Foreign Capital, National Welfare and Unemployment in a Fair Wage Model

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Abstract: The paper develops a three-sector general equilibrium model that can explain simultaneous existence of unemployment of both skilled and unskilled labour. The unemployment of unskilled labour is explicated in terms of rural-urban migration mechanism while that of skilled labour is shown using the 'fair wage hypothesis'. The paper finds that foreign direct investment (FDI) in the primary export sector improve both national welfare and urban unemployment problem of unskilled labour while the consequences of foreign capital flows into the import-competing sector and high-skill export sector are ambiguous. The paper justifies the desirability of FDI flow in the primary export sector from the perspective of both unemployment and social welfare.

Keywords: Fair wage hypothesis; skilled labour; unskilled labour; national welfare; unemployment.

JEL classification: F10, F13, J41, O15.

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1. Introduction

There exists a voluminous theoretical literature that examines the welfare consequence of foreign capital inflows in a small open economy both in the absence and presence of unemployment. Brecher and Alejandro (1977) have considered a two-commodity, two-factor full employment model while Khan (1982) has used a mobile capital Harris-Todaro (hereafter HT) model with urban unemployment for the analytical purpose. The important result, common to both which is well-known as the Brecher-Alejandro proposition, is as follows. The inflow of foreign capital with full repatriation of its earnings is necessarily immiserizing if the import-competing sector is capital-intensive and is protected by a tariff. However, social welfare does not change in the absence of any tariff. Here welfare is defined as a positive function of national income.

In the literature, the Brecher-Alejandro proposition has also been re-examined in terms of three-sector models. The third sector may either be a duty-free zone (DFZ) (sometimes called foreign enclave) as in the works of Beladi and Marjit (1992a, 1992b) or it may be an urban informal sector as in the works of Grinols (1991) and Chandra and Khan (1993). Beladi and Marjit (1992a) have shown that with full-repatriation of foreign capital income, an inflow of foreign capital may lead to immiserizing growth in the presence of tariff-distortion even if the foreign capital is employed in the export sector. This generalizes the main result in the existing literature, which primarily focuses on foreign capital inflow in the protected sector of the economy.

However, there are works like Marjit and Beladi (1996), Chaudhuri (2005, 2007) and Chaudhuri et al. (2006) which have demonstrated how foreign capital might produce favourable effect on welfare taking into consideration some essential features of the developing economies e.g. labour market distortion, presence of vast informal economy and non-traded goods. Chaudhuri (2007) and Chaudhuri et al. (2006) have adopted three-sector HT framework that explains urban unemployment as a migration-equilibrium phenomenon.

How to explain unemployment as a general equilibrium phenomenon depends on which type of labour we are considering, skilled or unskilled. The Harris-Todaro (1970) type of model is one way to explain unemployment in a general equilibrium setup where the efficiency of each worker is considered to be exogenously given and equal to unity. However, in such a model unemployment is specific to the urban sector and is suitable to explain unemployment of unskilled labour only.[1] But it does not account for the unemployment of skilled labour which is a disquieting problem in a developing economy particularly after global economic slowdown.

It is important to note that in an economy the possibility of being unemployed also rises with increasing education and skills. In the case of India, NSSO surveys conducted over the years show that the unemployment rate among those educated above the secondary level was higher, in both rural and urban areas, than those with lesser educational attainments. The NSSO 61st Round report, *Employment and Unemployment Situation in India 2004-05*, attributes this to the fact that "the job seekers become gradually more and more choosers as their educational level increases." Serneels (2007) also has found that in Ethiopia unemployment is concentrated among the relatively well-educated first time job seekers who come from the middle classes.

For explaining the existence of unemployment of skilled labour one has to recourse to the efficiency wage theories. A generalized version of efficiency wage theory is the 'fair wage hypothesis' (FWH). Agell and Lundborg (1992, 1995), Feher (1991), Akerlof and

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[1] The involuntary unemployment of unskilled labour can also be explained by using the 'consumption efficiency hypothesis' (CEH) of Leibenstein (1957), Bliss and Stern (1978), Dasgupta and Ray (1986) etc. where the nutritional efficiency of a worker depends positively on his consumption level. The CEH is the earliest version of the efficiency wage theory and is applicable to the poor unskilled workers who are at or slightly above their subsistence consumption level.

Yellen (1990), etc. have explained unemployment as a general equilibrium phenomenon using the FWH. As per the Agell and Lundborg (1992, 1995) treatment of the FWH, the efficiency of a worker is sensitive to the functional distribution of income. Consequently, the return to capital, wage rates and the unemployment rates of different types of labour appear as arguments in the efficiency function.

The objectives of the present paper are as follows. First, as the developing economies are plagued by both skilled and unskilled unemployment it is extremely important to develop an analytical framework that can be useful in analyzing the consequences of different policies on the national welfare and unemployment of both types of labour. We develop a three-sector specific-factor Harris-Todaro type general equilibrium model where the FWH is valid. Secondly, we intend to examine the validity of the standard immiserizing result of foreign capital inflows using this setup. Finally, the consequences of capital inflows on the unemployment of both types labour have been studied. The paper finds that although an inflow of foreign capital into the primary export sector unambiguously improves social welfare foreign capital inflows into the other two sectors may be welfare-worsening. Unemployment situation of skilled labour unequivocally improves in both cases. Finally, while capital of type N definitely lowers the urban unemployment of unskilled labour, an inflow of the other type of capital may fail to improve the situation unless the centripetal force of an increase in the rural sector wage is stronger than the centrifugal force resulting from an increase in the expected urban wage. Therefore the paper justifies the desirability of FDI flow in the primary export sector from the perspective of both unemployment and social welfare.

2. The Model

We consider a small open dual economy with three sectors: one rural and two urban. There are two types of capital, capital of type N and capital of type K, and two types of labour, skilled and unskilled. The rural sector produces an agricultural commodity using both types of capital and unskilled labour. Capital of type N is interpreted as a composite input[2] that is broadly defined to include not only natural resource like land but also durable capital equipments e.g. tractors, harvesters, weed cutters, pump sets for irrigation purpose. FDI in N implies an increased supply of the durable agricultural capital implements. On the other hand, capital of type K is used to purchase inputs like fertilizers, pesticides, weedicides etc. The capital (of type K)-output ratio in sector 1, a_{K1}, is assumed to be technologically given.[3] Sector 2 is an urban sector that produces a low-skill manufacturing good by means of capital of type K and unskilled labour. Finally, sector 3, another urban sector, uses capital of type K and skilled labour to produce a high - skill commodity. As sectors 2 and 3 produce non-agricultural commodities capital of type N is specific to the rural sector (sector 1). Skilled labour is a specific input in sector 3. Unskilled labour is imperfectly mobile between sectors 1 and 2 while capital of type K is completely mobile among all the three sectors of the economy. Sector 2 faces an imperfect unskilled labour market in the form of a unionized labour market where unskilled workers receive a contractual wage, W^*, while the unskilled wage rate in the rural sector, W, is market determined. The two unskilled wage rates are related by the Harris-Todaro (1970) migration equilibrium condition where the expected urban wage equals the rural wage rate and $W^* > W$. Hence, there is urban unemployment of unskilled labour. On the other hand, we use the FWH to explain unemployment of skilled labour and the efficiency function is similar to that in Agell and Lundborg (1992, 1995). This function can be derived from the effort norm of the skilled workers which is sensitive to the functional distribution of income and the skilled unemployment rate. This is the optimal effort function of the utility maximizing skilled workers. Capital of either type

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[2] This composite input is called 'land-capital' in the works of Bardhan (1973), Chaudhuri (2007) and Chaudhuri and Yabuuchi (2008).

[3] Although this is a simplifying assumption it is not completely without any basis. Agriculture requires inputs like fertilizers, pesticides, weedicides etc. which are to be used in recommended doses. Now if capital of type K is used to purchase those inputs, the capital (K type)-output ratio, a_{K1}, becomes constant technologically. However, labour and capital of type N are substitutes and the production function displays the property of constant returns to scale in these two inputs. However, even if the capital(K type)-output ratio is not given technologically the results of the paper still hold under an additional sufficient condition incorporating the partial elasticities of substitution between capital of type K and other inputs in sector 1.

includes both domestic capital and foreign capital. Incomes from foreign capital are completely repatriated. Sectors 1 and 3 are the two export sectors while sector 2 is the import-competing sector and is protected by an import tariff. Sector 2 uses capital of type K more intensively with respect to unskilled labour vis-à-vis sector 1. Production functions exhibit constant returns to scale[4] with positive and diminishing marginal productivity to each factor. Commodity 3 is chosen as the numeraire.

The following symbols will be used for formal presentation of the model.

$a_{Ki} =$ amount of capital of type K required to produce 1 unit of output in the ith sector, $i = 1,2,3$;

$a_{Ni} =$ amount of capital of type N required to produce 1 unit of output in sector 1;

$a_{Li} =$ unskilled labour-output ratio in the ith sector, $i = 1,2$;

$a_{S3} =$ skilled labour-output ratio in sector 3 (in efficiency unit);

$P_i =$ exogenously given relative price of the ith commodity, $i = 1,2$;

$t =$ ad-valorem rate of tariff on the import of commodity 2;

$X_i =$ level of output of the ith sector, $i = 1,2,3$;

$E =$ efficiency of each skilled worker;

$W_S =$ wage rate of skilled labour;

$\frac{W_S}{E} =$ wage rate per efficiency unit of skilled labour;

$W^* =$ unionized unskilled wage in sector 2;

$W =$ competitive wage rate of unskilled labour in sector 1;

$r =$ return to capital of type K (both domestic and foreign);

$R =$ return to capital of type N (both domestic and foreign)

$L =$ endowment of unskilled labour (in physical unit);

$S =$ endowment of skilled labour (in physical unit);

$v =$ unemployment rate of skilled labour;

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[4] See footnote 3 in this context.

L_U = urban unemployment of unskilled labour;

$K =$ economy's aggregate capital stock of K type (domestic plus foreign);

$N =$ economy's aggregate capital stock of N type (domestic plus foreign);

θ_{ji} = distributive share of the j th input in the i th sector for $j = N, L, S, K$ and $i =$ 1, 2, 3;

λ_{ji} = proportion of the j th input employed in the i th sector for $j = L, K$ and $i = 1,2,3$;

$'\wedge' =$ proportionate change.

Given the perfectly competitive commodity markets the three price-unit cost equality conditions relating to the three industries are as follows.

$$Wa_{L1} + ra_{K1} + Ra_{N1} = P_1 \tag{1}$$

$$W^* a_{L2} + ra_{K2} = P_2(1+t) \tag{2}$$

$$\frac{W_S}{E} a_{S3} + ra_{K3} = 1 \tag{3}$$

Following Agell and Lundborg (1992, 1995) we assume that the effort norms of the skilled labour depend positively on (i) skilled wage relative to average unskilled wage; (ii) skilled wage relative to returns on capital of both types; and, positively on (iii) the unemployment rate of skilled labour. It may be mentioned that the average unskilled wage in the economy is the rural sector wage that follows from the 'envelope property' of the HT framework.[5] Therefore, we write

$$E = E(\frac{W_S}{W}, \frac{W_S}{r}, \frac{W_S}{R}, v) \tag{4}$$

The efficiency function satisfies the following mathematical restrictions:

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[5] Unskilled workers are employed in the rural and low-skill urban manufacturing sectors where they earn W and W^* wages, respectively. Some of the unskilled workers remain unemployed in the urban sector earning nothing. The average wage income of all unskilled workers in the economy is the rural sector wage. This can be easily shown from equations (10) and (11). So, the efficiency function, given by equation (4), indirectly takes into account the unionized wage and the urban unemployment of unskilled labour as determinants.

$E_1, E_2, E_3, E_4 > 0$; $E_{11}, E_{22}, E_{33} < 0$; $E_{12} = E_{13} = E_{14} = E_{23} = E_{24} = E_{34} = 0$.[6]

The unit cost of skilled labour in sector 3, denoted ϖ, is given by

$$\varpi = (\frac{W_S}{E(.)}) \tag{5}$$

Each firm in sector 3 minimizes its unit cost of skilled labour as given by (5). The first-order condition of minimization is

$$E = \frac{W_S}{W}E_1 + \frac{W_S}{r}E_2 + \frac{W_S}{R}E_3 \tag{6}$$

where: E_i s are the partial derivatives of the efficiency function with respect to $(\frac{W_S}{W})$, $(\frac{W_S}{r})$ and $(\frac{W_S}{R})$, respectively. Equation (6) can be rewritten as

$$\varepsilon_1 + \varepsilon_2 + \varepsilon_3 = 1 \tag{6.1}$$

where ε_i is the elasticity of the $E(.)$ function with respect to its ith argument. This is the modified Solow condition as obtained in Agell and Lundborg (1992, 1995).

Full utilization of N and K types of capital respectively entail

$$a_{N1}X_1 = N \tag{7}$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K \tag{8}$$

There is unemployment of skilled labour in the economy and the rate of unemployment is v. The skilled labour endowment equation is, therefore, given by

$$a_{S3}X_3 = E(1-v)S \tag{9}$$

In the migration equilibrium there exists urban unemployment of unskilled labour. The unskilled labour endowment equation is given by

$$a_{L1}X_1 + a_{L2}X_2 + L_U = L \tag{10}$$

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[6] Mathematical derivation of the efficiency function from the rational behavior of a representative skilled worker and explanations of the mathematical restrictions on the partial derivatives are available in Agell and Lundborg (1992, 1995).

In a Harris-Todaro framework the unskilled labour allocation mechanism is such that in the labor market equilibrium, the rural wage rate, W, equals the expected wage income in the urban sector. Since the probability of finding a job in the urban low-skill sector is $(a_{L2}X_2 / (a_{L2}X_2 + L_U))$ the expected unskilled wage in the urban sector is $(W^* a_{L2}X_2 / (a_{L2}X_2 + L_U))$. Therefore, the rural-urban migration equilibrium condition of unskilled labour is expressed as

$(W^* a_{L2}X_2 / (a_{L2}X_2 + L_U)) = W$,

or equivalently,

$$(W^*/W)a_{L2}X_2 + a_{L1}X_1 = L \qquad (11)$$

Using (7) and (9) equations (11) and (8) can be rewritten as follows.

$$(\frac{W^*}{W})a_{L2}X_2 + \frac{a_{L1}}{a_{N1}}N = L\text{; and,} \qquad (11.1)$$

$$[(\frac{a_{K1}}{a_{N1}}N) + a_{K2}X_2 + \{\frac{a_{K3}E(1-v)S}{a_{S3}}\}] = K \qquad (8.1)$$

In this general equilibrium model there are ten endogenous variables; namely, W, r, R, W_S, E, v, L_U, X_1, X_2 and X_3 and the same number of independent equations; namely, (1) – (4), (6), (7), (8.1), (9), (10) and (11.1). The endogenous variables are determined as follows. The system does not possess the decomposition property. r is found from (2) as W^* is given exogenously. W, R, W_S, v and X_2 are simultaneously solved from equations (1), (4), (6), (8.1) and (11.1). E is then found from (3). X_1 and X_3 are solved from equations (7) and (9), respectively. Finally, L_U is found from (10).

A close look at the price system reveals that given the value of R, sectors 1 and 2 can be conceived to form a Heckscher-Ohlin subsystem (HOSS) as they use two common inputs: unskilled labour and capital of type K. It is sensible to assume that sector 2 is more capital-intensive than sector 1 in value sense with respect to unskilled labour. This implies that $(a_{K2} / W^* a_{L2}) > (a_{K1} / Wa_{L1})$.

We measure welfare of the economy by national income at world prices, Y, and is given by

$$Y = WL + RN_D + rK_D + W_S(1-v)S - tP_2X_2 \quad (12)$$

It is assumed that the foreign capital incomes of both types are fully repatriated. In equation (12), WL and $W_S(1-v)S$ give the aggregate wage incomes of the unskilled and skilled workers, respectively. RN_D and rK_D denote rental incomes from domestic capital of types N and K. Finally, tP_2X_2 measures the cost of tariff protection of the import-competing sector.

3. **Comparative Statics**

We are now going to analyze the consequences of inflows of foreign capital on national welfare and unemployment of both skilled and unskilled labour. An inflow of foreign capital into the primary export sector is captured by an increase in the endowment of N type of capital. On the other hand, the endowment of K type of capital goes up when foreign capital flows into the other two sectors including the tariff-protected import-competing sector. The incomes on foreign capital are completely repatriated.

Differentiating equations (1), (4) (6), (11.1) and (8.1) the following expressions are derived, respectively.[7]

$$\theta_{L1}\hat{W} + \theta_{N1}\hat{R} = 0 \quad (13)$$

$$\varepsilon_1\hat{W} + \varepsilon_3\hat{R} - \varepsilon_4\hat{v} = 0 \quad (14)$$

$$B_1\hat{W} + B_2\hat{R} - B_3\hat{W}_S + \varepsilon_4\hat{v} = 0 \quad (15)$$

$$-B_5\hat{W} + B_6\hat{R} + \lambda^*_{L2}\hat{X}_2 = -\lambda_{L1}\hat{N} \quad (16)$$

$$(-\lambda_{K1}S^1_{NL})\hat{W} + (\lambda_{K1}S^1_{NL})\hat{R} + \lambda_{K2}\hat{X}_2 + \lambda_{K3}\hat{W}_S - B_4\hat{v} = \hat{K} - \lambda_{K1}\hat{N} \quad (17)$$

where:

[7] Note that a_{K1} is technologically given. See footnote 2 in this context.

$$\left.\begin{array}{l} B_1 = \frac{E_{11}}{E}(\frac{W_S}{W})^2 < 0 \; ; B_2 = \frac{E_{33}}{E}(\frac{W_S}{R})^2 < 0 \; ; \\ B_3 = \left[(\frac{W_S}{W})^2 \frac{E_{11}}{E} + (\frac{W_S}{r})^2 \frac{E_{22}}{E} + (\frac{W_S}{R})^2 \frac{E_{33}}{E} \right] < 0 \; ; B_4 = (\frac{\lambda_{K3} v}{1-v}) > 0 \; ; \\ B_5 = [\lambda_{L2}^* + \lambda_{L1}(S_{LN}^1 + S_{NL}^1)] > 0 \; ; B_6 = [\lambda_{L1}(S_{LN}^1 + S_{NL}^1)] > 0 \; ; \text{ and,} \\ \lambda_{L2}^* = (\frac{W^*}{W})\lambda_{L2} > 0. \end{array}\right\} \quad (18)$$

Here S_{ji}^k is the degree of substitution between factors in sector k. For example, $S_{LL}^1 = (\frac{W}{a_{L1}})(\frac{\partial a_{L1}}{\partial W})$, $S_{LN}^1 = (\frac{R}{a_{L1}})(\frac{\partial a_{L1}}{\partial R})$ etc. $S_{ji}^k > 0$ for $j \neq k$; & $S_{jj}^k < 0$.

Arranging (13) – (17) in a matrix notation one obtains

$$\begin{bmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 \\ \varepsilon_1 & \varepsilon_3 & 0 & -\varepsilon_4 & 0 \\ B_1 & B_2 & -B_3 & \varepsilon_4 & 0 \\ -B_5 & B_6 & 0 & 0 & \lambda_{L2}^* \\ -\lambda_{K1}S_{NL}^1 & \lambda_{K1}S_{NL}^1 & \lambda_{K3} & -B_4 & \lambda_{K2} \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{R} \\ \hat{W}_S \\ \hat{v} \\ \hat{X}_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -\lambda_{L1}\hat{N} \\ \hat{K} - \lambda_{K1}\hat{N} \end{bmatrix} \quad (19)$$

The determinant to the coefficient matrix is

$$|D| = -\varepsilon_4 B_3 \left[\theta_{L1}(\lambda_{K2}B_6 - \lambda_{K1}\lambda_{L2}^* S_{NL}^1) + \theta_{N1}(\lambda_{K2}B_5 - \lambda_{K1}\lambda_{L2}^* S_{NL}^1) \right]$$

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$$+\lambda_{L2}^*[\varepsilon_4 \lambda_{K3} J - B_3 B_4 H] \quad (20)$$

(–)(+)

where

$$\left.\begin{array}{l} J = \{\theta_{L1}(B_2 + \varepsilon_3) - \theta_{N1}(B_1 + \varepsilon_1)\} \; ; \\ H = (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1) . \end{array}\right\} \quad (21)$$

As the production structure is indecomposable an increase in capital stock of type N must decrease its rate of return, R i.e. $(\hat{R}/\hat{N})<0$. Thus, solving (19) by Cramer's rule it can be easily proved[8] that

$$|D|>0 \tag{22}$$

For determining the signs of J and H we need to impose some restrictions on the relative responsiveness of the $E(.)$, E_1 and E_3 functions with respect to their two arguments: $(\frac{W_S}{W})$ and $(\frac{W_S}{R})$. The efficiency function, given by equation (4), is assumed to satisfy the following two special properties.

Property A The responsiveness of $E(.)$ with respect to $\frac{W_S}{R}$ is greater than that with respect to $\frac{W_S}{W}$ such that $(\frac{\varepsilon_3}{\theta_{N1}})>(\frac{\varepsilon_1}{\theta_{L1}})$.

Property B The algebraic value of the elasticity of E_3 with respect to $\frac{W_S}{R}$ is not less than that of E_1 with respect to $\frac{W_S}{W}$ i.e. $(\frac{E_{33}W_S}{E_3R})\geq(\frac{E_{11}W_S}{E_1W})$.

The implications of the above two properties are as follows. Although the efficiency of the skilled workers depends on the relative income distribution, they are expected to have different attitudes towards the earnings of different factors of production. So changes in incomes of different factors should affect the efficiency of skilled labour in different degrees. It is reasonable to assume that the average unskilled wage is substantially lower than the skilled wage. That is why the skilled workers are expected to have a soft feeling towards their unskilled counterparts. On the contrary, they would feel to be deprived significantly if the returns on both types of capital increase relative to the skilled wage

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[8] This has been shown in Appendix I.

which badly affect their work morale. It is reasonable, therefore, to assume that increases in incomes of the capitalists cause a greater negative response among the skilled workers and lower their efficiency than that resulting from an increase in the average unskilled wage.

Properties (A) and (B) of the efficiency function together imply that[9]

$$\left.\begin{aligned} &(\frac{\theta_{L1}}{\theta_{N1}}) > (\frac{\varepsilon_1}{\varepsilon_3}) \geq (\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}); \text{ and,} \\ &J = \{\theta_{L1}(B_2 + \varepsilon_3) - \theta_{N1}(B_1 + \varepsilon_1)\} > 0; H = (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1) > 0 \end{aligned}\right\} \quad (23)$$

Differentiating (2) and (3) it is easy to show that

$$\hat{E} = \hat{W}_S \quad (24)$$

This leads to the following corollary.

Corollary 1: The efficiency of skilled labour, E, and the skilled wage rate, W_S, always change in the same direction and in the same proportion.

From (13) we can write

$$\hat{W} = -(\frac{\theta_{N1}}{\theta_{L1}})\hat{R} \quad (25)$$

This establishes the following corollary.

Corollary 2: W and R are negatively correlated.

Using (25) equation (14) can be rewritten as follows.

$$\hat{v} = \frac{(\varepsilon_3\theta_{L1} - \varepsilon_1\theta_{N1})\hat{R}}{\varepsilon_4\theta_{L1}} \quad (26)$$

Using (23) from (26) the following corollary is imminent.

Corollary 3: R and v are positively related.[10]

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[9] This has been proved in Appendix II.

Adding (14) and (15) and substituting for $\hat{W}$ from (13) we get

$$\hat{W}_S = [\frac{\theta_{L1}(\varepsilon_3 + B_2) - \theta_{N1}(\varepsilon_1 + B_1)}{\theta_{L1}B_3}]\hat{R} \quad (27)$$

$$(-)$$

With the help of (23) from (27) the following corollary immediately follows.

Corollary 4: R and W_S are negatively related.

Solving (19) by Cramer's rule the following proposition can be easily established.[11]

Proposition 1: Under assumptions A and B, an inflow of either type of capital leads to (i) an increase in the rural unskilled wage (W); (ii) a decrease in the return to capital of type N; (iii) an increase in the skilled wage (W_S);.(iv) a fall in the unemployment rate of skilled labour (v); and, (v) an expansion of sector 3. Furthermore, (vi) sector 1 expands (contracts) while sector 2 contracts (expands) owing to inflows of capital of type N (type K).

An inflow of foreign capital of type N into sector 1 lowers its return, R. This raises the value of marginal product of unskilled labour and hence the rural unskilled wage, W. This becomes clear if one looks at equation (1). A fall in R lowers the skilled unemployment rate, v (corollary 3) and raises the skilled wage, W_S (corollary 4) and hence their efficiency, E (corollary 1). As employment of skilled labour rises in efficiency unit (also in physical unit) sector 3 expands and draws capital from the other two sectors. Consequently, the capital-intensive sector 2 contracts and the unskilled labour-intensive sector 1 expands following a Rybczynski type effect.

On the other hand, an inflow of foreign capital of type K cannot change its return, r, as it is determined from equation (2). It produces a Rybczynski effect in the HOSS. Sector 2

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[10] As the rural sector unskilled wage and the return on capital of type N are negatively related (corollary 2) there is a negative relationship between the average unskilled (rural) wage and skilled unemployment rate.

[11] See Appendix III for mathematical derivations of the results.

expands while sector 1 contracts as the former is more capital-intensive than the latter. As sector 1 contracts the demand for capital of type N falls. This lowers R which in turn raises both W (corollary 2) and W_S (corollary 4) and hence E (corollary 1) and lowers the skilled unemployment rate, v (corollary 3). As the employment of skilled labour rises both in efficiency and physical units sector 3 expands.

Differentiating the national income expression (equation 12) the following proposition can be proved.[12]

Proposition 2: An inflow of foreign capital of type N is unambiguously welfare-improving[13] while inflows of K type of capital may fail to boost up social welfare.

We can explain proposition 2 in the following fashion. In proposition 1 we find that an inflow of foreign capital of either type raises the aggregate unskilled wage, aggregate skilled employment and hence the aggregate skilled wage but lowers the domestic capital income of N type. The domestic capital income of K type, however, remains unchanged. It is easy to show that the increase in the aggregate unskilled wage income dominates over the fall in the capital income of N type. Hence in either case the aggregate factor income unambiguously rises. Besides, an inflow of capital of N type leads to a contraction of the tariff protected import-competing sector. Hence the cost of protection of the import-competing sector falls. Social welfare unequivocally improves in this case. But in the case of K type capital the protected sector expands. Hence there is no guarantee that it improves social welfare unless the positive aggregate factor income effect is strong enough to dominate over the negative distortionary effect of tariff protection of the import-competing sector.

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[12] This has been proved in Appendix IV.

[13] An inflow of foreign capital of type N raises the economy's aggregate stock of durable agricultural capital implements. Here foreign capital inflow takes place into the economy's primary export sector. There are other papers in the literature like Beladi and Marjit (1992a, 1992b) that have examined the welfare consequence of foreign capital into a small open economy's export sector. However, they have found the inflow of foreign capital to be immiserizing.

Subtraction of equation (10) from (11) yields

$$L_U = a_{L2}X_2\left(\frac{W^* - W}{W}\right) \tag{28}$$

Totally differentiating equation (28) one can establish the final proposition of the model.[14]

Proposition 3: An inflow of foreign capital of type N unambiguously improves the urban unemployment problem of unskilled labour. On the contrary, inflows of type K capital improve the unemployment situation of unskilled labour if $1 \geq \left(\left(\frac{(\theta_{L1} + \theta_{N1})\lambda_{L1}}{\theta_{N1}\lambda_{L2}}\right)(S_{LN}^1 + S_{NL}^1)\right)$.

We explain proposition 3 in the following manner. In the migration equilibrium the expected urban wage for a prospective unskilled rural migrant equals the actual unskilled rural wage. An inflow of foreign capital of either type affects the migration equilibrium in two ways. First, the low-skill urban manufacturing sector expands or contracts. This leads to a change in the number of jobs available in this sector. The expected urban wage for a prospective rural migrant, $[W^* / \{1 + (L_U / a_{L2}X_2)\}]$, changes as the probability of getting a job in this sector changes for every unskilled worker. This is *the centrifugal force*. If the expected urban wage rises (falls) *the centrifugal force* is positive (negative).This paves the way for fresh migration (reverse migration) from the rural (urban) to the urban (rural) sector. On the other hand, an inflow of foreign capital of either type raises the rural unskilled wage (see proposition 1). This is *the centripetal force* that prevents rural workers from migrating into the urban sector. Thus, there are clearly two opposite effects working on determination of the size of the unemployed urban unskilled workforce. In the case of an inflow of foreign capital of type N the low-skill urban manufacturing sector contracts both in terms of output and employment. The expected urban unskilled wage falls. So the centrifugal force is negative and drives the unemployed urban workers to return to the rural sector. Thus, both the centripetal and the centrifugal forces work in the same direction and cause the urban unemployment of

[14] See Appendix V for mathematical proof of this proposition.

unskilled labour to decline. On the contrary, in the case of an inflow of foreign capital of K type the low-skill urban sector expands and causes the expected urban unskilled wage to rise. This leads to more migration from the rural sector to the urban sector. Therefore, in this case the centrifugal and centripetal forces work in the opposite direction to each other. If the latter effect outweighs the former, the level of unemployment falls. This happens under the sufficient condition as mentioned in proposition 3.

4. Concluding remarks

This paper has developed a three-sector general equilibrium model that can explain unemployment of both skilled and unskilled labour. The unemployment of unskilled labour is explicated in terms the of rural-urban migration mechanism while that of skilled labour is shown using the 'fair wage hypothesis'. Apart from the two types of labour there are two types of capital in this model. Capital of type N is specific to the primary export sector (sector 1) while capital of type K is used in all the three sectors of the economy. Consequences of foreign capital inflows of both types have been studied on national welfare and unemployment of either type of labour. The paper finds that an inflow of foreign capital into the primary export sector unambiguously improves social welfare. On the contrary, although inflows of capital of type K unquestionably improve the aggregate factor income it may fail to improve social welfare. The unemployment situation of the skilled labour unequivocally improves in both the cases. Finally, while capital of type N definitely lowers the urban unemployment of the unskilled labour, the effect of an inflow of type K capital may fail to improve the situation unless the centripetal force of an increase in the rural sector wage is stronger than the centrifugal force resulting from an increase in the expected urban wage. The paper, therefore, justifies the desirability of FDI flow in the primary export sector from the perspective of both unemployment and social welfare. It is important to mention that after witnessing China's exemplary success in the agricultural front the developing economies like India are of late toying with the idea of permitting foreign investment in agriculture.[15] The

[15] See Deshpande (2007) in this context.

analysis of the paper provides a theoretical foundation of such a move by the developing nations.

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Appendix I:

Solving (19) by Cramer's rule the following result is obtained.

$$\frac{\hat{R}}{\hat{N}} = \frac{|\lambda^*|}{|D|}(\theta_{L1}\varepsilon_4 B_3) \qquad \text{(A.1)}$$

$$(+)(-)$$

where:

$$|D| = -\varepsilon_4 B_3 \left[\theta_{L1}(\lambda_{K2}B_6 - \lambda_{K1}\lambda^*_{L2}S^1_{NL}) + \theta_{N1}(\lambda_{K2}B_5 - \lambda_{K1}\lambda^*_{L2}S^1_{NL})\right]$$

$$(+) \qquad\qquad (+)$$

$$+\lambda^*_{L2}[\varepsilon_4\lambda_{K3}J - B_3B_4H] \qquad (20)$$

$$(-)$$

$$\left.\begin{aligned} &J = \{\theta_{L1}(B_2 + \varepsilon_3) - \theta_{N1}(B_1 + \varepsilon_1)\}\,; \\ &H = (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1)\,;\text{ and,} \\ &|\lambda^*| = (\lambda_{L1}\lambda_{K2} - \frac{W^*}{W}\lambda_{L2}\lambda_{K1}) > 0 \end{aligned}\right\} \qquad \text{(A.2)}$$

(Note that $|\lambda^*| > 0$ as sector 1 is more unskilled labour-intensive vis-à-vis sector 2 in value sense.)

In an indecomposable production structure like this it is sensible to assume that R falls (rises) if N rises (falls) i.e. $(\frac{\hat{R}}{\hat{N}}) < 0$. From (A.1) it then follows that

$$|D| > 0 \qquad (22)$$

From (20), (A.2) and (22) it follows that two sufficient conditions for $|D| > 0$ are: $J, H > 0$.

Appendix II:

As $E_1 = (\frac{\partial E}{\partial(\frac{W_S}{W})}); E_3 = (\frac{\partial E}{\partial(\frac{W_S}{R})}) > 0$ and $E_{11}, E_{33} < 0$ we must have

$[\varepsilon_1 E + E_{11}(\frac{W_S}{W})^2] > 0$; and,

$[\varepsilon_3 E + E_{33}(\frac{W_S}{R})^2] > 0$. Using (18) one can write

$$\left.\begin{array}{l}(\varepsilon_1 + B_1) > 0 \text{ ; and,} \\ (\varepsilon_3 + B_2) > 0 .\end{array}\right\} \quad \text{(A.3)}$$

From Assumption A it follows that

$$(\frac{\theta_{L1}}{\theta_{N1}}) > (\frac{\varepsilon_1}{\varepsilon_3}) \quad \text{(A.4)}$$

That $H > 0$ is a direct consequence of Assumption A. We are going to prove that $J > 0$ if Assumption B holds.

From (23)

$$J > 0 \Rightarrow (\frac{\theta_{L1}}{\theta_{N1}}) > (\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}) \quad \text{(A.5)}$$

Now

$$[\frac{\varepsilon_1}{\varepsilon_3} - \frac{(B_1 + \varepsilon_1)}{(B_2 + \varepsilon_3)}] = [\frac{(\varepsilon_1 B_2 - \varepsilon_3 B_1)}{\varepsilon_3 (B_2 + \varepsilon_3)}] = (\frac{\varepsilon_1}{B_2 + \varepsilon_3})[\frac{B_2}{\varepsilon_3} - \frac{B_1}{\varepsilon_1}]$$

Substituting the values of B_1 and B_2 from (18) and simplifying we can obtain the following expression.

$$[\frac{\varepsilon_1}{\varepsilon_3} - \frac{(B_1 + \varepsilon_1)}{(B_2 + \varepsilon_3)}] = (\frac{\varepsilon_1}{\varepsilon_3 + B_2})[\frac{E_{33} W_S}{E_3 R} - \frac{E_{11} W_S}{E_1 W}] \quad \text{(A.6)}$$

Now if $(\frac{E_{33} W_S}{E_3 R}) \geq (\frac{E_{11} W_S}{E_1 W})$ i.e. if Assumption B holds from (A.3) and (A.6) it follows that

$$\frac{\varepsilon_1}{\varepsilon_3} \geq \frac{(B_1+\varepsilon_1)}{(B_2+\varepsilon_3)} \tag{A.7}$$

From (A.4) and (A.7) we can write

$$(\frac{\theta_{L1}}{\theta_{N1}}) > (\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}) \Rightarrow J > 0\,.$$

Combining (A.4) and (A.7) and using (21) one can write

$$(\frac{\theta_{L1}}{\theta_{N1}}) > (\frac{\varepsilon_1}{\varepsilon_3}) \geq (\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}) \Rightarrow J, H > 0. \tag{22}$$

Appendix III:

Solving (19) by Cramer's rule, using (18), (22) and (23) and simplifying the following results can be obtained.

$$\left.\begin{array}{l}
\frac{\hat{W}}{\hat{N}} = -\frac{\varepsilon_4\theta_{N1}B_3\left|\lambda^*\right|}{|D|} > 0\,; \quad \frac{\hat{W}}{\hat{K}} = -\frac{\varepsilon_4\theta_{N1}B_3\lambda^*_{L2}}{|D|} > 0\,; \\
\frac{\hat{R}}{\hat{N}} = \frac{\left|\lambda^*\right|}{|D|}(\theta_{L1}\varepsilon_4 B_3) < 0\,; \quad \frac{\hat{R}}{\hat{K}} = \frac{\lambda^*_{L2}(\theta_{L1}\varepsilon_4 B_3)}{|D|} < 0 \\
\frac{\hat{W}_S}{\hat{N}} = \frac{\left|\lambda^*\right|}{|D|}\varepsilon_4 J > 0\,; \quad \frac{\hat{W}_S}{\hat{K}} = \frac{\lambda^*_{L2}}{|D|}\varepsilon_4 J > 0 \\
\frac{\hat{v}}{\hat{N}} = \frac{\left|\lambda^*\right|}{|D|}B_3 H < 0\,; \quad \frac{\hat{v}}{\hat{K}} = \frac{\lambda^*_{L2}}{|D|}B_3 H < 0 \\
\frac{\hat{X}_1}{\hat{N}} = \frac{1}{|\mathrm{D}|}[\lambda^*_{L2}(\varepsilon_4\lambda_{K3}J - B_3B_4H) - \lambda_{K2}\varepsilon_4B_3\{\lambda_{L1}S^1_{LN}(\theta_{N1}+\theta_{L1}) + \theta_{N1}\lambda^*_{L2}\}\ ] > 0 \\
\frac{\hat{X}_1}{\hat{K}} = \frac{B_3S^1_{NL}\lambda^*_{L2}\varepsilon_4}{|D|}(\theta_{L1}+\theta_{N1}) < 0\,; \frac{\hat{X}_2}{\hat{K}} = \frac{-B_3\varepsilon_4(\theta_{L1}B_6 + \theta_{N1}B_5)}{|D|} > 0 \\
\frac{\hat{X}_2}{\hat{N}} = \frac{1}{|D|}[-\lambda_{L1}(\varepsilon_4\lambda_{K3}J - B_3B_4H) + \lambda_{K1}\varepsilon_4B_3\{\lambda_{L1}S^1_{LN}(\theta_{N1}+\theta_{L1}) + \theta_{N1}\lambda^*_{L2}\}] < 0
\end{array}\right\} \tag{A.8}$$

Results presented in (A.8) have been verbally stated in proposition 1.

Appendix IV:

Totally differentiating (12), using (A.8), (18), (22) and (23) and simplifying the following two expressions can be derived

$$Y(\frac{\hat{Y}}{\hat{N}}) = -\frac{\varepsilon_4 B_3 |\lambda^*|}{|D|}(\theta_{N1}WL - \theta_{L1}RN_D) + \frac{W_S S|\lambda^*|}{|D|}\{(1-v)\varepsilon_4 J - vB_3 H\}$$

(+) (+) (−)(+)

$$-\frac{tP_2X_2}{|D|}[\lambda_{L1}(B_3B_4H - \varepsilon_4\lambda_{K3}J) + \lambda_{K1}\varepsilon_4 B_3\{\lambda_{L1}S^1_{LN}(\theta_{N1}+\theta_{L1}) + \theta_{N1}\lambda^*_{L2}\}] \quad \text{(A.9)}$$

(+) (−) (+) (+) (−) (+)

and,

$$Y(\frac{\hat{Y}}{\hat{K}}) = -\frac{\varepsilon_4 B_3}{|D|}(\theta_{N1}WL - \theta_{L1}RN_D)\lambda^*_{L2} + \frac{W_S S\lambda^*_{L2}}{|D|}\{(1-v)\varepsilon_4 J - vB_3 H\}$$

(−) (+) (+) (−)(+)

$$+\{(\frac{\varepsilon_4 B_3}{|D|})tP_2X_2(\theta_{L1}B_6 + \theta_{N1}B_5)\} \quad \text{(A.10)}$$

(−) (+)

Now

$$(\theta_{N1}WL - \theta_{L1}RN_D) = W\theta_{N1}(L - a_{L1}\frac{N_D}{a_{N1}}) > 0 \quad \text{(A.11)}$$

(as from (7) $\frac{N_D}{a_{N1}} \le X_1$; and, $N_D \le N$)

Using (A.11) from (A.9) we can conclude that

$(\frac{\hat{Y}}{\hat{N}}) > 0$.

However the sign of $(\frac{\hat{Y}}{\hat{K}})$ is ambiguous which is clear from (A.10).

Appendix V:

Total differentials of equation (28) yield

$$\lambda_{LU}\hat{L}_U = \lambda_{L2}[(\frac{W^* - W}{W})\hat{X}_2 - (\frac{W^*}{W})\hat{W}] \tag{A.12}$$

where $\lambda_{LU} = (\frac{L_U}{L})$

Using (A.8) and simplifying from (A.12) the following expressions can be derived.

$$(\frac{\hat{L}_U}{\hat{N}}) = (\frac{\lambda_{L2}}{\lambda_{LU}|D|})[[(\frac{W^* - W}{W})[\lambda_{L1}(B_3 B_4 H - \lambda_{K3}\varepsilon_4 J) + \lambda_{K1}\varepsilon_4 B_3\{\lambda_{L1}S^1_{LN}(\theta_{L1} + \theta_{N1}) + \theta_{N1}\lambda^*_{L2}\}]$$

(+) (−)(+)(+) (+)(+) (+)(−) (+)

$$+(\frac{W^*}{W})(\theta_{N1}\varepsilon_4 B_3)|\lambda^*|]] < 0. \tag{A.13}$$

(−) (+)

$$(\frac{\hat{L}_U}{\hat{K}}) = (\frac{\varepsilon_4 B_3 \lambda_{L2}}{\lambda_{LU}|D|})[(\theta_{L1} + \theta_{N1})\lambda_{L1}(S^1_{LN} + S^1_{NL}) + (\frac{W^*}{W})\{\theta_{N1}\lambda_{L2} - (\theta_{L1} + \theta_{N1})\lambda_{L1}(S^1_{LN} + S^1_{NL})\}] \tag{A.14}$$

From (A.14) it follows that

$$(\frac{\hat{L}_U}{\hat{K}}) < 0 \text{ if } 1 \geq ((\frac{\theta_{L1} + \theta_{N1})\lambda_{L1}}{\theta_{N1}\lambda_{L2}})(S^1_{LN} + S^1_{NL})) \tag{A.15}$$