{f'(\frac{L}{K})+x}{\bar{W}_r}, \frac{L}{N}\right) + \bar{r}_u \qquad (12)$$

where x is the amount of the subsidy.

Since $m_1 > 0$, more migration and hence faster labor force growth occur at every labor/capital ratio and employment rate. Graphically, the family of curves describing labor force growth shifts up.

The hiring rule employers follow will be to continue hiring until the wage equals the marginal product of labor plus the subsidy. Thus the minimum wage corresponds to a new, higher labor/capital ratio ceiling. Graphically, the $(\frac{L}{K})^*$ constraint shifts to the right. The higher labor/capital ratio permits more rapid capital stock growth. The growth rate of the demand for labor therefore increases as well.

It is not clear whether the increase in the growth of demand will be greater than or less than the increase in the growth of supply. If demand grows faster than supply, unemployed workers will be absorbed into the labor force until full employment is reached. From that point on, the wage will be bid up and the wage floor will become ineffective. This is illustrated in figures 8a and 8b.

**figure 8a**

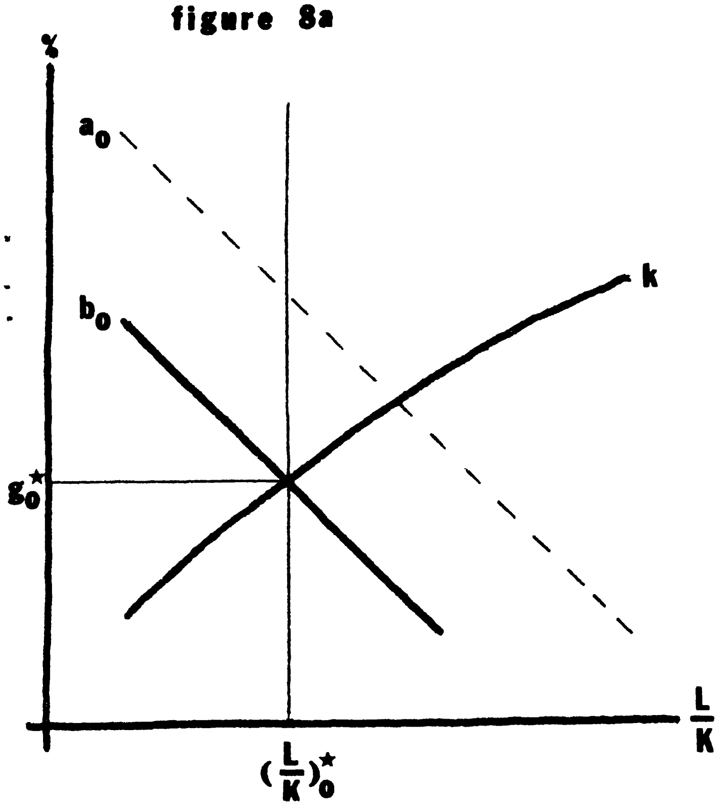
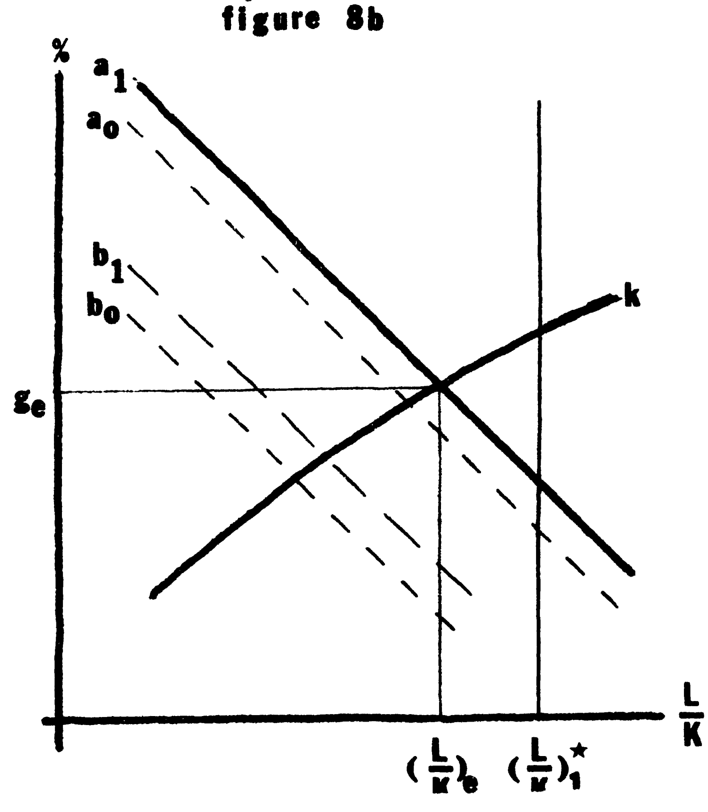



**figure 8b**



If on the other hand the increase in the growth of supply exceeds the increase in the growth in demand, employment falls until equilibrium is once again restored. This is demonstrated in figures 9a and 9b under these circumstances a tax on employed workers (a negative wage subsidy) would both reduce the rate of migration and increase the employment rate.

**figure 9a**

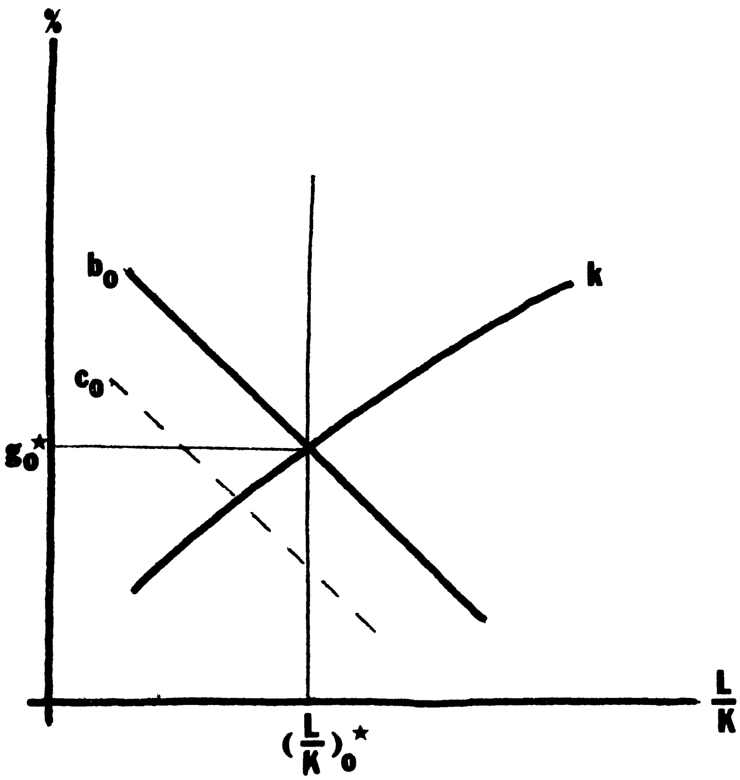
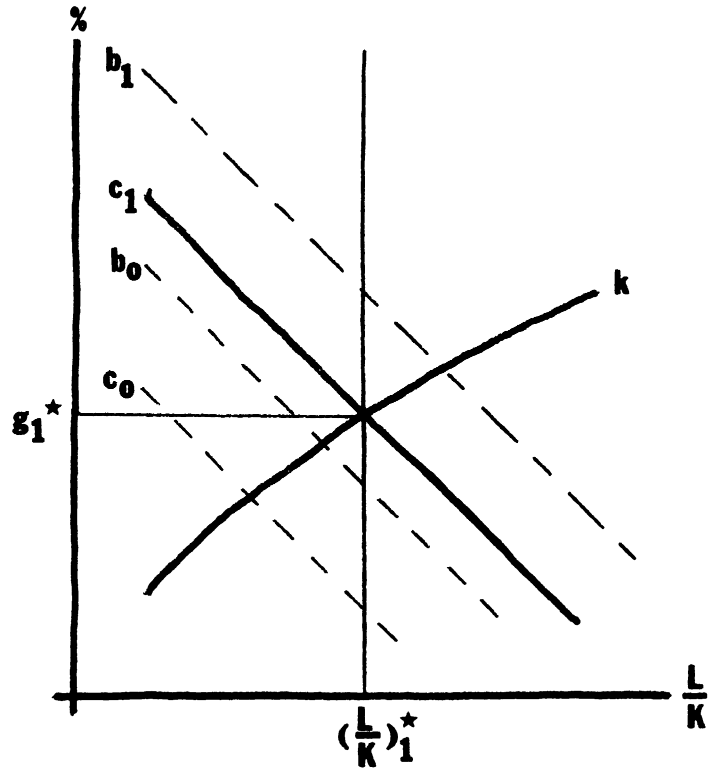



**figure 9b**




A policy of restricting the rate of rural-urban migration to a certain maximum would have at least a short-term impact. But if the growth rate of capital and hence labor demand is lower than the population growth rate permitted by this restriction, unemployment will nevertheless increase until stable disequilibrium is restored. In stable dynamic disequilibrium under these circumstances, the migration rate limit is ineffective. This is illustrated in figures 10a and 10b.

**figure 10a**

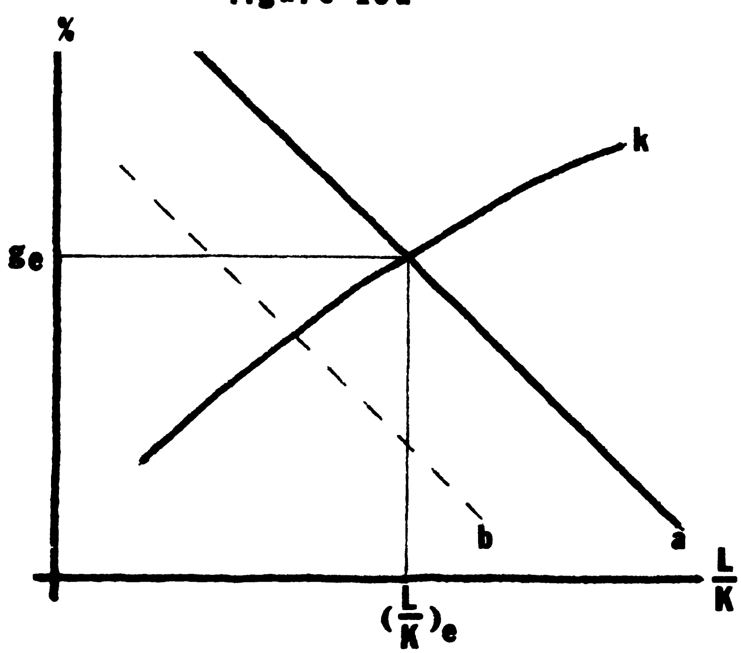



**figure 10b**

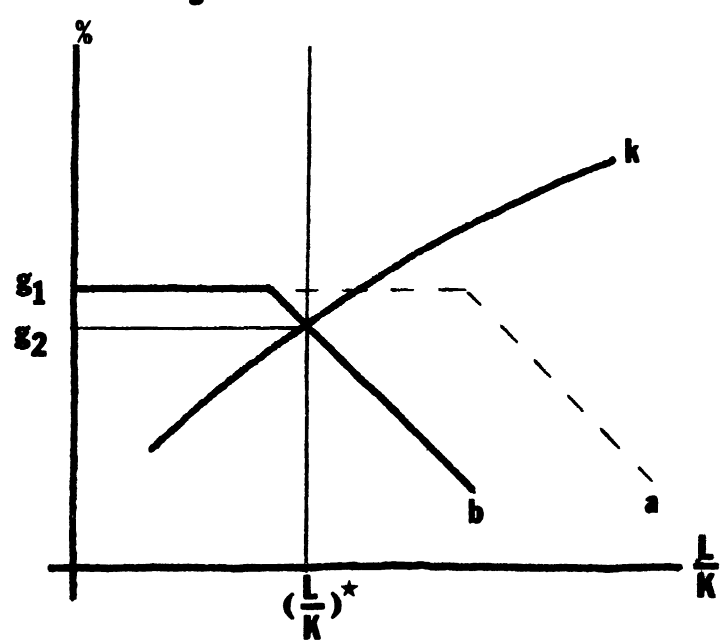
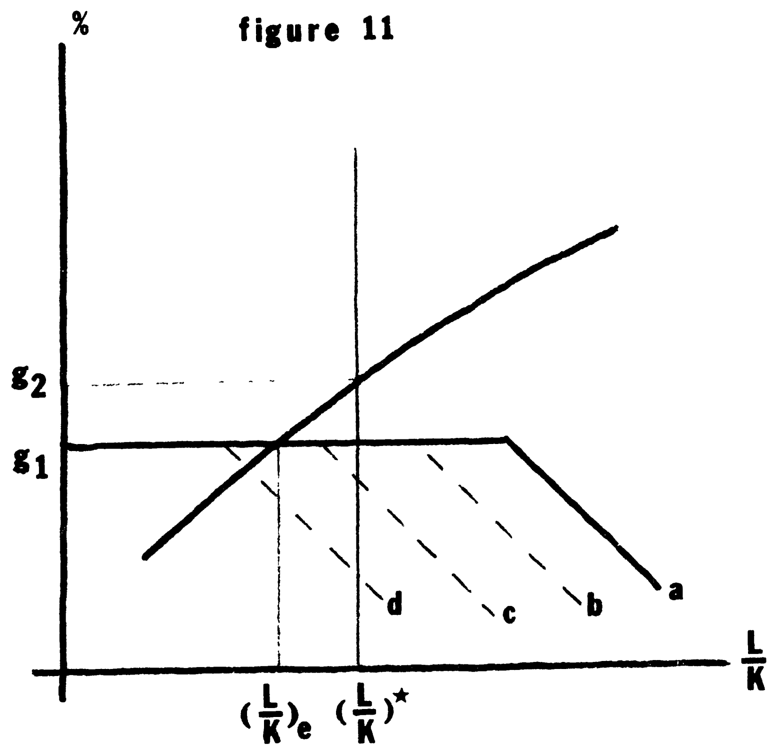


Figure 10a shows the initial equilibrium. The situation, after the imposition of a minimum urban wage and measures restricting migration to rate $g_1$ are taken, is represented in figure 10b. The entire family of population growth curves become perfectly inelastic at the rate permitted by the restriction on migration. But the restricted rate $g_1$ is greater than the growth in demand for urban labor, $g_2$, even though $g_1$ is lower than would otherwise temporarily prevail. With the supply of labor growing faster than the demand for labor, unemployment will rise to a rate corresponding to curve b in figure 10b, just as it would without the temporarily effective restriction on migration.

To have lasting effect, migration would have to be restricted to a rate that permitted an urban population growth rate of $g_2$ or less, as shown in figure 11. The demand for urban labor would outstrip the supply, reducing unemployment to zero and then driving the urban wage above its floor. There would, of course, be great incentive for both employers and potential migrants to circumvent the migration restrictions.

figure 11




V. Summary and conclusions

The rural-urban migration model presented in this paper differs from previous Harris-Todaro models in two main respects: first, it is dynamic rather than comparatively static and second, the growth of labor demand is endogenous rather than exogenous.

Given the saving ratio, the labor/capital ratio determines the rate of growth of the capital stock. The labor/capital ratio also determines the urban wage and hence the rate of migration. In the unconstrained free-wage case, if capital and labor grow at different rates the labor/capital ratio will adjust until they are equal.

But an institutionally determined minimum urban wage makes it unprofitable for employers to hire workers beyond a certain labor/capital ratio maximum. This restricts the rate of growth of capital to less than the rate of growth of the labor force. But employers will refuse to hire further workers after the marginal product of labor declines to the minimum wage. Unemployment arises and continues to worsen until migration is discouraged to a rate consistent with the growth rate of capital. The resulting situation can be described as a stable dynamic disequilibrium.

An increase in the savings ratio increases the rate of capital growth and hence the rate at which the demand for urban labor grows. Therefore increases in the saving ratio can mitigate unemployment.

Two policies to cope with the effects of an urban minimum wage have different results under the assumptions of the present model than they did under earlier assumptions. An urban wage subsidy may either increase or decrease the rate of unemployment, depending on the strength of the reactions of potential migrants and employers to the change. A policy of migration restriction may reduce the unemployment rate only in the short run. Unless migration is restricted to such a low rate that the urban wage is pushed above its floor the stable dynamic disequilibrium unemployment rate will be unaffected.

BIBLIOGRAPHY

1. Davis, Eric. "A Modified Golden Rule: The Case With Endogenous Labor Supply," A.E.R., March 1969.

2. Fei, J.C.H. and G. Ranis. Development of the Labor Surplus Economy, Homewood: Irwin, 1964.

3. Harris, J. and M. Todaro. "Migration, Unemployment and Development: A Two-Sector Analysis," A.E.R., March 1970.

4. Jorgenson, Dale W. "The Development of the Dual Economy," Economic Journal, June 1961.

5. Neher, Philip A. Economic Growth and Development: A Mathematical Introduction, John Wiley & Sons, Inc., New York, 1971.

6. Todaro, M. "A Model of Labor Migration and Urban Unemployment in Less Developed Countries," A.E.R., March 1969.

7. Todaro, M. "Labor Migration and Urban Unemployment: Reply," A.E.R., March 1970.

8. Zarembka, P. "Labor Migration and Urban Unemployment: Comment," A.E.R., March 1970.

Center for Research on Economic Development

CRED Discussion Papers

*(A list of the titles of Discussion Papers 1-24 will be sent upon request.)*

No. 25 C.R. Winegarden, *"Determinants of International Differences in Educational Effort,"* September 1972, 31 pp.

No. 26 Charles Staelin, *"A General Equilibrium Model of Tariffs in a Non-Competitive Economy,"* March 1973, 29 pp.

No. 27 Robin Barlow, *"Planning Public Health Expenditures with Special Reference to Morocco,"* April 1973, 72 pp. (French 81 pp.) A part of Task Order No. 3, to A.I.D. Contract No. afr-675.

No. 28 Theophile Lukusa Dia Bondo and Richard C. Porter, *"A Constant-Market Share Look at African Exports in the 1960s,"* June 1973, 25 pp.

No. 29 Richard C. Porter, *"Labor Migration and Urban Unemployment in Less Developed Countries: Comment,"* July 1973, 19 pp.

No. 30 Peter S. Heller, *"An Econometric Analysis of the Fiscal Behavior of the Public Sector in Developing Countries: Aid, Investment and Taxation,"* October 1973, 39 pp.

No. 31 Richard C. Porter, *"Some Doubts about Kenya's Future as an Exporter of Manufactures,"* October 1973, 30 pp.

No. 32 Thomas E. Weisskopf, *"Sources of American Imperialism: A Contribution to the Debate between Oethodox and Radical Theorists,"* November 1973, 46 pp.

No. 33 Thomas Hoopengardner, *"Rural-Urban Migration in Less Developed Countries: A Dynamic View,"* January 1974, 15 pp.