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FOREIGN CAPITAL INFLOW AND SKILL FORMATION: EFFECTS ON SKILLED-UNSKILLED WAGE INEQUALITY

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The existing theoretical literature asserts that the effects of foreign capital inflow on skilled-unskilled wage inequality depend crucially on the factor intensity conditions. The paper develops a three-sector full employment model and assumes a positive causal relation between foreign capital inflow and education subsidy. The comparative static results indicate that reduction in tax on foreign capital earning and improvement in institutional and legal framework, both leading to increased foreign capital inflow may reduce the skilled-unskilled wage inequality even under alternative factor intensity conditions. Thus the effects of investment liberalization policies on skilled-unskilled wage inequality depends more on the concomitant rise in skilled labour supply.

Keywords: Skilled labour, Unskilled labour, Education Subsidy, Foreign Capital Inflow, Wage Inequality
JEL Classification: D50, J31, F21

1. INTRODUCTION

The recent literature on wage inequality between skilled and unskilled workers largely attributes foreign capital inflow as one of the instrumental factors behind the growing incidence of the wage inequality in developing countries. The basic argument is that foreign capital inflow induces skill biased technological change due to capital-skill complementarity and raises the demand for skilled labour and the wage inequality (Behrman, Birdsall, and Szekey, 2000; Pavcnik, 2003; Goldberg and Pavcnik, 2004).

The empirical evidence so far provides mixed results of the impact of increased capital on skilled-unskilled wage gap in developing countries (Anderson, 2005; Goldberg and Pavcnik, 2007). Aitken, Harrison, and Lipsey (1996) in a study of Mexico and Venezuela and Zhang and Zheng (1998) and Wu (2001) in studies of China find evidences of rises in relative wages of skilled labour due to entrance of multinationals. Freeman et al. (2001) find no evidence of any consistent relationship between FDI and wage inequality in a large sample of developing countries. Owen and Yu (2003) find in a study of China that the effect of FDI depends on whether it is export or import oriented.

Tomohara and Yokota (2007) find that FDI's distributional effect in Thailand is closely related to the origin of FDI and its motivation, viz, horizontal or vertical FDI. Figini and Gorg (2011) in a study of panel data find the presence of a nonlinear effect in developing countries: wage inequality increases with FDI, but diminishes with further increases in FDI.

It is often argued that if liberalization policies are accompanied by conscious policies enhancing pro-technology adoption environments the wage gap may become markedly reduced (Fuentes et al, 2006). This view finds support in empirical findings that policies promoting FDI inflows towards countries with environments weakly prepared for pro-technology adoption may increase the wage gap between skilled and unskilled workers. (Feenstra and Hanson, 1997; Wood, 1997; Gopinath and Chen, 2003; Beaulieu, et al., 2004).

Since FDI generally entails a higher relative demand for skilled labour (Feenstra and Hanson, 1997), skill formation comprises one of the key mechanisms to provide favourable environment for FDI, resulting in significant impact on the wage gap. In fact, both demand-side factors (like skill biased technology) and supply-side factors (like education and skill) determine the wages and inequality thereof. In a study of five East Asian countries, Te Velde and Morrissey (2002) find that FDI has increased wage inequality in Thailand and Philippines, and reduced inequality in Korea, with less significant effects in Singapore and Hong Kong. While the Asian Tigers stand out as having high enrolment rates in secondary and tertiary education, this is less true for Philippines and Thailand. They suggest that countries wanting to develop on the basis of FDI should invest sufficient resources in good quality and appropriate human resources, or otherwise growth is likely to coincide with rising wage inequality.

A pervasive phenomenon found in developing countries is that FDI induces governments to boost up their allocation on education subsidy so as to induce further FDI flows. Slaughter (2002) shows that foreign capital positively contributes towards investment in human capital. Egger et al. (2005) shows that foreign capital tends to raise participation in higher education, both in cases when public education expenditure is held constant and when optimal adjustment of public education expenditure is allowed for. Zhuang (2013) shows theoretically as well as empirically that the jurisdiction government is willing to provide more education with the inflows of FDI by considering the fact that multinational enterprises will promote more production with higher stock of human capital. The FDI induced rise in the supply of skilled labour is likely to narrow the wage inequality.

However, the recent theoretical literature explains the effect of foreign capital on wage inequality in terms of production structures, capital mobility and nature of labour market. Beladi et al. (2006) in a dual-economy set-up that includes unemployment show that the effects of foreign capital inflow on the wage gap crucially depend on the difference in the intersectoral factor intensities between skilled labour and capital. Chaudhuri and Yabuuchi (2007) consider the existence of distortion in the market for unskilled labour and show that inflow of foreign capital into the manufacturing sectors

improves the wage inequality under a reasonable factor intensity condition. Oda and Stapp (2008) show that factor intensity plays a crucial role in the effect of factor mobility on wage inequality. Marjit, Beladi and Chakrabarti (2004) explain the worsening wage gap in situations with or without market fragmentation in trade. They show that in the absence of 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, while with trade fragmentation the wage inequality may worsen if the traded intermediate good sector is capital-intensive relative to the import-competing sector. Marjit, Broll, and Sengupta (2000) shows that the impact of trade liberalization on the skilled–unskilled wage gap in the presence of informal sectors depend on the nature of capital mobility between the formal and informal sectors. The effect of foreign capital on wage inequality in all these papers crucially hinges on the relative factor intensities of the sectors.[1]

On the other hand, public expenditure on education is found to have an unfavourable effect on wage inequality (Hendel et al, 2005; Caucutt and Kumar, 2003). Turrini (1998) shows how endogenous public investments in human capital can enhance the skilled/unskilled income differentials that arise from exogenous trade-related and technology shocks. Chaudhuri (2005) shows that the effect of skill formation on the wage inequality depends on the technologies of production of the economy and institutional nature of the markets for unskilled labour.

The motivation of the present paper is as follows. Evidences suggest that since FDI generates more demand for skilled labour, the skilled-unskilled wage inequality is adversely affected. So, if the government in a developing country could ensure higher supply of skilled labour through expansion of subsidization of education, favourable effects on wage inequality may be obtained; but education subsidy is believed to further widen the wage inequality. Country experiences indicate that there might exist a virtuous interlinkage between FDI, education subsidy and wage inequality. For example, Latin America's FDI grew from 2.7 to 4.9 percent from 1990 to 2012 (UNCTAD database, 2014), while the share of government expenditure on education expanded steadily across Latin American and Caribbean countries from 1999 to 2013 (World Bank database). On the other hand, there has been considerable reduction of wage inequality in Latin America and the Caribbean in the 2000s (Messina and Silva, 2017). However, the causal relation between foreign capital inflow, education subsidy and wage inequality has not been considered in the existing literature. The objective of the present paper is to examine the effects of concomitant rises in FDI and education subsidy on wage inequality.

[1] A notable exception is the paper by Chaudhuri (2008) that shows in a three-sector specific factor model with Harris-Todaro type unemployment that the consequences of foreign capital inflow on wage inequality may not necessarily depend on the difference in the factor intensity condition. It matters only when the unskilled wage in the low-skill urban sector is positively related to the rural wage.

The paper analyzes the effects of investment liberalisation on skilled-unskilled wage inequality in a 3-sector general equilibrium model where both foreign capital and skilled labour supply is endogeneously determined. It is assumed that inflow of foreign capital affects the government expenditure on education and therefore the skilled labour supply changes as well. It is found that the skilled-unskilled wage inequality may fall due to simultaneous changes in capital and labour endowments, even under alternative factor intensity conditions. Moreover, it is found that a rise in endogenously determined education subsidy might be instrumental in lowering the wage gap. The results question the conventional views in the theoretical literature that the detrimental effects of foreign capital on wage inequality crucially depend on the factor intensity conditions of the economy, and that education subsidy may not be successful in reducing wage inequality.

2. THE MODEL

We consider a small open economy with three sectors - a rural sector and two urban sectors. The rural sector (sector 1) produces an agricultural product, X_1 using unskilled labour and land. The urban sector has two sub-sectors: Sector 2 produces a manufacturing product, X_2 using unskilled labour and capital, while sector 3 produces another manufacturing product, X_3 using skilled labour and capital. The total capital stock in the economy consists of both domestic and foreign capital. The supply of foreign capital is endogeneously determined. Skilled labour is assumed to be specific to sector 3; unskilled labour is mobile between sectors 1 and 2 while capital is mobile between sectors 2 and 3. The supply of skilled labour is considered to be endogenously determined. Due to the assumption of small open economy, prices of all the products are internationally given. Production functions exhibit constant returns to scale with diminishing marginal productivity to each factor.

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

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

$$Wa_{L2} + ra_{K2} = P_2, \tag{2}$$

$$W_S a_{S3} + ra_{K3} = P_3. \tag{3}$$

Equations (1), (2) and (3) show the price-unit cost equality conditions depicting competitive industry equilibrium in the three sectors respectively. Here, a_{N1} denotes the land-output ratio in sector 1; a_{Ki} is the capital-output ratio in the i_{th} sector, $i = 2, 3$; a_{Li} is the unskilled labour-output ratio in the i_{th} sector, $i = 1, 2$; a_{S3} depicts the skilled labour-output ratio in sector 3; P_i is the world price of the i_{th} commodity, $i = 2, 3$; W_S denotes the wage rate of skilled labour; W is the wage rate of unskilled labour; R is the return to land and r is the return to capital.

Full employment of land and capital ensures equations (4) and (5).

$$a_{N1}X_1 = N, \tag{4}$$

where $a_{N1}X_1$ denotes the amount of land employed in sector 1 and N is the supply of land in the economy.

$$a_{K2}X_2 + a_{K3}X_3 = K_D + K_F = K, \tag{5}$$

where $a_{Ki}X_i$ is the amount of capital employed in the i_{th} sector, $i = 2,3$; while K_D, K_F and K represent the domestic capital stock, foreign capital and aggregate capital stock (domestic plus foreign) of the economy.

$$a_{L1}X_1 + a_{L2}X_2 = L_U. \tag{6}$$

Equation (6) shows the allocation of total unskilled labour, L_U in the economy, where $a_{Li}X_i$ is the employment of unskilled labour in the i_{th} sector for $i = 1,2$.

Since it is assumed that skilled labour (L_S) is fully employed and is used only in sector 3, the demand-supply equality is depicted in equation (7) as follows.

$$a_{S3}X_3 = L_S, \tag{7}$$

$$L_S = S(E);\ S' > 0. \tag{8}$$

Equation (8) depicts the skilled labour supply function. It shows that the total skilled labour supply in the economy depends on the level of education subsidy, E.[2] This assumption is particularly relevant for the developing countries, where skill formation[3] is predominantly state-funded.

$$K_F = K_F(r(1-t), \beta),$$

where

[2] Education subsidy may be in the form of infrastructure development for human capital formation, subsidization of education cost or direct incentives for skill formation like stipends, mid-day meals and so on.

[3] Although the effect of education subsidy on skill formation and supply of skilled labour should ideally be captured in a dynamic phenomenon, it may be argued that even an appropriate static model can depict some of the essence of a dynamic model. The static nature of the model may be considered as a stationary state equilibrium where the system repeats itself perpetually. See, Marjit and Acharyya (2001) and Chaudhuri (2005) in this context. Moreover, in the context of the present model, public investments on short-term vocational training and skill development programmes may contribute in rapid increases in skilled labour.

$$K_1 = \frac{\partial K_F}{\partial r(1-t)} > 0;\ K_2 = \left(\frac{\partial K_F}{\partial \beta}\right) > 0. \tag{9}$$

It is assumed that the government imposes an ad-valorem tax on the return to foreign capital at the rate t. Hence, the supply of foreign capital, K_F depends positively on the effective rate of return to capital after deducting the tax. It also depends on the institutional features that include relaxing of procedural stringencies, functioning of bureaucracy, transparent legal and regulatory framework, easiness to create a company, lack of corruption, etc.[4] that are captured compositely by the policy parameter, β. An improvement in any institutional or legal factors would raise the value of β and indicate a more favourable environment conducive to FDI.[5]

The total tax revenue earned on foreign capital earning, τ is given by

$$\tau = rtK_F(r(1-t), \beta). \tag{10}$$

It is assumed that the elasticity of supply of foreign capital exceeds unity, i.e. $\varepsilon_K = ((\bar{\partial} K_F)/(\partial r(1-t))(r(1-t))/K_F) > 1$. This implies that any change in the effective return to foreign capital (net of taxes) raises the total tax revenue.[6]

We assume that a proportion, $\alpha(< 1)$ of the tax revenue earned on foreign capital is spent as lumpsum transfers in the form of education subsidy, E.[7] Therefore, the balanced government budget is given by

$$E = \alpha rtK_F(r(1-t), \beta). \tag{11}$$

Equation (11) depicts a causal relation between foreign capital and education subsidy. It implies that an increase in foreign capital raises the level of education subsidy. Two possible explanations may be forwarded for this assumption. First, it is

[4] See Acemoğlu, Johnson and Robinson (2002), Dumludag, Saridogan and Kurt (2005) and Quéré, Coupet and Mayer (2007).

[5] Foreign capital supply is upward sloping due to the implicit assumption that the recipient country, although small in goods market, is large in the capital market. It affects the effective return to capital through its taxation policies. A rent seeking foreign investor is induced to invest more in a country where the effective return is higher. An appropriate example is the case of India. According to a report titled, 'World Investment Prospects Survey 2009-2012' by United Nations Conference on Trade and Development (UNCTAD) India is at the second place in global foreign direct investments. However, India accounts for only 1.1% of the world exports (International Trade Statistics Year Book, UN. 2008). In fact, most of the developing countries offer various incentives and adopt tax policies to affect the effective return to capital and thus regulate the inflow of foreign capital.

[6] In particular, the condition that ensures that a fall in the tax rate on foreign capital earning raises the total revenue is that the absolute value of $\{(\partial K_F/\partial r(1-t))(rt/K_F)\} > 1$.

[7] See Zhuang (2013) for empirical evidence.

plausible that if there is inflow of foreign capital, the government would be more inclined in subsidizing education and facilitating human capital formation since FDI ensures adequate demand for skilled labour.[8] Secondly, as already mentioned, a steady pool of skilled labour in the economy pulls more FDI; hence in an endeavour to attract FDI the government is induced to subsidize education and generate more skilled workers.

Using equations (8) and (11), equation (7) can be rewritten as

$$\alpha_{S3}X_3 = S(\alpha rtK_F(r(1-t)), \beta). \tag{7.1}$$

The total labour endowment (skilled and unskilled) of the economy is assumed to be given and normalized to unity. Thus,

$$L_S + L_U = L = 1 \text{ or } a_{L1}X_1 + a_{L2}X_2 + a_{S3}X_3 = 1. \tag{12}$$

There are twelve endogenous variables in the system: W, W_S, R, r, X_1, X_2, X_3, L_U, L_S, τ, E and K_F that can be solved from the above twelve equations (1) – (6), (7.1), (8) – (12). This is an indecomposable production system where any change in factor endowment affects factor prices and factor coefficients.

3. EFFECTS OF INVESTMENT LIBERALIZATION POLICIES ON SKILLED UNSKILLED WAGE INEQUALITY

In this section, we analyse the effects of investment liberalization policies in the form of (i) reduction in the rate of tax on foreign capital earning and (ii) an improvement in the institutional and regulatory framework on the skilled-unskilled wage inequality. Here, the investment liberalization policies directly stimulate foreign capital inflow and affect the tax revenue on foreign capital. This in turn affects the level of education subsidy. The consequent change in output composition and labour reallocation influences the skilled-unskilled wage inequality.

The skilled unskilled wage inequality is given by

$$W_I = (W_S - W). \tag{13}$$

Total differentiation of (13) yields

[8] Although education is a vital social sector and had typically been in the priority list when it comes to government subsidization, with most of the developing countries embarking on economic reforms, the respective governments have become selective while doling out subsidy to reduce the distortion associated with it. Hence it is likely that while financing education they are also careful that no additional cost, for example in the form of educated unemployment is generated in the economy.

$$\widehat{W} = (1/W_I)(W_S\,\widehat{W}_S - W\widehat{W}). \tag{13.1}$$

The wage inequality aggravates (reduces), if the rise in wages of skilled labour exceeds (is less than) that of unskilled labour.

3.1. Effect of Reduction in Tax on Foreign Capital Earning

Let us first consider the effects of a tax cut on foreign capital earning on the magnitudes of foreign capital inflow, education subsidy and skilled unskilled wage inequality. It is assumed that $\hat{t} < 0$ while all other parameters are unchanged.[9]

3.1.1. Effect on foreign capital inflow

The tax cut lowers the effective rate of return inducing inflow of foreign capital. But the resulting labour reallocation also affects r, which might reinforce the capital inflow or dampen it. Thus, the net effect of a cut in t on K_F is ambiguous and is given by

$$\begin{aligned}\widehat{K}_F = (-)(\hat{t}\varepsilon_K/(\Delta|\theta|))[&\theta_{N1}\theta_{L2}\theta_{S3}\{\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})(1+T)\\ &+\lambda_{L2}\lambda_F\varepsilon_K(1-T)\} + T\{\lambda_{K2}\lambda_{L1}\theta_{S3}\theta_{K2}(S^1_{LL} - S^1_{KL})\\ &+\lambda_{K2}\lambda_{L2}\theta_{S3}\theta_{K1}(S^2_{LL} - S^2_{KL}) + \lambda_{K3}\lambda_{L2}\theta_{L2}\theta_{K2}(S^3_{SS} - S^3_{KS})\}],\end{aligned} \tag{14}$$

where[10] θ_{ji} is the distributive share of the jth input in the ith sector; $i = 1,2,3$; $j = N, L_U, L_S, K$; λ_{ji} is the proportion of the jth input employed in the ith sector, $i = 1,2,3$; $j = N, L_U, L_S, K$; S^i_{jk} is the degree of substitution between factors j and k in the ith sector, $i = 1,2,3$; $\widehat{K}_F$ denotes proportionate change; $T = t/(1-t)$; $|\theta| = -\theta_{L1}\theta_{K2}\theta_{S3} < 0$ and

$$\begin{aligned}\Delta = (1/|\theta|)[&\lambda_{K2}\lambda_{L1}\theta_{S3}\theta_{K2}(S^1_{LL} - S^1_{KL}) + \lambda_{K2}\lambda_{L2}\theta_{S3}\theta_{K1}(S^2_{LL} - S^2_{KL})\\ &+\lambda_{K3}\lambda_{L2}\theta_{L2}\theta_{K2}(S^3_{SS} - S^3_{KS}) + (\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})\theta_{K1}\theta_{L2}\theta_{S3}\alpha\varepsilon_E(\varepsilon_K + 1)\\ &-\lambda_{L2}\theta_{K1}\lambda_F\varepsilon_K\theta_{L2}\theta_{S3}].\end{aligned} \tag{14.1}$$

From (14.1) it follows that

(i) When $\lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}$, then $\Delta > 0$ unambiguously

(ii) When $\lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3}$, $\Delta > 0$
if $\alpha\varepsilon_E\lambda_{K3}(\varepsilon_K + 1) < \lambda_F\varepsilon_K\alpha\varepsilon_E\lambda_{K3}(\varepsilon_K + 1) < \lambda_F\varepsilon_K$

However, since empirical evidences (De Mooij and Ederveen, 2003; Navaretti and

[9] The mathematical derivations are shown in details in the Appendix.

[10] See equations (A.7) and (A.15) for calculations.

Venables, 2004) suggest a negative relation between taxation on foreign capital earning and FDI, we derive conditions under which $\widehat{K}_F > 0$ as $\hat{t} < 0$.[11] From (14) one gets the following cases under alternative factor intensity conditions.

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, then\ \widehat{K}_F > 0 \text{ iff } 1 < T \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3},\ \widehat{K}_F > 0 \text{ if} \\ (i) 1 < T\ (ii) \alpha\varepsilon_E\lambda_{K3} < \lambda_F\varepsilon_K(1-T)\ and\ (iii)\ \alpha\varepsilon_E\lambda_{K3}(\varepsilon_K+1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (15)$$

3.2. Effect on Eeducation Subsidy

On the other hand, the effect on education subsidy is given by

$$\hat{E} = (\alpha\hat{t}/(\Delta|\theta|))[\lambda_{L2}\theta_{N1}\theta_{S3}\{\lambda_{K2}(1-T\varepsilon_K)(S^2_{LL}-S^2_{KL}) - \lambda_F\varepsilon_K\theta_{L2}(1+T)\} + (1-T\varepsilon_K)\{\lambda_{K2}\lambda_{L1}\theta_{K2}\theta_{S3}(S^1_{LL}-S^1_{KL}) + \lambda_{K3}\lambda_{L2}\theta_{K2}\theta_{L2}(S^3_{SS}-S^3_{KS})\}], \quad (16)$$

From (16), we get the following cases.

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, \hat{E} > 0 \text{ if} \\ (i)(1-T\varepsilon_K) < 0\ and\ (ii)\lambda_{K2}(1-T\varepsilon_k)(S^2_{LL}-S^2_{KL}) > \lambda_{L2}\lambda_F\varepsilon_K\theta_{L2}(1+T) \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3}, \hat{E} > 0 \text{ if} \\ (i)(1-T\varepsilon_K) < 0, (ii)\lambda_{K2}(1-T\varepsilon_k)(S^2_{LL}-S^2_{KL}) > \lambda_{L2}\lambda_F\varepsilon_K\theta_{L2}(1+T) \\ and\ (iii)\ \alpha\varepsilon_E\lambda_{K3}(\varepsilon_K+1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (17)$$

3.3. Effect on Skilled-unskilled Wage Inequality

Now, the effect on skilled-unskilled wage inequality is obtained as

$$\widehat{W}_I = \hat{t}(\theta_{N1}/(W_I\Delta|\theta|))(W_S\theta_{K3}\theta_{L2} - W\theta_{K2}\theta_{S3})[\lambda_{L2}\lambda_F\varepsilon_K T + \alpha\varepsilon_E(1-T\varepsilon_K)(\lambda_{K3}\lambda_{L2} - \lambda_{k2}\lambda_{S3})]. \quad (18)$$

From (18), we obtain the effects on wage inequality under alternative factor intensity conditions.

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, \widehat{W}_I < 0 \text{ if } (1-T\varepsilon_K) < 0 \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3}, \widehat{W}_I < 0 \text{ if} \\ (i)(1-T\varepsilon_K) < 0,\ (ii)\lambda_{L2}\lambda_F\varepsilon_K T < \alpha\varepsilon_E(1-T\varepsilon_K)(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) \\ and\ \alpha\varepsilon_E\lambda_{K3}(\varepsilon_K+1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (19)$$

[11] This result is crucial since it implies the efficacy of the investment liberalization through taxation policy in attracting FDI. In a situation when countries are competing for inward FDI, no country would reduce taxes if the latter lowers both the inflow of FDI and tax revenue thereof.

This leads to the following proposition:

Proposition 1: *A tax cut on foreign capital earning may increase FDI and reduce the skilled-unskilled wage inequality even under alternative factor intensity conditions.*

3.4. Effect of Improvement in Institutional and Regulatory Framework

An improvement in the institutional and regulatory framework captured by β would induce more FDI even if the rate of return on investment remains the same. However, an initial increase in FDI would lead to changes in output and labour reallocation. The rate of return would also be affected, with important implications on the net magnitude of FDI, education subsidy and wage inequality. To examine the effects, we assume that $\hat{\beta} > 0$ while all other parameters remain unchanged.

3.5. Effect on Foreign Capital Inflow

The effect on the inflow of foreign capital is given by

$$\widehat{K}_F = \hat{\beta}(\varepsilon_\beta/(|\theta|\Delta))[\theta_{N1}\theta_{L2}\theta_{S3}\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) + \lambda_{K2}\lambda_{L1}\theta_{S3}\theta_{K2}(S^1_{LL} - S^1_{KL}) + \lambda_{K2}\lambda_{L2}\theta_{S3}\theta_{K1}(S^2_{LL} - S^2_{KL}) + \lambda_{K3}\lambda_{L2}\theta_{L2}\theta_{K2}(S^3_{SS} - S^3_{KS})]. \quad (20)$$

Since empirical findings (see footnote 5) posit that an improvement in the institutional and regulatory framework induces more FDI, it is assumed that $\widehat{K}_F > 0$ as $\hat{\beta} > 0$.

From (20) we may obtain the following alternative cases:

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, \widehat{K}_F > 0 \text{ unambiguously} \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3},\ \widehat{K}_F < 0 \text{ if} \\ (i)|\theta_{L2}\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})| < |\lambda_{K2}\lambda_{L2}(S^2_{LL} - S^2_{KL})|\ and \\ (ii)\alpha\varepsilon_E\lambda_{K3}(\varepsilon_K + 1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (21)$$

Thus it follows from (21) that a positive relation of institutional and regulatory framework with FDI may hold under the alternate factor intensity conditions.

3.6. Effect on Education Subsidy

On the other hand, the effect on education subsidy is given by

$$\hat{E} = \hat{\beta}(\alpha\varepsilon_\beta/(|\theta|\Delta))[\theta_{N1}\theta_{L2}\theta_{S3}\lambda_{L2}\lambda_F + \lambda_{K2}\lambda_{L1}\theta_{S3}\theta_{K2}(S^1_{LL} - S^1_{KL}) + \lambda_{K2}\lambda_{L2}\theta_{S3}\theta_{K1}(S^2_{LL} - S^2_{KL}) + \lambda_{K3}\lambda_{L2}\theta_{L2}\theta_{K2}(S^3_{SS} - S^3_{KS})]. \quad (22)$$

From (22) one gets the following cases.

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, \hat{E} > 0 \text{ if } |\lambda_{K2}(S_{LL}^2 - S_{KL}^2)| > |\theta_{L2}\lambda_{F2}| \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3},\ \hat{E} > 0 \text{ if} \\ (i)|\lambda_{K2}(S_{LL}^2 - S_{KL}^2)| > |\theta_{L2}\lambda_{F2}|\ and \\ (ii)\ \alpha\varepsilon_E\lambda_{K3}(\varepsilon_K + 1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (23)$$

3.7. Effect on Skilled-unskilled Wage Inequality

Now, the effect on skilled-unskilled wage inequality is obtained as

$$\widehat{W}_I = \hat{\beta}(\varepsilon_\beta/(|\theta|\Delta W_I))\theta_{N1}(W_S\theta_{L2}\theta_{K3} - W\theta_{K2}\theta_{S3})[\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) - \lambda_{L2}\lambda_F]. \quad (24)$$

From (24) we get the following alternative cases.

$$\left.\begin{array}{l} Case\ I: When\ \lambda_{K3}\lambda_{L2} < \lambda_{K2}\lambda_{S3}, \widehat{W}_I < 0 \\ Case\ II: When\ \lambda_{K3}\lambda_{L2} > \lambda_{K2}\lambda_{S3},\ \widehat{W}_I < 0 \text{ if} \\ (i)\ \alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) > \lambda_{L2}\lambda_F\ and \\ (ii)\ \alpha\varepsilon_E\lambda_{K3}(\varepsilon_K + 1) < \lambda_F\varepsilon_K \end{array}\right\} \quad (25)$$

This leads to the following proposition.

Proposition 2: *An improvement in institutional features and investment environment may lead to increase in FDI and reduce the skilled-unskilled wage inequality irrespective of factor intensity.*

Propositions 1 and 2 may be explained as follows. A reduction in t that raises the effective return to foreign capital (net of tax) and/or an improvement in β stimulates inflow of foreign capital leading to expansion of both sectors 2 and 3. This generates higher demands for unskilled and skilled labour respectively and hence both W and W_S rise. To maintain the zero-profit conditions in sectors 2 and 3, there is a fall in r. This acts as a disincentive for supply of foreign capital. The net result on foreign capital inflow depends on the relative strengths of the two effects. However, there is an increase in foreign capital inflow under sufficient conditions as depicted in (15) and (21) for the two cases respectively. Since the supply of foreign capital is assumed to be elastic, the tax revenue from foreign capital and hence the level of education subsidy also increases under the sufficient conditions (see equations (17) and (23)). The supply of skilled labour augments, leading to expansion in sector 3 since skilled labour is specific to that sector. Consequently, there is an increase in demand for capital in sector 3, which raises r. To maintain the zero-profit conditions in sectors 2 and 3, both W and W_S fall. On the other hand, increase in skilled labour supply implies that there is less unskilled

labour. Both sectors 1 and 2 contract and reduce the demand for land and capital. As a result, r falls, while W and W_S increase. Thus, there are three effects on W and W_S due to (i) increase in capital; (ii) increase in skilled labour and (iii) decline in unskilled labour. The skilled-unskilled wage inequality reduces irrespective of factor intensities under the sufficient conditions stated in (19) and (25) for the two cases respectively.

From the above propositions, we can establish the following corollary.

Corollary: *An increase in education subsidy, if accompanied by increase in capital inflow, may be effective in reducing the skilled –unskilled wage inequality.*

4. CONCLUDING REMARKS

Foreign capital inflow is viewed to be one of the major reasons behind accentuating wage gap between skilled and unskilled labour in developing countries. The recent theoretical literature on the effects of foreign capital inflow emphasizes on the importance of the intersectoral factor intensities between skilled labour and capital. Countries with certain factor intensity conditions are believed to obtain unfavourable effects on the wage inequality due to foreign capital inflow.

However, there exist two important aspects regarding this issue. First, the relative wages of skilled and unskilled workers are determined by their relative demand and supply. While the relative demand for skilled/unskilled labour is determined by the existing technology, production and trade pattern; the relative supply depends on the level of skill formation. Secondly, foreign capital inflow is often accompanied by increased public spending on education that raises the supply of skilled labour, and has significant implications on the wage inequality.

The present paper purports to ascertain the effect of investment liberalization policies on the skilled-unskilled wage inequality by considering the causal relation between foreign capital inflow and education subsidy. It develops a three-sector full employment specific factor model. It is assumed that the supply of skilled labour depends positively on education subsidy, which is financed by tax revenue earned from foreign capital earning. On the other hand, foreign capital inflow depends on the effective rate of return (net of tax) on capital and institutional framework representing investment environment in the economy. In this scenario, it is shown that both the policies of tax cut and improvement in investment environment may induce more foreign capital inflow as well as increase the supply of skilled labour due to rise in education subsidy and ameliorate the skilled-unskilled wage inequality even under different factor-intensity conditions.

The contributions of the paper are threefold: (i) while most of the existing theoretical works suggest that foreign capital may have favourable or beneficial effects on wage inequality depending on the factor intensity conditions of the economy, the paper shows that the beneficial effects can be obtained even under alternative factor intensity

conditions; (ii) existing literature suggests that education subsidy may not be successful in reducing wage inequality, but the paper shows that it may indeed narrow down the wage gap, if accompanied by FDI; (iii) The positive effects of simultaneous increases in capital and skilled labour endowment is usually based on the contention that physical and human capital are complements and hence FDI leads to higher demand for skilled labour. However, the results are derived without any such explicit assumptions. This may perhaps act as a pointer to the importance of skill formation in the wake of FDI, whatever the production structures and whichever sector the foreign capital enters.

APPENDIX

A.1.

Total differentials of equations (1), (2) and (3) and the use of envelope conditions give

$$\theta_{L1}\widehat{W} + \theta_{N1}\hat{R} = 0, \tag{A.1}$$

$$\theta_{L2}\widehat{W} + \theta_{K2}\hat{r} = 0, \tag{A.2}$$

$$\theta_{S3}\widehat{W}_S + \theta_{K3}\hat{r} = 0. \tag{A.3}$$

It may be noted that producers in each industry choose techniques of production so as to minimize unit costs. This leads to the condition that the distributive-share weighted average of changes in input-output coefficients along the unit isoquant in each industry must vanish near the cost-minimization point. This states that an isocost line is tangent to the unit isoquant. For example, in mathematical terms, the cost minimization condition for sector 1 may be written as: $\theta_{L1}\hat{a}_{L1} + \theta_{N1}\hat{a}_{N1} = 0$. This is called the envelope condition. See Caves, Frankel and Jones (1990) and/or Chaudhuri and Mukhopadhyay (2009).

Solving (A.1), (A.2) and (A.3) by Cramer's rule yields

$$\widehat{W} = (1/|\theta|)\hat{R}\theta_{N1}\theta_{K2}\theta_{S3}, \tag{A.4}$$

$$\widehat{W}_S = (1/|\theta|)\hat{R}\theta_{N1}\theta_{L2}\theta_{K3}, \tag{A.5}$$

$$\hat{r} = (-)(1/|\theta|)\hat{R}\theta_{N1}\theta_{L2}\theta_{S3}, \tag{A.6}$$

where

$$|\theta| = -\theta_{L1}\theta_{K2}\theta_{S3} < 0.$$

Differentiating equation (9) we have

$$\hat{K}_F = \varepsilon_K(\hat{r} - T\hat{t}) + \varepsilon_\beta\hat{\beta}, \tag{A.7}$$

where

$$T = t/(1-t).$$

Differentiating equation (11) and using (A.7) one gets

$$\hat{E} = \alpha[\hat{r}(\varepsilon_K + 1) + \hat{t}(1 - T\varepsilon_K) + \varepsilon_\beta\hat{\beta}]. \tag{A.8}$$

Total differentiation of equation (4), (5), (7.1), and (12) and use of (A.4) - (A.8) yield respectively

$$\hat{X}_1 + A_1\hat{R} = 0, \tag{A.9}$$

$$\lambda_{K2}\hat{X}_2 + \lambda_{K2}\hat{X}_3 + A_2\hat{R} = A_3\hat{t} + A_4\hat{\beta}, \tag{A.10}$$

$$\hat{X}_3 + A_5\hat{R} = A_6\hat{t} + A_7\hat{\beta}, \tag{A.11}$$

$$\lambda_{L1}\hat{X}_1 + \lambda_{L2}\hat{X}_2 + A_8\hat{R} = A_9\hat{t} - A_{10}\hat{\beta}, \tag{A.12}$$

where,

$$\left.\begin{aligned}
A_1 &= (1/|\theta|)S^1_{KL}\theta_{K2}\theta_{S3} < 0\\
A_2 &= (1/|\theta|)\theta_{N1}[\lambda_{K2}S^2_{KL}\theta_{S3} + \lambda_{K3}S^3_{KS}\theta_{L2} + \lambda_F\varepsilon_K\theta_{L2}\theta_{S3}] < 0\\
A_3 &= (-)\lambda_F\varepsilon_K T < 0\\
A_4 &= \lambda_F\varepsilon_\beta > 0\\
A_5 &= (1/|\theta|)\theta_{N1}\theta_{L2}[S^3_{SS} + \alpha\varepsilon_E(\varepsilon_K + 1)\theta_{S3}]\\
A_6 &= \alpha\varepsilon_E(1 - T\varepsilon_K)\\
A_7 &= \alpha\varepsilon_E\varepsilon_\beta > 0\\
A_8 &= (1/|\theta|)\theta_{S3}[\lambda_{L1}S^1_{LL}\theta_{K2} + \lambda_{L2}S^2_{LL}\theta_{K1} + \alpha\varepsilon_E(\varepsilon_K + 1)\lambda_{S3}\theta_{N1}\theta_{L2}]\\
A_9 &= (-)\lambda_{S3}\alpha\varepsilon_E(1 - T\varepsilon_K)\\
A_{10} &= \lambda_{S3}\alpha\varepsilon_E\varepsilon_\beta > 0\\
\lambda_F &= (K_F/K)\\
\varepsilon_E &= (\partial S/\partial E)(E/S) \text{ is the elasticity of } \textit{skilled labour supply}\\
&\quad \textit{with respect to education subsidy.}
\end{aligned}\right\} \tag{A.13}$$

Here, S^i_{jk} is the degree of substitution between factors j and k in the ith sector, $i = 1, 2, 3$, for example, in sector 1, $S^1_{LL} = (da_{L1}/dW)(W/a_{L1})$, $S^1_{LN} = (da_{L1}/$

$dR)(R/a_{L1})$. $S_{jk}^{i} > 0$ for $j \neq k$ and $S_{jj}^{i} < 0$. It should be noted that as the production functions are homogeneous of degree one, the factor coefficients, a_{ji}s are homogeneous of degree zero in the factor prices. Hence the sum of elasticities for any factor of production in any sector with respect to factor prices must be zero. For example, in sector 1, we have $(S_{LL}^{1} + S_{LN}^{1}) = 0$.

Solving (A.9), (A.10), (A.11), and (A.12) by Cramer's rule gives

$$\hat{R} = (1/\Delta)[\hat{t}(\lambda_{K2}A_9 + \lambda_{K3}\lambda_{L2}A_6 - \lambda_{L2}A_3) + \varepsilon_{\beta}\hat{\beta}(\lambda_{K3}\lambda_{L2}A_7 - \lambda_{K2}A_{10} - \lambda_{L2}A_4)], \quad \text{(A.14)}$$

where

$$\begin{aligned}\Delta = (1/|\theta|\,[&\lambda_{K2}\lambda_{L1}\theta_{S3}\lambda_{K2}(S_{LL}^{1} - S_{KL}^{1}) + \lambda_{K2}\lambda_{L2}\theta_{S3}\theta_{N1}(S_{LL}^{2} - S_{KL}^{2}) \\ &+\lambda_{K3}\lambda_{L2}\theta_{L2}\theta_{K2}(S_{SS}^{3} - S_{KS}^{3}) + (\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})\theta_{N1}\theta_{L2}\theta_{S3}\alpha\varepsilon_{E}(\varepsilon_{K} + 1\,) \\ &-\lambda_{L2}\theta_{N1}\lambda_{F}. \end{aligned} \quad \text{(A.15)}$$

A.2. Effects of a fall in tax rate on foreign capital earning

It is assumed that $\hat{t} < 0$ but all other parameters are unchanged.
From (A.14) and using (A.13) we get

$$\hat{R} = (1/\Delta)\hat{t}[\lambda_{L2}\lambda_{F}\varepsilon_{K}T + \alpha\varepsilon_{E}(1 - T\varepsilon_{K})(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})], \quad \text{(A.14.1)}$$

Substitution of (A.14.1) in (A.4), (A.5) and (A.6) respectively yields

$$\widehat{W} = (\hat{t}/(\Delta|\theta|))\theta_{N1}\theta_{K2}\theta_{S3}[\lambda_{L2}\lambda_{F}\varepsilon_{K}T + \alpha\varepsilon_{E}(1 - T\varepsilon_{K})(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})], \quad \text{(A.16)}$$

$$\widehat{W}_{S} = (\hat{t}/(\Delta|\theta|))\theta_{N1}\theta_{L2}\theta_{K3}[\lambda_{L2}\lambda_{F}\varepsilon_{K}T + \alpha\varepsilon_{E}(1 - T\varepsilon_{K})(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})], \quad \text{(A.17)}$$

$$\hat{r} = (-)(\hat{t}/(\Delta|\theta|))\theta_{N1}\theta_{L2}\theta_{S3}[\lambda_{L2}\lambda_{F}\varepsilon_{K}T + \alpha\varepsilon_{E}(1 - T\varepsilon_{K})(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3})]. \quad \text{(A.18)}$$

Substitution of (A.18) in (A.7) and simplification gives the effect on foreign capital inflow as shown in equation (14). Substitution of (A.18) in (A.8) and simplification yields the effect on education subsidy as depicted in equation (16). Use of (A.16) and (A.17) in (13.1) yields the effect on skilled-unskilled wage inequality as shown in equation (18).

A.3. Effect of improvement in institutional and regulatory framework

Equation (A.14) and use of (A.13) yields

$$\hat{R} = \hat{\beta}\big(\varepsilon_{\beta}/\Delta\big)[\alpha\varepsilon_{E}(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) - \lambda_{L2}\lambda_{F}]. \quad \text{(A.14.2)}$$

Substitution of (A.14.2) in (A.4), (A.5) and (A.6) respectively

$$\widehat{W} = \hat{\beta}\left(\varepsilon_\beta/(|\theta|\Delta)\right)\theta_{N1}\theta_{K2}\theta_{S3}[\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) - \lambda_{L2}\lambda_F], \quad \text{(A.19)}$$

$$\widehat{W}_S = \hat{\beta}\left(\varepsilon_\beta/(|\theta|\Delta)\right)\theta_{N1}\theta_{L2}\theta_{K3}[\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) - \lambda_{L2}\lambda_F], \quad \text{(A.20)}$$

$$\hat{r} = (-)\hat{\beta}\left(\varepsilon_\beta/(|\theta|\Delta)\right)\theta_{N1}\theta_{L2}\theta_{S3}[\alpha\varepsilon_E(\lambda_{K3}\lambda_{L2} - \lambda_{K2}\lambda_{S3}) - \lambda_{L2}\lambda_F]. \quad \text{(A.21)}$$

Substitution of (A.21) in (A.7) and simplification gives the effect on foreign capital inflow as shown in equation (20). Substitution of (A.21) in (A.8) and simplification yields the effect on education subsidy as depicted in equation (22). Total differentiation of (13) and use of (A.19) and (A.20) yields the effect on skilled-unskilled wage inequality as shown in equation (24).

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