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16. March 2007

FOREIGN CAPITAL AND SKILLED-UNSKILLED WAGE INEQUALITY IN A DEVELOPING ECONOMY WITH NON-TRADED GOODS

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(First draft: 16.03.2007)

Abstract: The existing theoretical literature does not take into consideration the existence of non-traded goods and the nature of capital mobility between the traded and the non-traded sectors in analyzing the consequences of liberalized investment policies on the relative wage inequality in the developing countries. The present paper purports to fill in this gap using two four-sector general equilibrium models reasonable for a developing economy. We have found that inflows of foreign capital usually improve the wage inequality when the low-skill sector is capital-intensive. But, the relative wage gap may widen if the high-skill sector is capital-intensive. When the non-traded sector produces a non-traded final commodity wage inequality worsens if the low-skill sector is capital-intensive and employs only a very small proportion of the unskilled workforce and if the primary export sector is unskilled labour-intensive. Appropriate policy recommendations for improving the wage inequality have also been made.

JEL classifications: F13, J31.

Keywords: Skilled labour, unskilled labour, wage inequality, foreign capital inflows, non-traded goods, intersectoral capital mobility, labour market imperfection.

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1. Introduction:

Developing countries have chosen free trade as their development strategy and been vigorously implementing liberalized trade and investment policies for the last two decades or so. Radical measures for reducing tariff barriers and completely doing away with non-tariff barriers to ensure freer global trade have been undertaken in manufacturing commodities. FDI norms have liberalized considerably and several sectors, hitherto protected, have been opened up to foreign capitalists so that inflows of foreign capital take place in abundance in order to facilitate economic growth. It is important to mention that the developing countries have been able to attract a substantial amount of foreign capital during the period of economic reforms.[1]

The new development approach has not so far been an unmixed blessing. In their endeavor in implementing liberalized economic policies the developing countries have been facing some adjustment costs. Increasing skilled-unskilled wage inequality[2] and unemployment of unskilled labour are two major exacerbating problems of the developing world in the post-reform era. It is quite perplexing as to why the relative wage inequality has deteriorated, especially when as per the baseline 2×2×2 Heckscher-Ohlin-Samuelson trade model, economic liberalization was expected to improve the wage inequality in the developing economies following increases in the prices of the export commodities as these are generally exporters of commodities that are intensive in the use of unskilled labour.

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[1] As per the UNCTAD (2005) report, FDI inflows to developing countries increased from 8,455 millions of dollars in 1980 to 2,33,227 millions of dollars in 2004. FDI inward stocks in the corresponding years were 1,32,044 and 22,32,868 millions of dollars, respectively.

[2] See Robbins (1994, 1995, 1996), Wood (1997), Khan (1998) and Tendulkar et al. (1996) among others.

The scanty theoretical literature explaining the deteriorating wage inequality in the developing countries includes works of Feenstra and Hanson (1996), Yabuuchi and Chaudhuri (2007) and Marjit, Beladi and Chakrabarti (2004). They have shown how trade liberalization, international migration of labour and inflows of foreign capital might produce unfavourable effects on the wage inequality in the South given the specific structural characteristics of the less developed countries, such as features of labour markets, structures of production, nature of capital mobility etc.

As per the empirical literature, growth in foreign direct investment which is positively correlated with the relative demand for skilled labour has been one of the prime factors[3] responsible for the growing incidence of wage inequality in the Southern countries. The paper of Feenstra and Hanson (1996) is based on the famous Dornbusch-Fischer-Samuelson continuum-of-goods framework. According to them, inflows of foreign capital induced greater production of skilled-intensive commodities in Mexico, thereby leading to a relative decrease in the demand for unskilled labour. Marjit, Beladi and Chakrabarti (2004) have analyzed how diverse trade pattern and market fragmentation in world trade can adversely affect the skilled-unskilled wage inequality in the developing countries. They have also studied the consequences of an improvement of terms of trade and inflows of foreign capital on wage inequality with or without trade fragmentation. The paper finds that without trade fragmentation improvements in terms of trade and/or inflows of foreign capital may worsen wage inequality if the vertically integrated skilled export sector is more capital-intensive vis-à-vis the import-competing sector. But, with trade fragmentation the consequences on the relative wage inequality might be different.[4] However, in these papers all input markets have been assumed to be perfect and therefore labour market imperfection especially that of unskilled labour has not been taken care of. Further more, none of these papers takes into consideration the existence of non-traded

[3] See Harrison and Hanson (1999), Hanson and Harrison (1999), Curie and Harrison (1997), and Beyer, Rojas and Vergara (1999) in this context.

[4] An inflow of foreign capital may worsen the wage inequality even with trade fragmentation if the traded intermediate good sector is capital-intensive relative to the import-competing sector.

goods and the nature of capital mobility between the traded and the non-traded sectors in analyzing the consequence of foreign capital inflows on the relative wage inequality.

The existence of non-traded goods, the prices of which are determined domestically by demand-supply forces, is an essential feature of a developing economy. Liberalized economic policies are supposed to move resources away from the non-traded sectors to the traded sectors of the economy. The non-traded sectors usually use backward technologies of production and are intensive in the use of unskilled labour. Non-traded goods may be either inputs or final commodities. A non-traded sector that produces an intermediate good for a traded sector lives or dies with the latter. On the contrary, a final good-producing non-traded sector expands or contracts with an increase or a decrease in the purchasing power of the people who consume the commodity. Hence how the prices of non-traded goods change in response to policy changes plays a crucial role in determining the direction of relative wage movements. Furthermore, capital mobility between the traded and the non-traded sectors may be of different types. If the non-traded sector produces an agricultural commodity there should be capital mobility between the non-traded sector and the primary export sector while capital is likely to flow freely between the non-traded, low-skill manufacturing and the high-skill sectors if the non-traded sector produces a manufacturing good. The outcomes of any policy changes on the relative wages should depend on the type of the non-traded good and the nature of capital mobility between the traded and the non-traded sectors.

The present paper purports to address the above shortcomings of the existing theoretical literature on wage inequality in terms of two four-sector[5] general equilibrium models reasonable for a developing economy. First, the case of non-traded input is taken up where one of the four sectors produces an intermediate good for another sector. Both these sectors use unskilled labour, and capital flows freely between them. There is also capital mobility between these sectors and the high-skill sector while in the latter skilled

[5] One should ideally make use of a four-sector general equilibrium for capturing simultaneously both non-traded goods and imperfections in the market for unskilled labour.

labour is a specific input. We then deal with the case of final commodity where capital[6] is mobile only between the primary export sector and the non-traded sector. These two sectors, however, cannot receive capital from/ lend capital to the other sectors i.e. the low-skill manufacturing sector and the high-skill sector. There is imperfection in the market for unskilled labour in the low-skill sector (formal sector) where unskilled workers receive a high unionized wage while their counterparts in the other two sectors receive only a low and competitive wage. The capital endowment of the economy consists of both domestic capital and foreign capital and these are perfect substitutes.[7]

The consequences of foreign capital inflows on the skilled-unskilled wage inequality have been examined in these two alternative scenarios. The interesting results that emerge from the theoretical exercise are as follows. When the non-traded sector produces an intermediate input, inflows of foreign capital improve the wage inequality if the low-skill manufacturing sector is capital-intensive (in a special sense) relative to the high-skill sector. On the contrary, relative wages may move against unskilled labour when the high-skill sector is capital-intensive and the low-skill sector employs only a very small proportion of unskilled workforce. But, in the case of the non-traded final commodity wage inequality worsens (improves) if the low-skill sector (high-skill sector) is capital-intensive and employs only a very small proportion of the unskilled workforce and if the primary export sector is unskilled labour-intensive. A wage subsidy policy and/or a capital subsidy policy should be undertaken under different circumstances so as to make wages move in favour of unskilled workers.

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[6] These two sectors use land which is one type of capital in a wider sense. To avoid confusion, however, we can call this input land-capital which is broadly conceived to include durable capital equipments of all kinds. See Bardhan (1973) and Chaudhuri (2007) in this context.

[7] This assumption has been widely used in the theoretical literature on foreign capital and welfare. See, Brecher-Alejandro (1977), Chanda and Khan (1993), Yabuuchi (1982) and Chaudhuri (2007) among others.

2. The model with non-traded intermediate input

Let us consider a small open economy with four sectors. Sector 1 is the primary export sector that produces an agricultural commodity using unskilled labour and land-capital. The input 'land-capital' is broadly conceived to include durable capital equipments of all kinds.[8] Sector 2 produces a non-traded input for the low-skill manufacturing sector (sector 3) with the help of unskilled labour and capital. Sector 3, on the other hand, uses unskilled labour and capital apart from the non-traded input to produce a final manufacturing commodity. The per-unit requirement of the intermediate input, a_{23}, is assumed to be technologically fixed.[9] Sector 3 is the import-competing sector of the economy. Finally, sector 4, another export sector, produces a high-skill product using skilled labour and capital. So land-capital and skilled labour are specific factors in sectors 1 and 4, respectively. Capital is perfectly mobile between the non-traded, low-skill and high-skill sectors. Unskilled workers employed in the low-skill sector (sector 3) earn a unionized wage, W^*, while their counterparts in the other two sectors earn a competitive wage, W with $W^* > W$. Production functions exhibit constant returns to scale with diminishing marginal productivity to each factor. Perfect competition prevails in all markets, except the unskilled labour market in sector 3. The prices of the traded commodities are given by the small open economy assumption. But, the price of the non-traded input is determined

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[8] See footnote 6 in this context.

[9] It rules out the possibility of substitution between the non-traded input and other factors of production in sector 3. Although this is a simplifying assumption, it is not totally unrealistic. In industries like shoe making and garments, large formal sector firms farm out their production to small informal sector firms under the system of subcontracting. So the production is done in the informal sector while labeling, packaging and marketing are done by the formal sector firms. One pair of shoes produced in the informal sector does not change in quantity when it is marketed by the formal sector as a final commodity. It is also observed that that one car uses four tyres and one TV set requires one picture tube. Thus, there remains a fixed proportion between the use of the intermediate good and the quantity of the final commodity produced and marketed by the formal sector. On the other hand, if sector 2 produces an agricultural product like sugarcane or cotton, there might exist a fixed-proportion between the quantity of input used and the quantity of output produced in the sugar mills/textile firms. It may be noted that papers like Chaudhuri (2003), Marjit (2003) and Chaudhuri, Yabuuchi and Mukhopadhyay (2006) have also made this assumption for different reasons.

domestically. The diverse trade pattern of the economy is reflected in the fact that it exports both the primary agricultural and the high-skill commodities while it is a net importer of the low-skill manufacturing commodity. A developing country which fits this type of comparative advantage is India.[10] Commodity 1 is chosen as the numeraire.

The following symbols will be used in the equations.

a_{Ki} = capital-output ratio in the ith sector, $i = 2,3,4$;

a_{N1} = land capital-output ratio in sector 1;

a_{Li} = unskilled labour-output ratio in the ith sector, $i = 1,2,3$;

a_{S4} = skilled labour-output ratio in sector 4;

P_i = internationally given price[11] of the i th commodity, $i = 1,3,4$;

P_2 = domestically determined price of commodity 2;

X_i = level of output of the i th sector, $i = 1,2,3,4$;

W_S = wage rate of skilled labour;

W^* = institutionally determined (or unionized) unskilled wage rate in sector 3;

W = competitive wage rate of unskilled labour;

R = return to land-capital;

r = return to capital;

U, α = parameters denoting the extent of bargaining power of the trade unions;

L = endowment of unskilled labour;

S = endowment of skilled labour;

N = endowment of land-capital;

K = endowment of capital of the economy (domestic plus foreign);

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[10] It may be mentioned that besides primary agricultural commodities, India is also a large exporter of high-skill products like computer software. However, one may also consider alternative trade patterns as results of this paper do not depend on the pattern of trade of the economy.

[11] Commodity 1 is chosen as the numeraire here. So, these are relative prices as well.

θ_{ji} = distributive share of the jth input in the ith sector for $j = L, S, N, K$ and $i =$ 1, 2, 3,4;

λ_{ji} = proportion of the jth input employed in the ith sector for $j = L, K$ and $i = 1,2,3,4$;

$W_A = (\lambda_{L1}W + \lambda_{L3}W^*) =$ average unskilled wage;

S_{ji}^k = the degree of substitution between factors j and i in the k th sector, $j,i = L,N,S,K$; and, k = 1,2,3. For example, $S_{LN}^1 \equiv (R/a_{L1})(\partial a_{L1}/\partial R)$, $S_{LL}^1 \equiv (W/a_{L1})(\partial a_{L1}/\partial W)$ etc. $S_{ji}^k > 0$ for $j \neq i$; and, $S_{jj}^k < 0$;

'$\wedge$'= proportional change.

Given the assumption of perfectly competitive markets the usual price-unit cost equality conditions relating to the four sectors of the economy are given by the following four equations, respectively.

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

$$Wa_{L2} + ra_{N2} = P_2 \tag{2}$$

$$W^*(W,U)a_{L3} + ra_{K3} + P_2a_{23} = P_3 \tag{3}$$

$$W_S a_{S4} + ra_{K4} = P_4 \tag{4}$$

The formal sector faces a unionized labour market. The relationship for the unionized wage rate is specified as:[12]

$W^* = W^*(W,U)$ with $W^* = W$ for $U = 0, W^* > W$ for $U > 0$.

where U denotes the bargaining strength of the trade unions. This relationship states that in the absence of any bargaining power[13] of the trade unions i.e. when $U = 0$, the wage

[12] Assuming that each formal sector firm has a separate trade union, the unionized wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative union in the formal sector. For detailed derivation see Chaudhuri (2003).

rates are equal in different sectors. However, the unionized wage rate in sector 3, W^*, exceeds the competitive wage rate, W, when there is at least some power to the trade unions. The unionized wage is scaled upward as the competitive wage rate rises. Also with an increase in the bargaining power, the unions bargain for a higher wage.

For the sake of analytical simplicity we consider the following specific algebraic form of the unionized wage function.

$$W^* = \alpha W \text{ with } \alpha > 1. \tag{5}$$

Here α denotes the degree of imperfection in the market for unskilled labour. Higher the bargaining strength of the trade unions the higher would be the value of α.

Using (3), equation (5) can be rewritten as follows.

$$\alpha W a_{L3} + r a_{K3} = P_3 \tag{3.1}$$

Full-employment conditions for unskilled labour, capital, land-capital and skilled labour are as follows, respectively.

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{6}$$

$$a_{K2}X_2 + a_{K3}X_3 + a_{K4}X_4 = K \tag{7}$$

$$a_{N1}X_1 = N \tag{8}$$

$$a_{S4}X_4 = S \tag{9}$$

The output of sector 2, X_2, is used entirely for producing X_3, so that the supply of X_2 is circumscribed by its total demand by sector 3. The demand – supply equality condition is given by

$$X_2^D = a_{23}X_3 = X_2 \tag{10}$$

[13] The union power, denoted by U, is amenable to policy measures. If the government undertakes labour market reform measures e.g. partial or complete ban on resorting to strikes by the trade unions, reformation of employment security laws to curb union power, U takes a lower value.

There are nine endogenous variables in the system: $W, W_S, R, r, P_2, X_1, X_2, X_3$ and X_4; and, nine independent equations, namely, equations (1), (2), (3.1), (4) and (6) – (10). This is an indecomposable production system. Hence factor prices depend on both commodity prices and factor endowments. Using (8) and (9), equations (6) and (7) can be rewritten as follows, respectively.

$$(a_{L1}N / a_{N1}) + \tilde{a}_{L3}X_3 = L$$

$$(a_{K4}S / a_{S4}) + \tilde{a}_{K3}X_3 = K \qquad (9.1)$$

where $\tilde{a}_{L3} = a_{L2}a_{23} + a_{L3}$ and $\tilde{a}_{K3} = a_{K2}a_{23} + a_{K3}$. Note that $\tilde{a}_{L3}$ and $\tilde{a}_{K3}$ are the both direct and indirect uses of unskilled labour and capital in sector 3, respectively. The indirect uses take place through the application of the non-traded input.

The working of the general equilibrium model is as follows. The five input prices, W, W_S, r, R and P_2 and X_3 are determined by solving equations (1), (2), (3.1), (4), (8.1) and (9.1) simultaneously. Once the factor prices are known the factor coefficients, a_{ji} s, are also known. X_1, X_4 and X_2 are obtained from equations (8), (9) and (10), respectively.

Unskilled workers in this economy earn two different wages – either the unionized wage, W^*, in sector 3 or the competitive wage, W, in sectors 1 and 2. The average wage for unskilled labour must be a weighted average of the two wage rates and is given by

$$W_A \equiv (W(\lambda_{L1} + \lambda_{L2}) + W^* \lambda_{L3})$$

and using (5) which can be rewritten as follows.

$$W_A = W[1 + (\alpha - 1)\lambda_{L3}] \qquad (11)$$

where λ_{Li} denotes the proportion of unskilled labour employed in sector i, $i = 1,2,3$. In this case, the skilled–unskilled wage gap improves (worsens) in absolute terms if the gap between W_S and W_A falls (rises). On the other hand, the wage inequality improves (deteriorates) both in absolute and relative terms if $(\hat{W}_S - \hat{W}_A) < (>) 0$.

Differentiating equations (1), (2), (3.1), (4), (8.1) and (9.1) the following expression can be derived.[14]

$$(\hat{W}_S - \hat{W}_A) = (\frac{\hat{K}}{\Delta})[(\theta_{N1}\lambda_L)(\theta_{K4}\tilde{\theta}_{L3} - \theta_{S4}\tilde{\theta}_{K3})$$

$$-\{\frac{W\lambda_{L3}\theta_{S4}}{W_A}(\alpha - 1)\}\lambda_{L1}\tilde{\theta}_{K3}(S^1_{LN} + S^1_{NL}) + \theta_{N1}(S^2_{LK} - S^3_{LK})\lambda_{L2}\}], \qquad (12)$$

where $\tilde{\theta}_{L3} = \theta_{L2}\theta_{23} + \theta_{L3}$ and $\tilde{\theta}_{K3} = \theta_{K2}\theta_{23} + \theta_{K3}$. The expression for Δ has been presented in Appendix I and it can be checked that

$$\Delta > 0 \qquad (13)$$

From (12) it is evident that $(\hat{W}_S - \hat{W}_A) < 0$ when $\hat{K} > 0$ if (i) $S^2_{LK} \geq S^3_{LK}$; and, (ii) $(\theta_{K4}/\theta_{S4}) < (\tilde{\theta}_{K3}/\tilde{\theta}_{L3})$. On the contrary, $(\hat{W}_S - \hat{W}_A) > 0$ when $\hat{K} > 0$ if (i) $\lambda_{L3} \cong 0$; and, (ii) $(\theta_{K4}/\theta_{S4}) > (\tilde{\theta}_{K3}/\tilde{\theta}_{L3})$ This establishes the following proposition.

PROPOSITION 1: When the non-traded informal sector produces an input for the low-skill manufacturing sector an inflow of foreign capital improves the skilled-unskilled wage inequality if (i) the vertically integrated low-skill formal sector is capital-intensive (in a special sense) [15]; and, (ii) $S^2_{LK} \geq S^3_{LK}$. The relative wage inequality, however, deteriorates if the proportion of unskilled labour employed in the low-skill formal sector is significantly low and the high-skill sector is capital-intensive.

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[14] See Appendix I for detailed derivation of this expression.

[15] Here sectors 3 and 4 use two different types of labour. However, there is one intersectorally mobile input which is capital. So, these two industries cannot be classified in terms of factor intensities which is usually done in the Hechscher-Ohlin-Samuelson model. Despite this, a special type of factor intensity classification in terms of the relative distributive shares of the mobile factor i.e. capital may be used for analytical purposes. The industry in which this share is higher relative to the other may be considered as capital-intensive in a special sense. See Jones and Neary (1984) for details.

Proposition 1 can be intuitively explained as follows. As the system does not satisfy the decomposition property factor prices depend on both final commodity prices and factor endowments. An inflow of foreign capital lowers the return to capital, r, as the supply rises given the demand. All the three capital-using sectors expand. Sector 2 expands because sector 3 uses the output of the former as input in fixed proportion. The demand for skilled labour rises in sector 4 and that of unskilled labour increases in both sectors 2 and 3. Consequently, W_S and W increase. An increase in W implies an increase in the unionized unskilled wage, W^*. What happens to the average unskilled wage, W_A, depends crucially on the change in the proportion of unskilled labour employed in the high wage-paying sector (sector 3) i.e. λ_{L3}. As the (W^*/r) has increased producers in sector 3 would substitute unskilled-labour by capital. This lowers the labour-output ratio in sector 3, a_{L3}. But, as sector 3 has expanded the aggregate employment of unskilled labour (and hence λ_{L3}) increases if $S_{LK}^2 \geq S_{LK}^3$.[16] Under this sufficient condition W_A also rises. The outcome of foreign capital inflows on the skilled-unskilled wage inequality crucially depends on the rates of increase in W_S and W_A. Our analysis shows that if the vertically integrated low-skill manufacturing sector is capital-intensive relative to the high-skill sector relative wages move in favour of unskilled labour On the other hand, when the low-skill formal sector employs a very small proportion of the unskilled workforce[17], an expansion of sector 3 cannot produce any significant positive effect on λ_{L3} and W_A. The direction of relative wage movements now entirely depends on the rates of increases in the competitive unskilled wage and the skilled wage. Relative wages move against unskilled labour if the vertically integrated low-skill sector is less capital-intensive vis-à-vis the high-skill sector.

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[16] See Appendix I.

[17] As per NSS estimates the proportion of workforce engaged in unorganized sector in 1999-2000 in India was as high as 93 %. The unorganized sector, commonly known as the informal sector, comprises mainly of unskilled workers. Hence, the percentage of workforce engaged in the formal sector in 1999-2000 was quite low and this share is continuously declining over time with economic reforms. See Bhalotra (2002) in this context.

3. The modified system with non-traded final commodity

In this section we propose to modify the model of section 2 in two directions. First, sector 2 now produces a non-traded final commodity using unskilled labour and land-capital as two inputs. Thus, sectors 1 and 2 constitute a miniature HOS subsystem. Secondly, we introduce land-capital in the non-traded sector as well as in the primary export sector. Capital is perfectly flows freely between the low-skill manufacturing sector (sector 3) and the high-skill sector (sector 4). But, there is no capital mobility between the high-skill (or low-skill) sector and the non-traded sector. This setup fits well to developing countries that still have a dual structure with rural and urban areas.

In addition to the symbols that we have used in section 2 we shall here use the following symbols as well.

$a_{N2} =$ land-capital-output ratio in sector 2;

$Y =$ national income at domestic prices[18];

$K_D =$ domestic capital stock;

$D_2 =$ demand for the non-traded final commodity;

$E_P =$ own price elasticity of demand good 2;

$E_Y =$ income elasticity of demand for good 2.

The usual zero-profit conditions for the four sectors are as follows.

$$Wa_{L1} + Ra_{N1} = 1 \tag{14}$$

$$Wa_{L2} + Ra_{N2} = P_2 \tag{15}$$

$$\alpha Wa_{L3} + ra_{K3} = P_3 \tag{16}$$

$$W_S a_{S4} + ra_{K4} = P_4 \tag{17}$$

The demand for the non-traded final commodity is given by the following.

$$D_2 = D_2(P_2, Y) \tag{18}$$

[18] As there are no tariffs or subsidies national income at domestic prices and national income at world prices are the same in this model.

where, Y , is national income at domestic prices and is given by

$$Y = WL + (W^* - W)a_{L3}X_3 + RN + rK_D + W_S S \tag{19}$$

In equation (19), $(WL + (W^* - W)a_{L3}X_3)$ gives the aggregate wage income of the unskilled workers employed in the three sectors of the economy. RN is the rental income from land-capital while $W_S S$ is the wage income of skilled labour. Finally, rK_D is the domestic capital income. Income from foreign capital is fully repatriated.[19] Hence, it is not included in equation (19).

The demand for commodity 2 is a positive function of Y and a decreasing function of P_2. So we have: $(\partial D_2 / \partial Y) > 0; (\partial D_2 / \partial P_2) < 0$.

The market for commodity 2 must clear domestically. So in equilibrium we have

$$D_2(P_2, Y) = X_2 \tag{20}$$

Full-employment conditions for resources are as follows.

$$a_{N1}X_1 + a_{N2}X_2 = N \tag{21}$$

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{22}$$

$$a_{K3}X_3 + a_{K4}X_4 = K_D + K_F = K \tag{23}$$

$$a_{S4}X_4 = S \tag{24}$$

The modified model comprises of (11) equations (namely, equations (14) – (24)) and exactly the same number of endogenous variables; namely, $W, W_S, R, r, P_2, X_1, X_2, X_3, X_4, D_2$ and Y. The four unknown factor prices are solved from equations (14) – (17) as functions of P_2. As a_{ji} are functions of factor prices these are automatically obtained. Then from (21) – (24) X_i s are found as functions of P_2. Finally,

[19] This is the standard assumption made in the literature on foreign capital and welfare. See for example, Brecher and Alejandro (1977), Khan (1982) and Chau and Yu (1994).

using (19) P_2 is solved from (20). Once P_2 is obtained the values of all endogenous variables are obtained.

The average unskilled wage is again given by

$$W_A = W[1+(\alpha-1)\lambda_{L3}] \tag{25}$$

Differentiating (14) – (17), (19) – (24) and (25) the following expression can be obtained[20].

$$(\hat{W}_S - \hat{W}_A) = -(\frac{\theta_{N1}\hat{K}}{\Omega})|\lambda^*|[(\theta_{K4}-\theta_{K3}) - (\alpha-1)\lambda_{L3}(\theta_{S4}\theta_{K3} - S^3_{LK})]$$
$$-[W(\alpha-1)(\frac{\lambda_{L3}}{W_A})\hat{X}_3] \tag{26}$$

$$\left.\begin{array}{l} \text{where: } |\lambda^*| = [(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})B_{13} + \lambda_{N1}\lambda_{L3}]; \text{ and,} \\ B_{13} = [(E_Y/Y)(\alpha-1)Wa_{L3}X_3] > 0. \end{array}\right\} \tag{27}$$

The expression for Ω has been presented in Appendix II and using the static stability condition in the market for the non-traded commodity[21] it can be shown that in the stable equilibrium we must have:[22]

$$\Omega < 0; \quad \text{and,} \quad \hat{X}_3 > 0 \quad \text{when} \quad \hat{K} > 0 \tag{28}$$

Note that relative factor intensity between sectors 1 and 2 ,$|\lambda| = \lambda_{K3}(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})$, plays an extremely crucial role in determining the

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[20] See Appendices II, III and IV for mathematical derivation of this expression.

[21] The stability condition has been derived in Appendix V.

[22] Mathematical proofs of the two results have been provided in Appendices V and VI, respectively.

consequence of foreign capital inflows ($\hat{K} > 0$) on the relative wage inequality, $(\hat{W}_S - \hat{W}_A)$. Out results are summarized in the following table.

Table 1. The effects on wage inequality

$\lambda_{L3} > 0$	$\lvert\lambda\rvert > 0$ (or $\lvert\lambda\rvert < 0$ but $\lvert\lambda^*\rvert > 0$)	$\theta_{K3} \geq \theta_{K4}$	$\theta_{S4}\theta_{K3} \geq S_{LK}^3$	(Inequality) Improves
$\lambda_{L3} \cong 0$	$\lvert\lambda\rvert > 0$	$\theta_{K3} > \theta_{K4}$.		Improves
		$\theta_{K3} < \theta_{K4}$.		Deteriorates
	$\lvert\lambda\rvert < 0$	$\theta_{K3} < \theta_{K4}$.		Improves
		$\theta_{K3} > \theta_{K4}$.		Deteriorates

From the results one now establish the following proposition.

PROPOSITION 2: When the non-traded sector produces an agricultural commodity and there is another common factor, land-capital, in the non-traded sector and the primary export sector, inflows of foreign capital are likely to improve the skilled-unskilled wage inequality if the low-skill manufacturing sector is capital-intensive and employs a significant proportion of the unskilled labour force. On the contrary, when the low-skill sector employs only a very small proportion of unskilled labour the wage inequality improves if the primary export sector is land-capital-intensive (or unskilled labour-intensive) and the low-skill manufacturing sector (or high-skill sector) is capital-intensive. The relative wage inequality, however, deteriorates provided the primary export sector is land-capital-intensive (or labour-intensive) and the high-skill sector (low-skill sector) is capital-intensive.

We explain proposition 2 in the following fashion. Here the non-traded sector and the primary export sector use the same two inputs– unskilled labour and land-capital, and together form a Hechscher-Ohlin Subsystem (HOSS). We have already stated that the factor prices come out from the price system as functions of the price of the non-traded good, P_2, and that P_2 is determined by its demand and supply forces. Besides, an inflow of foreign capital leads to expansion of both sector 3 and sector 4. As sector 3 expands more (less) unskilled workers are now employed in the higher (lower) wage-paying sector (sectors). This raises the aggregate unskilled wage income. This we call the unskilled labour reallocation effect, which produces a positive effect on the aggregate factor income, Y and raises the demand for the non-traded good (good 2). As sector 3 draws unskilled labour from the HOSS a Rybczynski type effect takes places that results in a contraction of the unskilled labour-intensive sector and an expansion of the other.

If sector 1 is land-capital-intensive, it expands while sector 2 contracts. P_2 rises[23] as its supply has fallen while the demand has increased. This in turn produces a Stolper-Samuelson effect in the HOSS and raises the competitive unskilled wage, W, as sector 2 is labour-intensive. The unionized unskilled wage, W^*, also rises. To satisfy the zero-profit condition for sector 3 the return to capital, r, falls. Saving on capital input raises the skilled wage, W_S, in sector 4. As producers in sector 3 substitute unskilled labour by capital, a_{L3} falls. Despite this, the proportion of unskilled labour employed in the higher wage-paying sector 3 (i.e. λ_{L3}) rises if $\theta_{K3} \geq S_{LK}^3$.[24] We, therefore, find that the average unskilled wage increases due to (i) an increase in W; (ii) an increase in W^*; and, due to (iii) an increase in the proportion of unskilled labour employed in the higher wage-paying sector if $\theta_{K3} \geq S_{LK}^3$. Consequently, the average unskilled wage, W_A, rises in this case under the sufficient condition as stated above. What happens to the skilled-unskilled wage inequality depends on the rates of increase in W_S and W_A. If $(\theta_{K3} / \theta_{L3}) > (=)(\theta_{K2} / \theta_{S2})$ the saving on capital input in sector 3 is more than (equal to) that in sector 4, which in turn, implies that the rate of increase of the unionized unskilled wage, W^*, is greater than (equal to) that of the skilled wage, W_S. But, there are two other factors working

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[23] See Appendix III.

[24] This has been shown in Appendix IV.

positively on the average unskilled wage.[25] Thus, the wage inequality gets better following inflows of foreign capital under the two sufficient conditions as mentioned above. On the other hand, if the proportion of unskilled labour employed in the high wage-paying sector is considerably small (i.e. $\lambda_{L3} \cong 0$), W_A increases following an inflow of foreign capital as the competitive unskilled wage, W, rises. If $\theta_{K3} > (<) \theta_{K4}$ saving on capital cost will be higher (lower) in the low-skill sector than that in the high-skill sector. Consequently, the wage inequality improves (worsens).

If sector 1 (sector2) is unskilled labour-intensive (land-capital-intensive) the supply of the non-traded good rises following a Rybczynski type effect. The larger is the proportion of unskilled labour employed in the low-skill sector, the higher would be the magnitude of the Rybczynski type effect in the HOSS. Although both the demand and the supply of the non-traded good increase, the Rybczynski type effect of a sufficiently high magnitude (consequence of a high λ_{L3}) will make the expansionary supply side effect of the non-traded good stronger than the demand side effect. The price of the non-traded good, P_2, falls which in turn raises W following the Stolper-Samuelson effect as sector 1 is now unskilled labour-intensive. The qualitative effects on $W^*, r, W_S, \lambda_{L3}$ and W_A would exactly be the same as in the earlier case. Consequently, the skilled-unskilled wage inequality improves under the same set of sufficient conditions.

Finally, if sector 1 (sector 2) is unskilled labour-intensive (land capital-intensive) but the proportion of the unskilled workforce employed in the low-skill sector is significantly low (i.e. $\lambda_{L3} \cong 0$), the magnitude of the Rybczynski type effect in the HOSS would be very small and consequently the supply of good 2 rises only by a small magnitude. P_2 increases in this case as the demand side effect dominates over the supply side effect. The competitive unskilled wage, W, decreases following the Stolper-Samuelson effect as sector 2 is land-capital-intensive[26]. The return to capital rises despite an increase in the

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[25] These have already been discussed under (i) and (iii).

[26] The return to land-capital rises.

endowment of capital as sector 3 expands and the allocative share of capital in this sector is sufficiently high. Sector 4 contracts for want of capital[27] and the skilled wage, W_S, falls as its demand falls. As $\lambda_{L3} \cong 0$, the average unskilled wage, W_A, decreases as W falls. If $\theta_{K4} > (<) \theta_{K3}$ increase on capital cost will be higher (lower) in the high-skill sector vis-à-vis the low-skill sector. Consequently, the wage inequality improves (worsens).

4. Policy implications and concluding remarks

Growth in foreign direct investment, positively correlated with the relative demand for skilled labour, has been one of the prime factors responsible for widening of wage inequality in the Latin American countries like Mexico. But, foreign capital cannot be held accountable for the growing incidence of wage inequality in the developing economies in general. It is extremely important to judge the consequences of foreign capital in the light of the typical structural characteristics of these countries e.g. presence of non-traded goods, imperfections in the market for unskilled labour and type of intersectoral capital mobility. This has been done in this paper using two four-sector specific factors general equilibrium models.

We have found that barring a few special cases inflows of foreign capital in general improve the wage inequality when the low-skill sector is capital-intensive. But, the relative wage gap may widen if the high-skill sector is capital-intensive. A capital subsidy policy to the low-skill manufacturing sector should be undertaken so as to increase the capital-intensity of production in this sector. On the other hand, when the non-traded sector produces a non-traded final commodity wage inequality worsens if the low-skill sector is capital-intensive and employs only a very small proportion of the unskilled workforce and if the primary export sector is unskilled labour-intensive. In such a case, the policy prescription should be to provide a wage subsidy to the low-skill sector. A wage subsidy would help in increasing the proportion of employment of unskilled labour

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[27] This has been shown in Appendix VII.

in the low-skill sector. This would also lend a hand in raising the competitive unskilled wage. If these policies are followed whenever necessary abundant inflows of foreign capital might be a solution to deteriorating skilled-unskilled wage in the liberalized regime.

Appendix I:

Differentiating totally equations (1), (2), (3.1), (4) and (6) – (10) and arranging in a matrix notation one gets:

$$\begin{pmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 & 0 \\ \theta_{L2} & 0 & \theta_{K2} & 0 & -1 & 0 \\ \theta_{L3} & 0 & \theta_{K3} & 0 & \theta_{23} & 0 \\ 0 & 0 & \theta_{K4} & \theta_{S4} & 0 & 0 \\ -A_1 & A_2 & A_3 & 0 & 0 & \lambda_L \\ A_4 & 0 & -A_5 & A_6 & 0 & \lambda_K \end{pmatrix} \begin{pmatrix} \hat{W} \\ \hat{R} \\ \hat{r} \\ \hat{W}_S \\ \hat{P}_2 \\ \hat{X}_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \hat{K} \end{pmatrix} \tag{A.1}$$

where:

$$\left.\begin{array}{l} A_1 = (\lambda_{L1}S_{LN}^1 + \lambda_{L2}S_{LK}^2 + \lambda_{L3}S_{LK}^3 + \lambda_{L1}S_{NL}^1) > 0\,; \\ A_2 = \lambda_{L1}(S_{LN}^1 + S_{NL}^1) > 0\,;\ A_3 = (\lambda_{L2}S_{LK}^2 + \lambda_{L3}S_{LK}^3) > 0\,; \\ A_4 = (\lambda_{K2}S_{KL}^2 + \lambda_{K3}S_{KL}^3) > 0\,; \\ A_5 = (\lambda_{K2}S_{KL}^2 + \lambda_{K3}S_{KL}^3 + \lambda_{K4}S_{KS}^4 + \lambda_{K4}S_{SK}^4) > 0\,; \\ A_6 = \lambda_{K4}(S_{KS}^4 + S_{SK}^4) > 0\,; \\ \lambda_L = (\lambda_{L2} + \lambda_{L3}) > 0\,;\ \lambda_K = (\lambda_{K2} + \lambda_{K3}) > 0\,. \end{array}\right\} \tag{A.2}$$

and,

$$\Delta = \theta_{L1}\theta_{S4}A_2\lambda_K(\theta_{23}\theta_{K2} + \theta_{K3}) + \theta_{N1}[\theta_{S4}(\theta_{23}\theta_{K2} + \theta_{K3})(A_1\lambda_K + A_4\lambda_L)$$
$$+(\theta_{23}\theta_{L2} + \theta_{L3})\{\theta_{K4}A_6\lambda_L + \theta_{S4}(A_3\lambda_K + A_5\lambda_L)\}] > 0. \tag{A.3}$$

As commodity 2 is internationally non-traded its market must clear domestically through adjustments in its price, P_2. The stability condition in the market for commodity 2 requires that

$(d(X_2^D - X_2)/dP_2) < 0$. This implies around equilibrium, initially, $X_2^D = X_2$. Thus, $((\hat{X}_2^D/\hat{P}_2) - (\hat{X}_2/\hat{P}_2)) < 0$. This requires that $\Delta > 0$. In this case, of course, the stability condition is automatically satisfied. This is because from (A.2) and (A.3) it follows that Δ is unconditionally positive.

Solving (A.1) by Cramer's rule the following expressions are obtained.

$$\hat{W} = (\theta_{N1}\theta_{S4}\lambda_L\tilde{\theta}_{K3})\hat{K}/\Delta \qquad (A.4)$$

$$\hat{W}_S = (\theta_{N1}\theta_{K4}\lambda_L\theta_{L3})\hat{K}/\Delta \qquad (A.5)$$

$$\hat{r} = -(\theta_{N1}\theta_{S4}\lambda_L\theta_{L3})\hat{K}/\Delta \qquad (A.6)$$

$$\hat{X}_3 = \theta_{S4}[\tilde{\theta}_{K3}(\theta_{L1}A_2 + \theta_{N1}A_1) + \theta_{N1}\tilde{\theta}_{L3})A_3]\hat{K}/\Delta \qquad (A.7)$$

$$\hat{P}_2 = (\theta_{N1}\theta_{S4}\lambda_L)(\theta_{L2}\theta_{K3} - \theta_{L3}\theta_{K2})\hat{K}/\Delta \qquad (A.8)$$

where $\tilde{\theta}_{L3} = \theta_{L2}\theta_{23} + \theta_{L3}$ and $\tilde{\theta}_{K3} = \theta_{K2}\theta_{23} + \theta_{K3}$. Differentiating (11), using (A.4), (A.6) and (A.7) and simplifying one can derive the following expression.

$$\hat{W}_A = (\frac{W\hat{W}}{W_A})[1 + (\alpha - 1)\lambda_{L3}] + \frac{W}{W_A}(\alpha - 1)\lambda_{L3}\theta_{S4}\frac{\hat{K}}{\Delta}[\lambda_{L1}\tilde{\theta}_{K3}(S_{LN}^1 + S_{NL}^1) + \theta_{N1}(S_{LK}^2 - S_{LK}^3)\lambda_{L2}] \qquad (A.9)$$

Using (A.2) and (A.3) from (A.4) – (A.9) the following results are obtained.

When $\hat{K} > 0$, (i) $\hat{W} > 0$; (ii) $\hat{W}_S > 0$; (iii) $\hat{r} < 0$; (iv) $\hat{X}_3 > 0$; (v) $\hat{W}_A > 0$ if $S_{LK}^2 \geq S_{LK}^3$; and, (vi) $\hat{P}_2 > 0$ (as $\theta_{L2}\theta_{K3} > \theta_{L3}\theta_{K2}$ i.e. sector 3 is more capital-intensive vis-à-vis sector 2 with respect to unskilled labour).

Appendix II:

Total differentials of (14) – (17) yield the following expressions, respectively.

$$\theta_{L1}\hat{W} + \theta_{N1}\hat{R} = 0 \tag{A.10}$$

$$\theta_{L2}\hat{W} + \theta_{N2}\hat{R} - \hat{P}_2 = 0 \tag{A.11}$$

$$\theta_{L3}\hat{W} + \theta_{K3}\hat{r} = 0 \tag{A.12}$$

$$\theta_{S4}\hat{W}_S + \theta_{K4}\hat{r} = 0 \tag{A.13}$$

Using (24), equation (23) may be rewritten as follows.

$$a_{K3}X_3 + (a_{K4}S / a_{S4}) = K \tag{A.14}$$

Differentiating totally equations (21), (22) and (23.1) one gets, respectively.

$$B_1\hat{W} - B_2\hat{R} + \lambda_{N1}\hat{X}_1 + \lambda_{N2}\hat{X}_2 = 0 \tag{A.15}$$

$$-B_3\hat{W} + B_4\hat{R} + B_5\hat{r} + \lambda_{L1}\hat{X}_1 + \lambda_{L2}\hat{X}_2 + \lambda_{L3}\hat{X}_3 = 0 \tag{A.16}$$

$$B_6\hat{W} - B_7\hat{r} + B_8\hat{W}_S + \lambda_{K3}\hat{X}_3 = \hat{K} \tag{A.17}$$

Also differentiating (19) and (20) one gets:

$$B_9\hat{W} + B_{10}\hat{R} + B_{11}\hat{r} + B_{12}\hat{r} + B_{13}\hat{X}_3 + E_P\hat{P}_2 - \hat{X}_2 + B_{13}\hat{X}_3 = 0 \tag{A.18}$$

where:

$$\left.\begin{array}{l}
B_1 = B_2 = (\lambda_{N1}S^1_{NL} + \lambda_{N2}S^2_{NL}) > 0; \\
B_3 = (\lambda_{L1}S^1_{LN} + \lambda_{L2}S^2_{LN} + \lambda_{L3}S^3_{LK}) > 0; \\
B_4 = (\lambda_{L1}S^1_{LN} + \lambda_{L2}S^2_{LN}) > 0; B_5 = (\lambda_{L3}S^3_{LK}) > 0;\ B_6 = (\lambda_{K3}S^3_{KL}) > 0; \\
B_7 = (\lambda_{K3}S^3_{KL} + \lambda_{K4}(S^4_{KS} + S^4_{SK})) > 0; B_8 = \lambda_{K4}(S^4_{KS} + S^4_{SK})) > 0; \\
B_9 = (E_Y W / Y)[L + (\alpha - 1)a_{L3}X_3(1 - S^3_{LK})];\ B_{10} = (E_Y RN / Y) > 0; \\
B_{11} = (E_Y / Y)[rK_D + (\alpha - 1)Wa_{L3}X_3S^3_{LK}] > 0;\ B_{12} = (E_Y W_S S / Y) > 0; \text{and,} \\
B_{13} = [(E_Y / Y)(\alpha - 1)Wa_{L3}X_3] > 0.
\end{array}\right\} \tag{A.19}$$

Arranging (A.10) – (A.13), (A.15) – (A.17) and (A.18) in a matrix notation one gets the following.

$$\begin{pmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 & 0 & 0 & 0 \\ \theta_{L2} & \theta_{N2} & 0 & 0 & -1 & 0 & 0 & 0 \\ \theta_{L3} & 0 & \theta_{K3} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \theta_{K4} & \theta_{S4} & 0 & 0 & 0 & 0 \\ B_1 & -B_2 & 0 & 0 & 0 & \lambda_{N1} & \lambda_{N2} & 0 \\ -B_3 & B_4 & B_5 & 0 & 0 & \lambda_{L1} & \lambda_{L2} & \lambda_{L3} \\ B_6 & 0 & -B_7 & B_8 & 0 & 0 & 0 & \lambda_{K3} \\ B_9 & B_{10} & B_{11} & B_{12} & E_P & 0 & -1 & B_{13} \end{pmatrix} \begin{pmatrix} \hat{W} \\ \hat{R} \\ \hat{r} \\ \hat{W}_S \\ \hat{P}_2 \\ \hat{X}_1 \\ \hat{X}_2 \\ \hat{X}_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \hat{K} \\ 0 \end{pmatrix} \quad \text{(A.20)}$$

where:

$$\begin{aligned} \Omega = -[(|\theta||\lambda|E_P) - \{ & (B_9\theta_{N1}\theta_{K3}\theta_{S4}|\lambda|) - (B_{10}\theta_{L1}\theta_{K3}\theta_{S4}|\lambda|) - (B_{11}\theta_{N1}\theta_{L3}\theta_{S4}|\lambda|) \\ & + (B_{12}\theta_{N1}\theta_{L3}\theta_{K4}|\lambda|) - B_{13}(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})\theta_{N1}(\theta_{K3}\theta_{S4}B_6 + \theta_{L3}\theta_{K4}B_8 + \theta_{L3}\theta_{S4}B_7) \\ & - (\theta_{N1}\theta_{K3}\theta_{S4})(\lambda_{N1}\lambda_{K3}B_3 + \lambda_{N1}\lambda_{L3}B_6 + \lambda_{L1}\lambda_{K3}B_1) \\ & - (\lambda_{K3}\theta_{K3}\theta_{S4}\theta_{L1})(B_2\lambda_{L1} + B_4\lambda_{N1}) - (\lambda_{N1}\theta_{N1}\theta_{L3}\theta_{S4})(B_5\lambda_{K3} + B_7\lambda_{L3}) \\ & - (\lambda_{N1}\lambda_{L3}\theta_{N1}\theta_{L3}\theta_{K4}B_8)\}] \end{aligned} \quad \text{(A.21)}$$

$|\theta| = \theta_{K3}\theta_{S4}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$; and, (A.22)

$|\lambda| = \lambda_{K3}(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})$ (A.23)

So, we always have: $|\theta||\lambda| < 0.$ (A.24)

Using the stability condition in the market for commodity 2 (see Appendix V) it can be shown that: $\Omega < 0.$

Appendix III:

Solving (A.20) by Cramer's rule the following expressions are obtained.

$$\hat{W} = -(\theta_{N1}\theta_{K3}\theta_{S4}|\lambda^*|\hat{K}/\Omega) \quad (A.25)$$

$$\hat{W}_S = -(\theta_{N1}\theta_{L3}\theta_{K4}|\lambda^*|\hat{K}/\Omega) \quad (A.26)$$

$$\hat{r} = (\theta_{N1}\theta_{L3}\theta_{S4}|\lambda^*|\hat{K}/\Omega) \quad (A.27)$$

$$\hat{P}_2 = (\theta_{K3}\theta_{S4}|\lambda^*|\hat{K}/\Omega)(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) \quad (A.28)$$

where: $|\lambda^*| = [(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})B_{13} + \lambda_{N1}\lambda_{L3}]$ (A.29)

$\hat{X}_3$ also can be solved in the same manner. The final expression for $\hat{X}_3$ has been derived in Appendix VI. Using the stability condition in the market for commodity 2 it can be shown that: $\hat{X}_3 > 0$ when $\hat{K} > 0$

From (A.25) – (A.28) the following results can be obtained.

1. If sector 1 is more land-capital-intensive vis-à-vis sector 2 with respect to unskilled labour (i.e. $|\lambda|, |\lambda^*| > 0; |\theta| < 0$) when $\hat{K} > 0$ (i) $\hat{W} > 0;$ (ii) $\hat{W}_S > 0;$ (iii) $\hat{r} < 0;$ (iv) $\hat{P}_2 > 0.$

2. If sector 1 is more labour-intensive (but not sufficiently labour-intensive) than sector 2 (i.e. $|\lambda| < 0;$ $|\lambda^*|, |\theta| > 0$) when $\hat{K} > 0$ (i) $\hat{W} > 0;$ (ii) $\hat{W}_S > 0;$ (iii) $\hat{r} < 0;$ (iv) $\hat{P}_2 < 0.$

3. If sector 1 is sufficiently labour-intensive (i.e. $|\lambda|, |\lambda^*| < 0; |\theta| > 0$) when $\hat{K} > 0$ (i) $\hat{W} < 0$; (ii) $\hat{W}_S < 0$; (iii) $\hat{r} > 0$; (iv) $\hat{P}_2 > 0$.

Appendix IV:

Differentiating (25) one gets:

$$\hat{W}_A = (\frac{W\hat{W}}{W_A})[1 + (\alpha - 1)\lambda_{L3}(1 - S_{LK}^3)] + W(\alpha - 1)(\frac{\lambda_{L3}S_{LK}^3}{W_A})\hat{r} + W(\alpha - 1)(\frac{\lambda_{L3}}{W_A})\hat{X}_3$$

Using (A.25) and (A.27) the above expression may be simplified to

$$\hat{W}_A = (\frac{W\hat{K}}{\Omega W_A})[(\theta_{N1}\theta_{S4}|\lambda^*|)\{(\alpha - 1)\lambda_{L3}(S_{LK}^3 - \theta_{K3}) - \theta_{K3}\} + (\frac{W}{W_A}(\alpha - 1)\lambda_{L3})\hat{X}_3 \quad \text{(A.30)}$$

From (A.30) it is evident that

1. When $\hat{K} > 0, \hat{W}_A > 0$ if (i) ($|\lambda| > 0$ and $\lambda_{L3} > 0 \Rightarrow |\lambda^*| > 0$) / ($|\lambda| < 0$ and $\lambda_{L3} > 0$ such that $|\lambda^*| > 0$); and, (ii) $\theta_{K3} \geq S_{LK}^3$.
2. When $\hat{K} > 0$, $\hat{W}_A < 0$ if (i) $|\lambda| < 0$ and $\lambda_{L3} \cong 0$ so that $|\lambda^*| < 0$.

Subtracting (A.30) from (A.26), using (A.25) and (A.27) and simplifying we get:

$$(\hat{W}_S - \hat{W}_A) = -(\frac{\theta_{N1}\hat{K}}{\Omega})[(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})B_{13} + \lambda_{N1}\lambda_{L3}][(\theta_{K4} - \theta_{K3}) - (\alpha - 1)\lambda_{L3}(\theta_{S4}\theta_{K3} - S_{LK}^3)] - \frac{W(\alpha - 1)\lambda_{L3}\hat{X}_3}{W_A} \quad \text{(A.31)}$$

For the sake analytical convenience we rewrite (A.31) as follows.

$$(\hat{W}_S - \hat{W}_A) = -(\frac{\theta_{N1}\hat{K}}{\Omega})|\lambda^*|[(\theta_{K4} - \theta_{K3}) - (\alpha - 1)\lambda_{L3}(\theta_{S4}\theta_{K3} - S_{LK}^3)] - \frac{W(\alpha - 1)\lambda_{L3}\hat{X}_3}{W_A} \quad (26)$$

The notation, $|\lambda^*|$, has already been defined in (A.29).

Appendix V: ***Stability condition of the market for commodity 2***

As commodity 2 is internationally non-traded its market must clear domestically through adjustments in its price, P_2. The stability condition of the market for commodity 2 requires that

$(d(D_2 - X_2)/dP_2) < 0$. This implies around equilibrium, initially, $D_2 = X_2$. Thus,

$$((\hat{D}_2/\hat{P}_2) - (\hat{X}_2/\hat{P}_2)) < 0. \quad \text{(A.32)}$$

Totally differentiating equations (14) – (17) and solving one can find out the following expressions.

$$(\hat{W}/\hat{P}_2) = -(\theta_{N1}\theta_{K3}\theta_{S4}/|\theta|); \quad \text{(A.33)}$$

$$(\hat{R}/\hat{P}_2) = (\theta_{L1}\theta_{K3}\theta_{S4}/|\theta|); \quad \text{(A.34)}$$

$$(\hat{r}/\hat{P}_2) = (\theta_{N1}\theta_{L3}\theta_{S4}/|\theta|) \text{ ;and,} \quad \text{(A.35)}$$

$$(\hat{W}_S/\hat{P}_2) = -(\theta_{N1}\theta_{L3}\theta_{K4}/|\theta|). \quad \text{(A.36)}$$

Then differentiating equations (21) – (24), using (A.33) – (A.36), putting $\hat{K} = 0$ and solving by Cramer's rule the following expressions may be obtained.

$$\hat{X}_2 = (\frac{-\hat{P}_2}{|\theta||\lambda|})[(\lambda_{N1}\lambda_{K3}B_3 + \lambda_{N1}\lambda_{L3}B_6 + \lambda_{L1}\lambda_{K3}B_1)(\theta_{N1}\theta_{K3}\theta_{S4}) + (\lambda_{N1}B_4 + \lambda_{L1}B_2)\lambda_{K3}(\theta_{K3}\theta_{S4}\theta_{L1}) + \lambda_{N1}(\lambda_{K3}B_5 + \lambda_{L3}B_7)(\theta_{N1}\theta_{L3}\theta_{S4}) + \lambda_{N1}\lambda_{L3}B_8\theta_{N1}\theta_{L3}\theta_{K4}] \quad \text{(A.37)}$$

$$\hat{X}_3 = -(\frac{\hat{P}_2}{|\lambda||\theta|})[(\lambda_{N2}\lambda_{L1} - \lambda_{N1}\lambda_{L2})(\theta_{K3}B_6 + \theta_{L3}B_7 + \theta_{L3}B_8)\theta_{N1}\theta_{S4}] \quad \text{(A.38)}$$

Differentiating equations (18) and (19) and considering $\hat{K} = 0$ one can derive

$$\hat{D}_2 = E_P\hat{P}_2 + B_9\hat{W} + B_{10}\hat{R} + B_{11}\hat{r} + B_{12}\hat{W}_S + B_{13}\hat{X}_3 \tag{A.39}$$

Using (A.33) – (A.36) and (A.38), equation (A.39) may be rewritten as follows.

$$\hat{D}_2 = (\hat{P}_2)[E_P - (\frac{1}{|\theta|})\{B_9\theta_{N1}\theta_{K3}\theta_{S4} - B_{10}\theta_{K3}\theta_{S4}\theta_{L1} - B_{11}\theta_{N1}\theta_{L3}\theta_{S4} + B_{12}\theta_{N1}\theta_{L3}\theta_{K4}$$

$$-(B_{13}/|\lambda|)(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})\theta_{N1}(\theta_{K3}\theta_{S4}B_6 + \theta_{L3}\theta_{S4}B_7 + \theta_{L3}\theta_{S4}B_8)\}] \tag{A.40}$$

Substituting the expressions for $(\hat{D}_2/\hat{P}_2)$ and $(\hat{X}_2/\hat{P}_2)$ from (A.40) and (A.37) into (A.32) and simplifying one obtains

$$[E_P - (\frac{1}{|\lambda||\theta|})\{|\lambda|(B_9\theta_{N1}\theta_{K3}\theta_{S4} - B_{10}\theta_{K3}\theta_{S4}\theta_{L1} - B_{11}\theta_{N1}\theta_{L3}\theta_{S4} + B_{12}\theta_{N1}\theta_{L3}\theta_{K4})$$

$$-(B_{13}\theta_{N1})(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})(\theta_{K3}\theta_{S4}B_6 + \theta_{L3}\theta_{S4}B_7 + \theta_{L3}\theta_{S4}B_8)$$

$$-(\theta_{N1}\theta_{K3}\theta_{S4})(\lambda_{N1}\lambda_{K3}B_3 + \lambda_{N1}\lambda_{L3}B_6 + \lambda_{L1}\lambda_{K3}B_1) - (\lambda_{K3}\theta_{K3}\theta_{S4}\theta_{L1})(\lambda_{N1}B_4 + \lambda_{L1}B_2)$$

$$-(\lambda_{N1}\theta_{N1}\theta_{L3}\theta_{S4})(\lambda_{K3}B_5 + \lambda_{L3}B_7) - (\lambda_{N1}\lambda_{L3}B_8\theta_{N1}\theta_{L3}\theta_{K4})\}] < 0 \tag{A.41}$$

Thus, the stability condition in the market for commodity 2 is given by (A.41).

Using (A.24) and (A.41) from (A.21) it now trivially follows that

$$\Omega < 0. \tag{A.42}$$

Appendix VI: ***Derivation of expression for*** $\hat{X}_3$

Solving (A.20) we can find the following expression.

$$\hat{X}_3 = -(\frac{\hat{K}}{\Omega\lambda_{K3}})[|\theta||\lambda|E_P - \{\theta_{K3}\theta_{S4}(\theta_{N1}B_9 - \theta_{L1}B_{10}) + \theta_{N1}\theta_{L3}(\theta_{K4}B_{12} - \theta_{S4}B_{11})\}|\lambda|$$

$$+\theta_{S4}\lambda_{K3}\{\theta_{N1}\theta_{K3}(\lambda_{N1}B_3 + \lambda_{L1}B_1) + \theta_{K3}\theta_{L1}(B_2\lambda_{L1} + B_4\lambda_{N1}) + \lambda_{N1}\theta_{N1}\theta_{L3}B_5\}] \tag{A.43}$$

It may be noted that:

$$\left.\begin{aligned}
&W_S S = \theta_{P4} X_4 ; Wa_{L3} = (P_3 \theta_{L3} / \alpha); \\
&rK_D = (\theta_{K3} P_3 X_3 + \theta_{K4} P_4 X_4 - rK_F); \\
&(\theta_{N1} WL - \theta_{L1} RN) = [P_2 X_2 (\theta_{N1} \theta_{L2} - \theta_{L1} \theta_{N2}) + \theta_{N1} \theta_{L3} P_3 X_3]; \\
&(\theta_{K4} W_S S - \theta_{S4} rK_D) = \theta_{S4} (rK_F - \theta_{K3} P_3 X_3)
\end{aligned}\right\} \quad \text{(A.44)}$$

Inserting the values of B_i s from (A.19), using (A.44) and simplifying it easily seen that

$$\{\theta_{K3}\theta_{S4}(\theta_{N1}B_9 - \theta_{L1}B_{10}) + \theta_{N1}\theta_{L3}(\theta_{K4}B_{12} - \theta_{S4}B_{11})\}$$
$$= (\frac{E_Y}{Y})\{\theta_{N1}\theta_{S4}W(\alpha-1)a_{L3}X_3(\theta_{K3} - S_{LK}^3) + \theta_{N1}\theta_{S4}\theta_{L3}rK_F - |\theta|P_2X_2\} \quad \text{(A.45)}$$

Using (A.45) and simplifying, from (A.43) the following expression can be easily obtained.

$$\hat{X}_3 = -(\frac{\hat{K}}{\lambda_{K3}\Omega})[|\theta||\lambda|(E_P + \frac{E_Y P_2 X_2}{Y})$$
$$-|\lambda|(\frac{E_Y \theta_{N1}\theta_{S4}\theta_{L3}}{Y})\{(\frac{\alpha-1}{\alpha})P_3X_3(\theta_{K3} - S_{LK}^3) + rK_F\}$$
$$+\theta_{S4}\lambda_{K3}\{\theta_{N1}\theta_{K3}(\lambda_{N1}B_3 + \lambda_{L1}B_1) + \theta_{L1}\theta_{K3}(\lambda_{L1}B_2 + \lambda_{N1}B_4) + \lambda_{N1}\theta_{N1}\theta_{L3}B_5\}] \quad \text{(A.46)}$$

Using (A.19) and (A.41) and comparing terms we can check that the sign of the square-bracketed term in (A.46) is positive. As $\Omega < 0$, from (A.46) it now follows that: $\hat{X}_3 > 0$ when $\hat{K} > 0$.

Appendix VII: ***Derivation of expression for*** $\hat{X}_4$

Differentiating equation (24) one gets:

$$\hat{X}_4 = -\hat{a}_{S4} = S_{SK}^4(\hat{W}_S - \hat{r}) \quad \text{(A.47)}$$

Inserting the values of $\hat{W}_S$ and $\hat{r}$ from (A.26) and (A.27) into (A.47) and simplifying the following expression is finally obtained.

$$\hat{X}_4 = -(\frac{S_{SK}^4\theta_{N1}\theta_{L3}|\lambda *|\hat{K}}{\Omega}) \quad \text{(A.48)}$$

From (A.48) the following results can be stated.

1. If sector 1 is land-capital-intensive/unskilled labour-intensive (but not sufficiently enough) (i.e. $|\lambda^*| > 0$), $\hat{X}_4 > 0$ when $\hat{K} > 0$.
2. If sector 1 is sufficiently unskilled labour-intensive (i.e. $|\lambda^*| < 0$), $\hat{X}_4 < 0$ when $\hat{K} > 0$.

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