International Factor Mobility, Skills Formation and Welfare

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Abstract: The paper examines the welfare consequences of an inflow of foreign capital and an emigration of skilled labour in a small open economy in terms of a four sector general equilibrium model in the presence of endogenous skill formation and imperfection in the market for unskilled labour. It finds that both foreign capital and emigration of skilled labour may be welfare-improving although the outcomes of these policies depend on the relative capital intensities of different sectors and the magnitude of imperfection in the market for unskilled labour. Measures like labour market reform and capital subsidy (or tax) to the appropriate sector may be resorted to improve national welfare and ensure higher skills formation.

International Factor Mobility, Skills Formation and Welfare

1. Introduction

The last two decades have witnessed a rapid growth of the global economy, reflected in reduced trade barriers, increased international trade, highly mobile capital and labour and the rapid transmission of technology across national lines. As an integral part of liberalized economic policy package FDI norms in developing countries have been relaxed 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 these countries have been able to attract a substantial amount of foreign capital during the period of economic reforms.[1] After allowing FDI in key sectors such as telecom, insurance, food processing and even retail, policymakers of the developing countries, for example, India are toying with the idea of permitting foreign investment in elementary and higher education.

As the Indian economy is growing at about 9%, she has started to experience a large gap between the demand for skilled labour and the supply of it. The role of agriculture in the economy in terms of its contribution to GDP is declining fast and the contribution of the industry, particularly the services sector, is increasing. Now, as the role of services sector is predominant, the question of shortage of skilled labour, therefore, arises. That is why with a sense of urgency, the government has initiated the national skill development mission. The policymakers have been doing intensive exercise as to how this mission could be brought into existence and the skill deficit could be mitigated. The private sector is being urged to be involved in every stage of the mission, particularly, in designing the process and supplying the faculty. The policymakers are even contemplating with the idea of allowing FDI in higher education.

When the country is facing a shortage of skilled labour and looking out for measures for overcoming the problem emigration of labour, particularly that of skilled labour, has gained a tremendous momentum in the liberalized regime. Globalization perpetuates emigration from

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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.

developing countries in the following way. It stimulates consumerism and consumption and raises expectations regarding the standard of living. The widening gap between consumption expectations and the available standard of living within structural constraints of the developing countries, combined with easy access to information and migration networks, in turn create tremendous pressure for emigration (Zhou and Gatewood (2000)).

In a typical developing country there is scarcity of both capital and skilled labour. Therefore, economic growth, induced by foreign capital inflows, and skills formation are equally important from the perspective of these nations. To overcome the shortage of educated workforce the developing countries have been allocating a higher amount of fund for secondary education and the higher education over the last two decades.[2] It is beyond any doubt that inflows of foreign capital, expansion of higher educational facilities and skills formation and emigration of skilled labour from developing countries must have important consequences for the country in question. Quite naturally, trade and development economists are likely to be concerned in examining the implications of all these policies on welfare and labour markets of these countries.

There is a large theoretical literature that examines the consequence of foreign capital inflows in the developing economies. Notable contributions are those of Brecher and Alejandro (1977), Khan (1980, 1982), Chandra and Khan (1993), Grinols (1991), Marjit and Beladi (1996), Chaudhuri (2005, 2007) etc. Although in the early literature FDI was shown to be immiserizing, later analyses have shown that variants of the Hechscher-Ohlin-Samuelson structure can be constructed adequately taking into consideration the salient features of the developing economies where foreign capital inflows could be welfare-improving. On the other hand, there exists a conventional theoretical literature, which analyzes the effect of emigration of labour from a developing country on the welfare of the non-migrants in that country. Some of the important works are Bhagwati and Rodriguez (1975), Rodriguez (1975), Rivera-Batiz (1982) and Quibria (1988). These works show that emigration of labour may or may not improve the welfare of the non-migrants under different circumstances. However, in these papers we do not find any distinction between migrant and non-migrant labour force from the viewpoint of skill. There are some later works like Feenstra and Hanson (1996), Yabuuchi and Chaudhuri (2007), Marjit and Acharya (2003), Marjit, Beladi and Chakrabarti (2004), Chaudhuri and Yabuuchi (2007) and Kar

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[2] For example, the Indian government in its central budget 2008 has increased total allocation for the education sector by 20 per cent from Rs28,674 crore in 2007-08 to Rs34,400 crore in 2008-09. Allocation of fund for secondary and higher education has been increased significantly.

and Marjit (2005) that have explained the rising skilled-unskilled wage inequality in the developing nations during the liberalized period. However, none of these papers examines the welfare consequence of emigration of skilled labour, analyzes the process of endogenous skill formation and considers the possibility of foreign capital inflow in education. There is, however, a paper by Kar and Beladi (2004) that has studied the welfare implications of skill formation and international migration of both skilled and unskilled labour using a four-sector general equilibrium framework. However, they have not taken into consideration the imperfection in the market for unskilled labour, which is an important characteristic of the developing nations, and the possibility of foreign capital inflow into the education sector.[3] Besides, they have neither explicitly discussed policy implications of their results nor have suggested appropriate measures that can improve welfare of the economy in the presence of skill formation and international migration of labour.

The present paper develops a four-sector general equilibrium model to analyze welfare consequence of an inflow of foreign capital and emigration of skilled labour in the presence of endogenous skill formation and imperfection in the market for unskilled labour. There is an agricultural sector that requires land and unskilled labour for its production. Another sector produces a low-skill manufacturing commodity using unskilled labour and capital. In this sector unskilled workers are unionized and earn a higher unionized wage than their counterparts in the agricultural sector. There is a skill formation sector as well where one unit of unskilled labour and some amount of capital are required to produce one unit of skilled labour. Finally, sector 4 produces a high-skill product with the help of skilled labour and capital. The economy starts with given endowments of both types of labour. The endowment of skilled labour increases and that of unskilled labour decreases due to skills formation. This theoretical analysis leads to some interesting results. For example, both foreign capital inflow and emigration of skilled labour may be welfare-improving under reasonable conditions. However, the welfare effects depend on the relative capital intensities of different sectors and the magnitude of imperfection in the market for unskilled labour. The policy consequences on skills formation also depend on these factors. Labour market reform and/or the protectionist policy and/or a capital subsidy policy to the appropriate sector (s) should be adopted so as to foster both economic growth and skills formation.

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[3] One of the results of Kar and Beladi (2004) is that skills formation suffers if the price of the primary export good rises. This result is different in the present paper. See footnote 8 for details.

2. The Model

We consider a small open economy with four sectors where all the sectors operate at close vicinity. Land, capital, skilled and unskilled labour are the four inputs of production. Sector 1 is an export sector that produces an agricultural commodity using unskilled labour and land. Sector 2 is the tariff protected import-competing sector that produces a low-skill manufacturing commodity with the help of unskilled labour and capital. The unskilled labour market in sector 2 is imperfect. The workers are here unionized and receive a higher unionized wage, W^*, than their counterparts in sector 1. Sector 3 is the education sector where skilled labour is the output and unskilled labour and capital are the two inputs. Some amount of capital and one unit of unskilled labour together produce 1 one unit of skilled labour. Finally, sector 4 is another export sector that produces a high-skill commodity using skilled labour and capital. So land and skilled labour are specific to sectors 1 and 4, respectively. Unskilled labour is perfectly mobile between sectors 1 and 3 while capital is perfectly mobile among sectors 2, 3 and 4. Sector 3 is a non-traded sector.[4] Unskilled workers in this model have three options. First they try to get employment in sector 2 that offers a high wage. Those who are unable to get employment in this sector are automatically absorbed either in the low-skill sector (sector 1) or in sector 3 for endogenous skill formation. The economy has an initial endowment of skilled labour, S_0. Owing to endogenous skill formation the endowment increases to $(S_0 + X_3)$ at the expense of the endowment of unskilled labour. The capital stock of the economy consists of both domestic capital and foreign capital and these are perfect substitutes. Production functions exhibit constant returns to scale with diminishing marginal productivity to each factor. All markets except the labour market facing sector 2 are perfectly competitive. All the four inputs are fully employed. Commodity 2 is chosen as the numeraire.

We will use the following symbols for formal presentation of the model.

a_{ji} = amount of j th input required to produce 1 unit of output of the i th sector, $i = 1,2,3,4$ and $j = L, S, N, K$;

P_i = world price of the i th commodity, $i = 1, 4$;

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[4] The trade pattern is relevant to a country like India which exports both high-skill and primary agricultural commodities.

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

R = return to land;

r = return to capital;

W = competitive unskilled wage rate in sectors 1 and 3;

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

W_S = skilled wage rate;

L = labour endowment;

N = endowment of land;

K_D = domestic capital stock;

K_F = foreign capital stock;

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

S_0 = initial endowment of skilled labour;

X_i = output of the i th sector;

$\theta_{ji} \equiv$ distributive share of the j th input in the i th industry; $i = 1, 2, 3, 4$ and $j = L, S, N, K$;

$\lambda_{ji} \equiv$ proportion of the j th input employed in the i th sector, $i = 1, 2, 3, 4$ and $j = L, S, N, K$;

"$\wedge$" = proportional change;

Y = national income at world prices.

The general equilibrium is represented by the set of following equations.

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

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

$$Wa_{L3} + ra_{K3} = W_S \tag{3}$$

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

Equations (1) – (4) state that unit cost of production of each commodity must equal its domestic price in equilibrium. In other words, these are the four competitive industry equilibrium conditions in the different sectors of the economy.

Full-employment of land, unskilled labour, skilled labour and capital implies the following equations, respectively.

$$a_{N1}X_1 = N \tag{5}$$

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L\,\square^{5} \tag{6}$$

$$a_{S4}X_4 = S_0 + X_3 \tag{7}$$

$$a_{K2}X_2 + a_{K3}X_3 + a_{K4}X_4 = K_D + K_F = K \tag{8}$$

We measure welfare of the economy by national income at world prices, Y, which is given by[6]

$$Y = W(a_{L1}X_1 + a_{L3}X_3) + W * a_{L2}X_2 + W_S S_0 + RN + rK_D - tP_2X_2 \tag{9}$$

It is assumed that the foreign capital income is fully repatriated. In equation (9), $W(a_{L1}X_1 + a_{L3}X_3)$ gives the aggregate wage income of the unskilled workers employed in sectors 1 and 3 of the economy. $W * a_{L2}X_2$ is the wage income of the unskilled workers in sector 2. $W_S S_0$ is the wage income of the skilled workers that the economy is initially endowed with[7]. RN denotes the rental income to land. rK_D is the rental income from domestic capital. Finally, tP_2X_2 measures the cost of tariff protection of the import-competing sector. Using (6) equation (9) may be rewritten as follows.

$$Y = WL + (W * - W)a_{L2}X_2 + W_S S_0 + RN + rK_D - tP_2X_2 \tag{9.1}$$

This is a decomposable production structure as the number unknown factor prices and the number of zero-profit conditions are equal. So factor prices depend on commodity prices only. Given $W *$ the value of r is obtained from equation (2). W_S is then found from (4). Then plugging the values of r and W_S into (3) the value of W is determined. Finally, R is obtained from (1) as

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[5] Note that a_{L3} is equal to 1.

[6] Alternatively, one can measure social welfare by using the strictly concave social welfare function which ultimately becomes function of relative commodity prices and the national income at domestic prices. However, as the relative prices here do not change national income at world prices or at domestic prices can be used as a good proxy for social welfare.

[7] It may be noted that income of the workers (X_3) who are the product of the education sector (sector 3) is not included in the expression for national income as X_3 is produced by using unskilled labour and capital and their remunerations have been included in (9.1).

W has already been determined. Once factor prices are known the factor coefficients, a_{ji} s are also known. Then from the output equations (5) – (8) X_i s are determined.

3. Comparative statics

In this section of the paper we are going to analyze the welfare consequences of both foreign capital inflow and an emigration of skill labour. We shall also study the effects of these policies on the endogenous skill formation in the economy.

After using (5) and (7) equations (6) and (8) can be rewritten as follows, respectively.

$$a_{L2}X_2 + a_{L3}X_3 = L - (\frac{a_{L1}N}{a_{N1}}) \tag{6.1}$$

$$a_{K2}X_2 + a_{K3}X_3 = K - (\frac{a_{K4}}{a_{S4}}(S_0 + X_3)) \tag{8.1}$$

Totally differentiating equations (6.1) and (8.1) and writing in a matrix notation one gets the following.

$$\begin{bmatrix} \lambda_{L2} & \lambda_{L3} \\ \\ \lambda_{K2} & (\lambda_{K3} + \overline{\lambda}_{K4}) \end{bmatrix} \begin{bmatrix} \hat{X}_2 \\ \\ \hat{X}_3 \end{bmatrix} = \begin{bmatrix} 0 \\ \\ (\hat{K} - S * \hat{S}_0) \end{bmatrix} \tag{10}$$

where: $\overline{\lambda}_{K4} = [\frac{a_{K4}}{a_{S4}K}(a_{S4}X_4 - S_0)] = [\frac{a_{K4}}{a_{S4}K}X_3] > 0$; and, $S* = (\frac{a_{K4}S_0}{a_{S4}}) > 0$. \tag{11}

Solving (10) by Cramer's rule one obtains.

$$\hat{X}_2 = -[(\frac{\lambda_{L3}}{|\lambda|})(\hat{K} - S*\hat{S}_0)] \; ; \text{and,}$$

$$\hat{X}_3 = [(\frac{\lambda_{L2}}{|\lambda|})(\hat{K} - S*\hat{S}_0)] \qquad \qquad \Bigg\} \quad \Box^{8}$$

$$\tag{12}$$

where: $|\lambda| = [\lambda_{L2}(\lambda_{K3} + \overline{\lambda}_{K4}) - \lambda_{K2}\lambda_{L3}]$ (13)

Differentiating (9) with respect to K, using (12) and simplifying one gets.

$$(\frac{dY}{dK}) = -[\frac{\{(W*-W)a_{L2} - tP_2\}\lambda_{L3}X_2}{|\lambda|K}] \tag{14}$$

From (14) it is evident that

$$(\frac{dY}{dK}) > 0 \text{ if and only if } [\frac{\{(W*-W)a_{L2} - tP_2\}}{|\lambda|}] < 0 \tag{15.1}$$

$$\text{i.e. if } [(W*-W)a_{L2} - tP_2] > 0; \text{ and, } |\lambda| < 0 \tag{15.2}$$

$$\text{or if } [(W*-W)a_{L2} - tP_2] < 0; \text{ and, } |\lambda| > 0 \tag{15.3}$$

From equations (15.1 – 15.3) the following proposition can now be established.

Proposition 1: An inflow of foreign capital with full repatriation of foreign capital income and tariff protection of the import-competing sector is welfare-improving if $[(W*-W)a_{L2} > tP_2]$ and, $|\lambda| < 0$ or if $[(W*-W)a_{L2} < tP_2]$ and, $|\lambda| > 0$. The endogenous skill formation, however, rises (falls) if and only if $|\lambda| > (<)0$.

We explain proposition 1 as follows. In this model sectors 2 and 3 use the same two inputs: unskilled labour and capital. Sector 2 is the tariff protected import-competing sector while sector 3 is the skills formation sector. The output of sector 3 is skilled labour which is basically

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[8] If we examine the consequence of a change in the price of the primary export commodity, P_1, on the extent of skills formation, X_3, we find that this depends on the relative factor intensities between the low-skill manufacturing and the vertically integrated skills formation sectors. This is because an increase in P_1 raises the return to land and leads to an expansion of sector 1. Sector 1 draws more unskilled labour from sectors 2 and 3. A Rybczynski type effect takes place and X_3 rises (falls) and X_2 falls (rises) if the sector 2 is unskilled labour-intensive (capital-intensive) relative to the vertically integrated sector 3.

endogenously transformed unskilled labour who have acquired skills. These workers in turn are used in tandem with capital to produce a high-skill commodity in sector 4. So X_3 numbers of unskilled workers actually use capital both directly (in sector 3 in the process of skill formation) and indirectly (in sector 4 while producing the high-skill commodity). The import-competing sector (sector 2) is capital-intensive (unskilled labour-intensive) relative to the vertically integrated skills formation sector if $|\lambda| < (>)0$. An inflow of foreign capital that raises the aggregate capital endowment of the economy produces a *Rybczynski effect*. The import-competing sector expands (contracts) and the skills formation sector contracts (expands) if the former sector is capital-intensive (unskilled labour-intensive) relative to sector 3. If sector 2 expands (contracts) the cost of tariff protection of the import-competing sector rises (falls) that works unfavorably (favorably) on national welfare. This may be called the *output effect (of sector 2)*. On the other hand, as the higher wage-paying sector 2 expands (contracts)[9] and the lower wage-paying sector 3 contracts (expands), the aggregate unskilled wage income rises (falls). This we call the *unskilled labour reallocation effect*, which produces a positive (negative) effect on welfare. So, two opposite forces on welfare are generated. The *labour reallocation effect* is given by the first term within the curly-brackets in right-hand side of (14) while the second term captures the *output effect (of sector 2)*. If the import-competing sector is capital-intensive the *labour reallocation effect* has to be stronger than the *output effect (of sector 2)* for welfare improvement. On the contrary, if the vertically integrated skills formation sector is capital-intensive for welfare improvement the *output effect* has to dominate over the *labour reallocation effect*. It should be noted that foreign capital enters into the education sector (sector 3) and endogenous skills formation in the economy rises if and only $|\lambda| > 0$.

Differentiating (9) with respect to S_0, using (12) and simplifying one obtains

$$(\frac{dY}{dS_0}) = W_S + [(W*-W)a_{L2} - tP_2](\frac{\lambda_{L3}S*X_2}{|\lambda|S_0}) \tag{16}$$

From (12) it follows that

$$\hat{X}_3 > (<)0 \text{ as } \hat{S}_0 < 0 \text{ if and only if } |\lambda| > (<)0 \tag{17}$$

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[9] Note that in sector 2 unskilled workers receive the unionized wage, $W*$, which is greater than the competitive unskilled wage, W, that their counterparts receive in sectors 1 and 3

From (16) and (17) the following proposition immediately follows.

Proposition 2: An emigration of skilled labour raises endogenous skill formation iff the vertically integrated education sector is capital-intensive. The economy's welfare may also improve as a consequence. If the economy's welfare rises the welfare of the non-migrants definitely rises.

Proposition 2 can be intuitively explained in the following fashion. An emigration of skilled labour leads to a contraction of the high-skill sector releasing capital to the other two sectors. The skill formation sector expands (contracts) and the tariff-protected import-competing sector contracts (expands) if the former (latter) sector is capital-intensive. We again have *output effect (of sector 2)* and *unskilled labour reallocation effect*. But apart from these two effects we now have another effect which we call the *factor endowment effect*. As the initial endowment of skilled labour has fallen the country's aggregate factor income falls by the extent of the forgone skilled wage. But the welfare of the economy may still improve if the combined magnitude of the *output* and *labour reallocation effects* is positive and exceeds the negative effect of the *factor endowment effect*. If it happens then the per capita income of all non-migrant workers unambiguously rises and their welfare improves as the size of population has fallen.

If one looks at (16) he finds that one of the necessary conditions for $(\dfrac{dY}{dS_0}) < 0$ to be negative is that $[\dfrac{\{(W^*-W)a_{L2}-tP_2\}}{|\lambda|}] < 0$. This is exactly the condition under which $(\dfrac{dY}{dK}) > 0$. So if emigration of skilled labour is welfare-improving an inflow of foreign capital also improves social welfare. The reason for the similarity in the necessary condition is as follows. An emigration of skilled labour leads to a contraction of the high-skill sector (sector 4). This releases capital to the other two sectors that produces a *Rybczynski type effect*. Consequently, sector 2 expands (contracts) and the education sector contracts (expands) if sector 2 is more (less) capital-intensive than the vertically integrated education sector with respect to unskilled labour. An inflow of foreign capital also produces the same *Rybczynski effect* and that is why the necessary conditions are identical.

4. Policy implications of results

Higher economic growth and skills formation are two of the most important objectives in a developing economy. But how to achieve these objectives without hurting each other is an important task of the policymakers. The analysis of the papers has found that economic growth with foreign capital is possible in both the following situations: (1) $[(W*-W)a_{L2} - tP_2] > 0$; and, $|\lambda| < 0$ and (2) $[(W*-W)a_{L2} - tP_2] < 0$; and, $|\lambda| > 0$. But higher skills formation results only when $|\lambda| > 0$. So the economy's twin objectives would be satisfied only in the second case. But what has to be done if the conditions are reverse? There is scope for government intervention in this situation. It should resort to labour market reform which would lower the unionized wage, $W*$ and help to satisfy the condition, $[(W*-W)a_{L2} - tP_2] < 0$. An increase in the ad-valorem rate of tariff on sector 2 also serves the same purpose. On the other hand, a capital subsidy policy to either sector 3 or 4 or both and/or a wage subsidy to the unionized sector 2 and/or a tax on the use of capital in sector 2 may be undertaken so as to make $|\lambda| > 0$. The subsidies should be financed by non-distortionary taxes on factor incomes. Any combination of these policies, if undertaken, would ensure the fulfillment of the economy's twin objectives of achieving high economic growth with foreign capital and higher skills formation. These policies are equally effective in the case of an emigration of skilled labour. However, the magnitudes of different interventions required must depend on technological, institutional and trade-related factors of the economy in question.

5. Concluding remarks

Globalization has considerably increased the international mobility of different factors of production. The developing economies are yearning for foreign capital and have been able to attract a substantial amount of foreign capital over the liberalized regime. After opening up of different key sectors to foreign capitalists the policymakers of these countries are thinking in terms of allowing the entry of foreign capital in higher education as well so as to bridge up the increasing gap between the demand for and the supply of skilled labour. The brain-drain of skilled labour is accentuating the problem of shortage of skilled labour. What consequences do these policies have on national welfare and endogenous skills formation are the issues that have been addressed in this paper in terms of a four sector general equilibrium model reasonable for a

developing country like India. The analysis of the paper has found that all these effects crucially depend on relative factor intensities of the low-skill manufacturing sector and the education sector and the degree of imperfection in the market for unskilled labour. Under reasonable conditions the paper has shown that both inflows of foreign capital and emigration of skilled labour may improve social welfare and increase the endogenous skills formation. However, if these lower welfare there is scope for government interventions. Measures like labour market reform, a protectionist policy and capital subsidy (or tax) to the appropriate sector may be resorted to improve national welfare and ensure higher skills formation.

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