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Migration and Capital Accumulation in a Labour-Surplus Economy

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Abstract

In this paper, we show that if capital and labour are complementary inputs and labour is in surplus[LS], economic development will reduce investment in the agricultural sector. We analyse the impact of factor substitutability and factor mobility on economic welfare as indicated by changes in output by the use of appropriate fiscal policies in LS economies. Next, we demonstrate how a LS economy results in a higher agricultural employment but it can also accumulate more capital in the rural sector under certain conditions given by the elasticity of substitution between inputs in a nested CES production function. Finally, we analyse the welfare economics of migration and show that the net benefits crucially depend on the response of urban unemployment rate to migration and the flexibility of real wages with respect to unemployment rate. Migration without capital mobility is welfare enhancing iff the absolute value of the semi-elasticity of the urban real wage with respect to industrial unemployment is large. Benefits from migration are then estimated by calibrating the model. In the long-run, we allow capital to adjust to the increases in migration to show the welfare-enhancing impact of migration.

Keywords: Migration; labour surplus economies; capital accumulation; welfare.
JEL Classification: F 22, O15, J61.

1. Introduction

The theoretical foundations of very few formal models that exist to explain investment in backward regions, say, agriculture, in 'labour-surplus' (LS) economies of less developed countries (LDCs) in many parts of Asia, Africa, Latin America and Eastern Europe(see,e.g. Dixit,1968; Stern,1972; Neher, 1966) are weak. It is assumed that since real wages, usually institutionally given, are in excess of its marginal productivity in the backward areas, the private return to capital would be below its marginal social product; hence investment falls. As the wage level is above the Pareto optimum, labour employment in industry is sub-optimal relative to the use of capital. Growth in industrial capital accumulation is regarded as essential for using 'surplus' labour in LDCs. Since the MPL in poor regions is very low, it is impossible to maintain full employment at any positive wage rate (Dixit,1968). Dixit, along with Lewis (1954), assumes a perfectly elastic supply of labour from

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the backward sector at an institutionally given wage. Stern (1972) relaxes this assumption and calculates the optimal capital accumulation path and the shadow wage rate. However, few try to analyse the impact of investment and migration in a LS economy, particularly when inputs for production could be substitutes or complements and the MPL in backward region is less than the real wage. Nor do they explain the co-existence of surplus labour and **rising** stock of capital in LDCs -an empirical phenomenon that intrigued Marx, Schultz (1964), and Thomas (1982). The main motivation of this paper is to show that if capital and labour are complementary inputs and labour is in surplus, economic development will reduce investment in the agricultural sector. Here, we analyse the impact of factor substitutability and factor mobility on economic welfare as indicated by changes in output by the use of appropriate fiscal policies in LS economies. In section II, we determine real product wage and the unemployment rate in the urban sector with given capital cost and the terms of trade between the agricultural and industrial sector. In equilibrium, the marginal product is less than rural wage and the solution is Pareto-inefficient. We also determine rural employment and capital formation given rural prices, wages and the price of capital. In section III, we demonstrate how a LS economy results in a higher agricultural employment. We also show that a LS economy can accumulate **more** capital in the rural sector under certain conditions given by the elasticity of substitution between inputs in a nested CES production function. In section IV, we analyse the welfare economics of migration and show that the net benefits crucially depend on the response of urban unemployment rate to migration and the flexibility of real wages with respect to unemployment rate. Migration without capital mobility is welfare enhancing iff the absolute value of the semi-elasticity of the urban real wage with respect to industrial unemployment is large. Benefits from migration are then estimated by calibrating the model. In the long-run, we allow capital to adjust to the increases in migration to show the welfare-enhancing impact of migration. The final section draws conclusions.

2. The Model

Consider a two-sector economy, industry and agriculture. Each sector employs labour and capital K_i, L_i, $i = I,A$ corresponding to the two sectors and, in addition, agriculture employs a fixed amount of land, R. Production in each sector is characterised by a constant returns to scale production function. Both labour and capital are free to move between the two sectors. Output markets are competitive but in the labour market, unemployment exists and the pool of unemployment forms part of the urban workforce $N_I \geq L_I$. The details are as follows.

2.1 The Industrial Sector

The representative industrial firm maximises profits

$$\Pi_i = P_I Y_I - W_I L_I - r_K P_I K_I \tag{2.1}$$

with respect to L_I, and K_i, where P_I is the price of output, W_I the wage, r_K the cost of capital and Y_I is output given by the homogeneous production function

$$Y_I = F(L_I, K_I) = L_I f(K_I / L_I); F_{L_I}, F_{K_I}, F_{L_I K_I} > 0; \; F_{L_I L_I}, F_{K_I K_I} < 0 \quad (2.2)$$

The capital good consists of output from the industrial sector. In carrying out this optimisation, P_I, W_I and r_K are parametric to the firm. The first order conditions are

$$W_I = P_I \frac{\partial Y_I}{\partial L_I} = P_I (f(k_I) - k_I f'(k_I)) \quad (2.3)$$

and

$$r_K = \frac{\partial Y_I}{\partial K_I} = f'(k_I) \quad (2.4)$$

where $k_I = K_I/L_I$ is the capital-labour ratio. Equation (2.3) holds in the **short run** when capital is fixed. Since $F_{L_I L_I} < 0$ we have the familiar diminishing marginal product of labour curve and labour demand is a diminishing function of L_I. In the **long run** both (2.3) and (2.4) hold. Hence given the cost of capital r_K, (2,4) determines the capital-labour ratio k_I. Then given k_I, (2.3) determines the real product wage W_I/P_I. The second order conditions for a maximum are

$$F_{L_I L_I} F_{K_I K_I} > F_{L_I K_I}^2 : \; F_{L_I L_I} < 0 \quad (2.5)$$

To determine employment and unemployment in the industrial sector we require a 'wage equation' which determines the nominal wage given the price level. A formulation which is consistent with both a bargaining and efficiency wage theory [3] is

$$W_I = P_C h(U_I); \; h' < 0 \quad (2.6)$$

where P_C is the consumer price index and

$$U_I = \frac{N_I - L_I}{N_I} \quad (2.7)$$

is the urban unemployment rate. Let P_A be the price of agricultural output and θ the fixed share of industrial output in the urban workers' consumption basket. Then we put

$$P_C = P_I^{\theta} P_A^{1-\theta} \quad (2.8)$$

and the real product wage is then given by

$$\frac{W_I}{P_I} = \left(\frac{P_A}{P_I} \right)^{1-\theta} h(U_I) \quad (2.9)$$

[3] See, for example Layard et al (1991), chapter 2.

Given the cost of capital r_K and the terms of trade between the agricultural and urban sectors P_A/P_I, (2.3), (2.4) and (2.9) determine the real product wage and the unemployment rate in the urban sector. Then given the size of the urban workforce N_I, (2.7) determines urban employment in the long run.

2.2 The Backward Sector

The idea of a labour surplus in a backward economy is formalised by assuming that the EAU firm maximises a utility function consisting of profits plus the monetary value associated with achieving a high employment target. Thus the farm-owner maximises a utility

$$U_A = P_A Y_A - W_A L_A - r_K P_I K_A - r_R R - \alpha(\widehat{L}_A - L_A)^2 \tag{2.10}$$

with respect to L_A and K_A, where agricultural output Y_A is given by a constant returns to scale production function

$$\begin{gathered} Y_A = G(L_A, K_A, R); G_{L_A}, G_{K_A}, G_R > 0 \; G_{L_A L_A}, G_{K_A K_A} G_{RR} < 0; \\ G_{L_A K_A}, G_{L_A R}, G_{K_A R} \geq, \leq 0 \end{gathered} \tag{2.11}$$

r_R is the rental cost of land and $\widehat{L}_A \geq L_A$ is the target level of employment. Other variables are defined as before. The last term in (2.11) is a quadratic welfare loss associated with $L_A < \widehat{L}_A$. The first order conditions for an internal solution are

$$P_A \frac{\partial Y_A}{\partial L_A} = W_A - 2\alpha(\widehat{L}_A - L_A) = 0 \tag{2.12}$$

$$\frac{P_A}{P_I} \frac{\partial Y_A}{\partial K_A} = r_K \tag{2.13}$$

and in macroeconomic equilibrium land rent is given by

$$P_A \frac{\partial Y_A}{\partial R} = r_R \tag{2.14}$$

Second order conditions are

$$(P_A G_{L_A L_A} - 2\alpha) G_{K_A K_A} > P_A \, G^2_{L_A K_A}; \; G_{K_A K_A} < 0 \tag{2.15}$$

Thus in (2.12) the marginal product of labour is less than the EAU wage. Equations (2.12) and (2.13) determine rural employment and capital stock given P_A, W_A, and r_K. To complete the model we need two relationships to determine W_A and the urban workforce. (r_K, prices P_A and P_I we recall are exogenous). These are provided by the equations in the following section 2.3.

2.3 The Migration Equilibrium and Resource Constraint

In a Harris-Todaro migration equilibrium the rural wage is equated with the expected urban wage minus the real costs of migration C (in terms of units of industrial output). Urban workers are chosen at random so that the probability of employment in the urban sector is given by

$$p = \frac{L_I}{N_I} = 1 - U_I \tag{2.16}$$

Thus the no migration equilibrium condition is given by

$$p_I W_I + (1 - p_I) W_u - P_I C = W_A \tag{2.17}$$

where W_u is the income of the urban unemployed. The resource constraint

$$N_I + L_A = N \tag{2.18}$$

where N is the total population, completes the model.

3. The Implications of a Labour Surplus for Rural Investment

From (2.16) and (2.17) the rural wage W_A is determined by the unemployment rate in the urban sector and the urban wage. Given P_I, both are determined in the urban sector and are given to the rural sector. We may therefore differentiate (2.12) to give

$$P_A\left(G_{L_A L_A}\frac{dL_A}{da} + G_{L_A K_A}\frac{dK_A}{da}\right) = 2(\overline{L}_A - L_A) + 2a\frac{dL_A}{da} \tag{3.1}$$

and differentiating (2.14)

$$G_{K_A K_A}\frac{dK_A}{da} + G_{L_A K_A}\frac{dL_A}{da} = 0 \tag{3.2}$$

Hence solving we arrive at

$$\frac{dL_A}{da} = \frac{-2(\overline{L}_A - L_A)G_{K_A K_A}}{(P_A G_{L_A L_A} 2a)G_{K_A K_A} - P_A G^2_{L_A K_A}}$$

which from (2.15) is positive. Hence

Proposition 1

A labour surplus economy results in higher agricultural employment.

All this is obvious. Of more substance is the following proposition which follows from proposition 1 and (3.3).

Proposition 2

A labour surplus economy results in a **higher** level of capital stock in the rural sector if $G_{L_A K_A} > 0$.

To provide more insight into proposition 2 consider the following nested CES production function

$$G(L,K,R) = (w_1 M^{-\varrho_1} + (1-w_1)R^{(-\varrho_1)})^{-1/\varrho_1}; \quad \varrho_1 \neq 0$$
$$= M^{w_1} R^{1-w_1}; \quad \varrho_1 = 0 \tag{3.4}$$

where

$$M = (w_2 K^{-\varrho_2} + (1-w_2)L^{-\varrho_2})^{-1/\varrho_2}; \quad \varrho_2 \neq 0$$
$$= K^{w_2} L^{1-w_2} \quad \varrho_2 = 0 \tag{3.5}$$

In (3.4) and (3.6) we have dropped the subscript A since we are now focusing exclusively on the rural sector. The elasticity of substitution between land and other factor inputs is given by $\sigma_1 = 1/(1+\varrho_1)$ and $\sigma_2 = 1/(1+\varrho_2)$ is the labour-capital elasticity. $-1 < \varrho_i <$ *infinity; i* = 1,2 and $\varrho_i < 0$ applies if factors are good substitutes.

Partially differentiating (3.4) twice we have

$$G_{LK} = G_{KL} = \frac{\partial G}{\partial K\, \partial L} = \frac{\partial}{\partial K}\left[\frac{\partial G}{\partial M}\frac{\partial M}{\partial L}\right]$$
$$= \frac{\partial^2 G}{\partial M^2}\frac{\partial M}{\partial K}\frac{\partial M}{\partial L} + \frac{\partial G}{\partial M}\frac{\partial^2 M}{\partial K\, \partial L} \tag{3.6}$$

Rewriting (3.4) and (3.5) as

$$G = \Theta_1^{-1/\varrho_1}; \quad M = \Theta_2^{-1/\varrho_2} \tag{3.7}$$

for $\varrho_i \neq 0$, i = 1,2 we then have

$$\frac{\partial G}{\partial M} = w_1 \Theta_1^{-1/\varrho_1 - 1} M^{-\varrho_1 - 1} \tag{3.8}$$

$$\frac{\partial^2 G}{\partial M^2} = w_1(1+\varrho_1) M^{-\varrho_2 - 2} \Theta_1^{-1/\varrho_1 - 1}(w_1 M_1^{-\varrho_1}/\Theta_1 - 1) \tag{3.9}$$

$$\frac{\partial M}{\partial L} = (1-w_2)\Theta_2^{-1/\varrho_2 - 1} L^{-\varrho_2 - 1} \tag{3.10}$$

$$\frac{\partial^2 M}{\partial L \partial K} = (1+\varrho_2) w_2 (1+w_2) \Theta_2^{-1/\varrho_2 - 2} L^{-\varrho_2 - 1} K^{-\varrho_2 - 1} \tag{3.11}$$

Hence combining (3.7) to (3.11) the condition $G_{LK}>0$ becomes

$$1-w_1M^{-\varrho_1}/\Theta_1<(1+\varrho_2)/(1+\varrho_1) \tag{3.12}$$

The left-hand-side of (3.12) is less than unity and has a straightforward economic interpretation. From the first-order condition (2.13) we have

$$\frac{r_K R}{P_A G}=\frac{(1-w_1)R^{-\varrho_1}}{\Theta_1}=1-\frac{w_1M^{-\varrho_1}}{\Theta_1} \tag{3.13}$$

Hence the following corollary to proposition 2:

Corollary

For the nested CES production function (3.4) and (3.5) a labour surplus economy results in a **higher** level of capital stock iff

$$\frac{r_R R}{Y_A}<\frac{1+\varrho_2}{1+\varrho_1} \tag{3.14}$$

The left-hand-side of (3.14) is the land rent's share of agricultural income. For Cobb-Douglas technology $\varrho_1=\varrho_2=0$ and condition (3.14) is always satisfied. But a combination of land and capital being good substitutes ($\varrho_2<0$) and land and other factors being poor substitutes ($\varrho_1>0$) can result in (3.14) breaking down. Then the labour surplus effect captured by introducing a parameter $\alpha>0$ in the farm-owner's utility function (2.10) can result in a **lower** level of capital stock in agriculture.

Empirically, it has been observed that land and capital are good substitutes in relatively land-abundant countries. They are poor substitutes in many other LDCs either because of an adverse man-land ratio or because of the very small size-holding of land witnessed in large parts of the Indian sub-continent and China. If it is relatively easy to substitute capital for land, the factor whose price has increased will be substituted for the cheaper one. Schultz (1964) argued that traditional agriculture does in fact employ substantial amount of capital. Note that the tendency to over - or – under-invest in agriculture will depend on the source of savings. Where landlords are main potential sources of such savings (see. e.g., Fei and Ranis, 1964 for empirical evidence), an increase in capital accumulation in developing agriculture is to be expected, particularly with a rise in the landlord's share in total income. Under such circumstances, the empirical validation of equation (3.14) is not difficult to understand. Thomas (1983) reports that in some rural areas of Turkey, agricultural equipment is 'plentiful':' the intensive mechanisation of certain agricultural regions has had the effect of...increasing rural unemployment and at the sane time the numbers of people drifting to the towns.' Hence, the introduction of new techniques and capital accumulation becomes ineffective in improving material benefits in a traditional LS economy. Such a phenomenon provides an explanation for more capital accumulation and industrialisation at the expense of labour absorption in a **LS** economy(Norton and Alwang,1993).Moreover, when the small enterprises of an industrial society are surrounded by backward technology in a LDC, the modern sector tends to accumulate more capital - regardless of its quality- despite the presence of surplus labour. (Higgins,1956; Myint,1964; Maciewski, et.al. on Poland,1995).

Whether capital and land are good (or poor) substitutes ($p_2 < 0$) and land and other factors are poor substitutes (p_1, >0) are really empirical issues which warrant country- specific studies. A priori, African countries like Nigeria and Kenya, Uganda are examples where $p_2 <0$ and $p_1 >0$ (because of poor availability of proper HYV seeds and organic fertilisers) which have also experienced a lower level of capital stock in agriculture (Lele,U,1992; World Bank,1992).

4. The Welfare Economics of Migration

Consider a migration equilibrium with employment in the two sectors given by $L_A=\bar{L}_A$ and $L_I=\bar{L}_I$. We now pose the question as to whether this equilibrium implies that the urban workforce is too big or too small. To answer the question consider a further migration of $M\bar{L}_A$ workers from the rural to the urban sector where M is the migration rate. The urban workforce then grows to $N_I=\bar{N}_I+ML_A$ but many of these will become unemployed. The rural workforce which is fully employed falls to $L_A=\bar{L}_A-M\bar{L}_A$.

4.1 Short-run Analysis

First consider the short run with capital in both sectors fixed. We choose a straightforward measure of social welfare equal to total output minus migration costs. It depends on the migration rate (relative to our initial migration equilibrium) and is given by

$$S(M)=Y_I+qY_A-M\bar{L}_AC \tag{4.1}$$

in units of industrial output where $q=P_A/P_I$ is the relative price of agricultural output.

The urban sector is then too large if $dS/dM<0$ measured at the migration equilibrium. To investigate this condition differentiate (4.1) and use $dL_A/dM=-\bar{L}_A$ to obtain

$$\frac{dS}{dM}=\frac{\partial Y_I}{\partial L_I}.\frac{dL_I}{dM}-\bar{L}_A(q\frac{\partial Y_A}{\partial L_A}+C) \tag{4.2}$$

The first term on the RHS of (4.2) are the possible benefits of further incremental migration arising from higher industrial output. The only exist if some of the increase in the urban workforce results in higher urban output. This will only occur if there is **some** real wage flexibility i.e., $h'<0$ in (2.6). The second term are the costs consisting of the drop in rural output (in units of industrial output) and migration costs.

From (2.12) we can write the marginal product of labour (MPL) in the rural sector as

$$P_A \frac{\partial Y_A}{\partial L_A} = W_A - 2a(\widehat{L}_A - L_a) = (1-\mu)W_A \tag{4.3}$$

say, where $0<\mu<1$ captures the labour surplus effect driving the MPL below the rural wage.

Denote the real wage in the two sector both in terms of units of industrial output by $w_I = W_I/P_I$ and $w_A = W_A/P_I$ and express migration costs as a proportion of the rural i.e., $P_I C = \varphi W_A$. Then introducing the first order conditions (2.3) and (4.3) into (4.2) gives the condition for more migration to be welfare-enhancing in the short run as

$$\frac{dS}{dM} = w_I \frac{dL_I}{dM} - \overline{L}_A(1-\mu+\varphi)w_A > 0 \tag{4.4}$$

Whether (4.4) holds or not depends critically on dL_I/dM, the response of urban employment to further migration.

At the intersection of the real wage equation given by (2.9) and the demand for labour curve (2.3) we have:

$$q^{1-\theta}h(U_I) = \frac{\partial Y_I}{\partial L_I} \tag{4.5}$$

where the unemployment rate U_I is defined by (2.7). Differentiating (4.5) gives

$$q^{1-\theta}h'(U_I)\left(-\frac{1}{N_I}\frac{dL_I}{dM} + \frac{L_I}{N_I^2}\overline{L}_A\right) = \frac{\partial^2 Y_I}{\partial L_I^2}\cdot\frac{dL_I}{dM} \tag{4.6}$$

Hence at the migration equilibrium we have

$$\frac{dL_I}{dM} = \frac{q^{1-\theta}h'\overline{L}_A\overline{L}_I}{\overline{N}_I(\overline{N}_I F_{LL\ I} + q^{1-\theta}h')} \quad \text{(4.7) using (2.2).}$$

At this stage it is useful to specialise the production function (2.2). As for the backward sector we assume a CES function of the form

$$Y_I = F(K_I, L_I) = (wK_I^{-\varrho} + (1-w)L_I^{-\varrho})^{-1/\varrho} = \Theta^{-1/\varrho} \tag{4.8}$$

say. Then differentiating

$$\frac{\partial Y_I}{\partial L_I} = (1-w)L_I^{-\varrho-1}\Theta^{-(1+1/)\varrho} = w_I \tag{4.8}$$

using the first order condition (2.3) and

$$F_{L_I L_I} = \frac{\partial^2 Y_I}{\partial L_I^2} = -(1+\varrho)\frac{w_I}{L_I}(1-(1-w)\frac{L_I^{-\varrho}}{\Theta}) = -(1+\varrho)\frac{w_I}{L_I}s_K \tag{4.9}$$

where s_K is capital's share of output.

Now define η to be the semi-elasticity of the real product wage w_I with respect to the unemployment rate U_I. Then from (2.9) we have

$$\eta = \frac{1}{w_i}\frac{dw_I}{dU_I} = q^{1-\theta}\frac{h'(U_I)}{w_I} \tag{4.10}$$

where we recall that $q = P_A/P_I$. Substituting (4.9) and (4.10) into (4.7) and substituting the resulting expression for dL_I/dM into (4.4) gives the condition for more migration to be welfare-enhancing as

$$\frac{w_I \eta L_I^2}{(-N_I^2(1+\varrho)s_K + \eta \overline{N}_I \overline{L}_I} > (1-\mu+\varphi)w_A \tag{4.11}$$

Putting $L_I/N_I = 1-U_I$ a little algebra then gives the following proposition:

Proposition 3

Consider a Harris-Todaro migration equilibrium with rural and urban real wages given by w_A and w_A respectively in terms of units of industrial output. Let U_I be the urban unemployment rate at this equilibrium. Then a further rural to urban migration without an adjustment of capital is welfare-enhancing iff the absolute value of the semi-elasticity of the urban real wage with respect to U_I, η, is sufficiently large. In particular the condition is

$$|\eta| > \frac{(1-\mu+\varphi)w_A(1+\varrho)s_K}{w_I(1-U_I)^2 - w_A(1-\mu+\varphi)(1-U_I)} \tag{4.12}$$

If (4.12) is not satisfied then a migration the other way from the urban to the rural sectors will be increase welfare and there exists 'urban bias' in the migration equilibrium. From (4.12) we can see that factors which may lead to insufficient migration are: a high labour surplus effect μ; a low rural/urban wage ratio; a low cost of migration captured by φ; a low urban unemployment ratio U_I and a $\varrho<0$ which implies that the new migrants can substitute for capital. All this is in accordance with economic intuition.

The importance of real wage flexibility for migration is illustrated in figures 1 and 2. Assume for the moment that in an initial migration equilibrium the size of the workforce in the urban and rural sectors is equal (OA in the figures). Suppose that a number BA leave agriculture and migrate to the cities increasing the urban workforce by AC=BA. With some real wage flexibility the BRW curve shifts to BRW' and urban employment increases by AD<AC increasing unemployment by DC in that sector.

The welfare implications of migration can be assessed by comparing the increase in urban output, area ADHG, with the drop in rural output, area BAFE (both in terms of units of industrial output). Starting from this initial migration equilibrium rural to urban migration by an increment BA is welfare enhancing if ADHG > BAFE + costs of migration. If this is not satisfied there is 'urban bias' and some reverse migration back to agriculture is welfare-enhancing.

The two figures compare the case of a relatively high degree of responsiveness of the urban real wage to unemployment (see figure 1) with a very low degree of responsiveness (see figure 2). In the latter case (which is close to that of a fixed real wage as in HT) area ADHG < area BAFE and urban bias exists.

How likely is condition (4.12) to be satisfied? A problem with the condition is that it is expressed in terms of the cost of migration $\bar{C}$ which is difficult to measure. However given data for the urban/rural wage ratio, the urban unemployment rate and a guesstimate of the formal/informal urban wage ratio, the cost of migration can be deduced from HT migration equilibrium condition (2.10). To proceed along these lines, first express the alternative disposable wage W_u as a proportions of the urban wage. i.e., put $W_u = \zeta W_I$.

Then from the HT migration equilibrium condition (2.17) we have that

$$\varphi = \frac{w_I}{w_A}[1 - U_I(1-\zeta)] - 1 \tag{4.13}$$

and the cost of migration is revealed by observable data.

We now calibrate the model with different sets of parameter values. The results are reported in Tables A and B. Note that Table A exaggerates the costs of migration because it uses the HT selection process. In table A, high migration costs are associated with high real wage elasticities. If migration costs are assumed to be zero (see Table B), we obtain much lower and plausible values of real wage elasticities at different proportions of surplus labour i.e., 0.15, 0.20,and 0.25 (column 1 in table B: the starting figure of 0.15 or 15% labour surplus, i.e. μ has been obtained from the GOI - **Economic Survey**,1991. The ratio of Wu/Wr i.e. 1.30 to 1.45 has been frequently cited as the necessary wage gap to make migration incentive- compatible, see. e.g. Lewis,W.A. 1954; Ghatak,S and K. Ingersent, 1984).

Table A: *Critical values for η*

μ \ ***Wu/Wr***	**1.3**	**1.35**	**1.40**	**1.45**
0.15	$\varphi = 0.20\eta = 7.90$	$\varphi = 0.24\eta = 8.52$	$\varphi = 0.29\eta = 9.17$	$\varphi = 0.37\eta = 9.88$
0.20	$\varphi = 0.20\eta = 4.68$	$\varphi = 0.24\eta = 5.00$	$\varphi = 0.29\eta = 5.32$	$\varphi = 0.37\eta = 5.66$
0.25	$\varphi = 0.20\eta = 3.23$	$\varphi = 0.24\eta = 3.43$	$\varphi = 0.29\eta = 3.65$	$\varphi = 0.34\eta = 3.86$

$U_I = 0.13$; = 0.8; $S_K = 0.3$; φ given by (4.13)

Table B: *Different Values of η*

0.15	1.88	1.63	1.43	1.28
0.20	1.50	1.33	1.19	1.08
0.25	1.22	1.10	0.99	0.99

As above $\varphi = 0$

The different parameter values have been obtained from the following sources:

GOI - Statistical Abstract, 1990-1991, CSO, New Delhi, India.

GOI - Economic Survey 1990-91, CSO, New Delhi, India.

Lucas, R, and G. Papanek (eds.), (1990), The Indian Economy, Oxford University Press, India.

Figure 1

Rural to Urban Migration with High Real Wage Flexibility

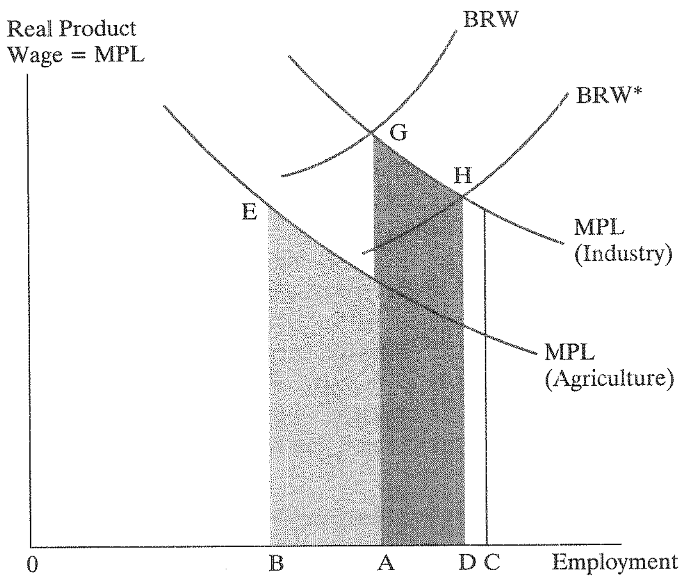
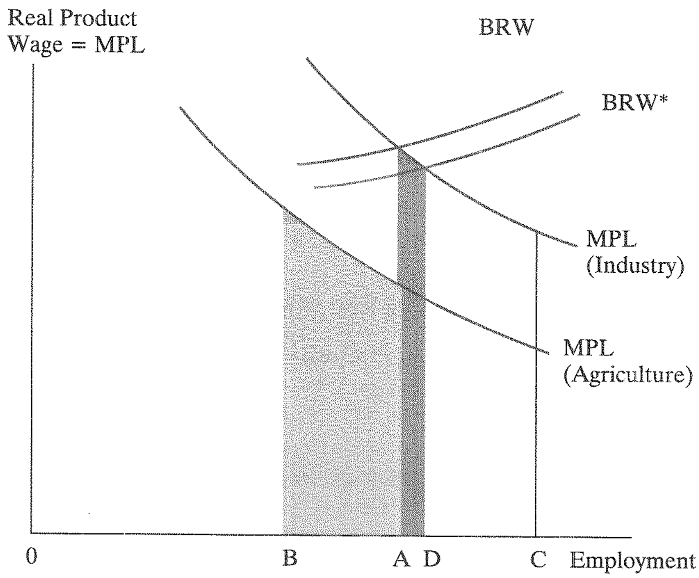


Figure 2
Rural to Urban Migration with Low Real Wage Flexibility



4.2 Long-run Analysis

In the long run, we allow capital to adjust to the increases migration. The social welfare function (4.1) must now be amended to

$$S(M) = Y_I + qY_A - M\overline{L}_A C - r_K(K_A + K_B) \tag{4.14}$$

As before we differentiate with respect to M but now allowing the capital stock to adjust. Thus

$$\frac{dS}{dM} = \frac{\partial Y_I}{\partial L_I}.\frac{dL_I}{dM} + \frac{\partial Y_I}{\partial K_I}.\frac{dK_I}{dM} + q\left[\frac{\partial Y_A}{\partial L_A}.\frac{dL_A}{dM} + \frac{\partial Y_A}{\partial K_A}.\frac{dK_A}{dM}\right] - \overline{L}_A C - r_K\left[\frac{dK_I}{dM} + \frac{dK_A}{dM}\right] \tag{4.15}$$

This rather long expression simplifies considerably when the long-run first order conditions are introduced. From (2.4) and (2.13) the terms in dK_I/dM and dK_A/dM are zero. Furthermore in the long run the capital-labour ratio and the urban real wage are both fixed at values determined by the exogenously given real interest rate. Hence $h(U_I)$=constant. Putting $U_I=1-L_I/N_I$ and differentiating we get

$$h'(U_I)\left[\frac{-1}{\overline{N}_I}\frac{dL_I}{dM} + \frac{\overline{L}_A\overline{L}_I}{\overline{N}_I^2}\right] = 0 \tag{4.16}$$

provided that $h'(U_I)$ne0. It follows that

$$\frac{dL_I}{dM} = (1-U_I)L_A \tag{4.17}$$

in the long run. As before $\frac{dL_A}{dM} = -\bar{L}_A$. Substituting into (4.15) gives

$$\frac{dS}{dM} = \bar{L}_A[w_I(1-U_I) - w_A(1-\mu) - C] \tag{4.18}$$

In a HT migration equilibrium we have from (2.17) that

$$(1-U_I)w_I + U_I w_u - C = w_A \tag{4.19}$$

Hence

$$\frac{dS}{dM} = w_A\mu - U_I w_u \tag{4.20}$$

There are therefore two distortions which might prevent the HT equilibrium being socially efficient in the long run: the existence of an alternative wage w_u and the labour surplus effect in agriculture. If the latter dominates then more migration is welfare-enhancing. This seems to have happened in some countries in Eastern Europe like Poland during the process of its industrialisation (Kondratowicz A. et.al. 1995).Thus we have the following analogue of proposition 3 for the long run

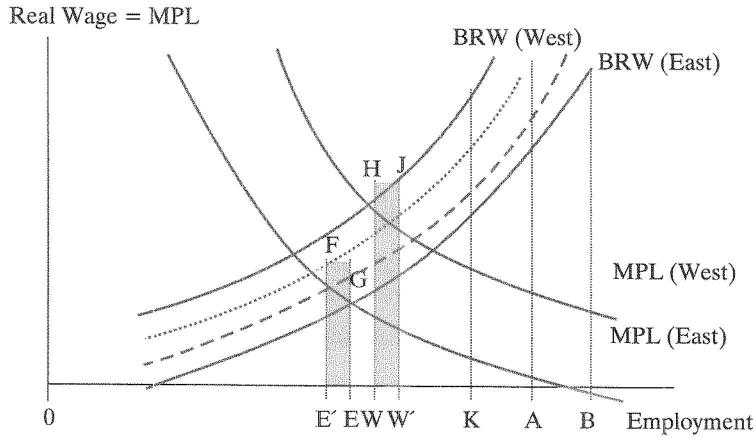
Proposition 4

Consider a Harris-Todaro migration equilibrium with rural and urban real wages given by w_A and w_A respectively in terms of units of industrial output. Let U_I be the urban unemployment rate at this equilibrium. Then a further rural to urban migration **with** an adjustment of capital is welfare-enhancing iff $h'(U_I)>0$ and

$$\frac{dS}{dM} = w_A\mu - U_I w_u > 0 \tag{4.21}$$

The long run equilibrium is illustrated in figure 3. We measure real wages and MPL on the vertical axis and employment on the horizontal axis. The bargained real wages (BRW) lines slope upwards. OA is the total labour force in East and West prior to migration. Let HA = AB be equal to migration. As the BRW in the West shifts to the right, employment rises by WW'. In the East, BRW shifts to left and employment falls by E'E. The net output gain is given by HJW'W - FGEE' the sign of which cannot be determined apriori. The measurement of that area should of considerable future research interest.

Figure 3
Migration in the Long run



BRW = "BARGAINED REAL WAGE"
OA = TOTAL LABOUR FORCE IN EAST AND WEST PRIOR TO MIGRATION
KA = AB = MIGRATION
BRW (WEST) SHIFTS TO RIGHT: EMPLOYMENT RISES BY WW'
BRW (EAST) SHIFTS TO LEFT: EMPLOYMENT FALLS BY E'E
NET OUTPUT GAIN = HJW'W – FGEE' OF INDETERMINATE SIGN

Conclustions

On the basis of our analysis of migration and investment in a labour-surplus economy, we conclude that a LS economy generally results in a higher level of agricultural employment. However, under certain conditions, a LS economy can lead to a high degree of capital accumulation depending on the values of the elasticity of substitution among different inputs in a nested CES production function. This conclusion is in accord with the special characteristics of the dual economies which exhibit considerable accumulation of capital within capitalistic farming systems despite the presence of surplus labour. We compare the benefits of migration from higher industrial with costs of migration and a fall in rural output. Our results tend to suggest that the net benefits of migration depend on the response of urban unemployment rate to migration and the flexibility of real wages with respect to unemploment rate. Migration without capital mobility increases welfare if the absolute value of the semi-elasticity of the urban real wage with respect to unemployment is large. We also show that migration is welfare enhancing in the long run if capital is mobile between different sectors.

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