

International Factor Mobility, Wage Inequality and Welfare: A Theoretical Analysis

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Abstract

This paper shows that inflow of skilled (unskilled) labour increases wage inequality and its effect on foreign investment in the industrial sector and welfare in the shortrun is positive (negative) as long as the positive (negative) impact on the output of varieties of producer services is sufficiently large. An increase in the supply of domestic capital decreases wage inequality and its effect on foreign investment and welfare in the shortrun is positive as long as the positive impact on the output of varieties of producer services is sufficiently large. The magnitude of the longrun effect on foreign investment, wage inequality and welfare depends on the size of external economies in the industrial sector. Inflow of skilled labour leads to an unambiguous increase in foreign investment, wage inequality and welfare; whereas inflow of unskilled labour can decrease foreign investment and its effect on wage inequality and welfare can be negative. Finally, an increase in the supply of domestic capital increases foreign investment and its effect on wage inequality and welfare can be positive.

JEL Classification: F21; F22

Key Words: Wage inequality; Foreign investment; Labour inflow; Welfare

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1. Introduction

Trade liberalisation and increase in the pace of globalisation have made a significant contribution to the growth of world economy in the past few decades. While, in overall terms, both developed and developing countries appear to have gained, concerns regarding the distribution of gains within an economy have resulted in street protests against globalisation as well as further liberalisation of international trade. Opponents of trade liberalisation and globalisation in developed countries have attempted to link wage inequality between the skilled and unskilled labour to inflow of unskilled labour. Based on these concerns, some recent studies have examined the impact of labour inflow/outflow on wage inequality. For example, by making use of a simple general equilibrium model of a small open economy that produces two goods under competitive conditions and where constant returns to scale prevail in all industries, Marjit and Kar (2005) have shown that immigration induced wage inequality crucially depends on income shares of capital across industries rather than the type of workers that emigrate. This is a very important result, which adds a new dimension to the debate concerning the impact of labour inflow/outflow on wage inequality.

While Marjit and Kar have made a significant contribution to a growing body of literature that includes valuable contributions such as Davis (1998), Das (2002), Feenstra and Hanson (2003), Marjit and Acharyya (2003), Marjit, Beladi and Chakrabarty (2003) and Ethier (2005), their work suggests that labour inflow/outflow does not affect wage inequality if the income shares of capital across industries were identical. Anwar (2006) has attempted to extend Marjit and Kar's work by showing that in the presence of specialisation-based external economies, labour inflow can affect wage inequality even if the income shares were identical across industries.

It is interesting to note that models utilised by earlier studies can be interpreted as longrun models that focus exclusively on the impact of exogenous labour inflow/outflow on wage inequality. It is well-known that the shortrun effect can be substantially different from the longrun effect. In addition, while there has been a significant increase in foreign investment in most real economies since the early 1980s, most available studies are based on models that implicitly assume that foreign investment is exogenous, which is an unrealistic assumption. In fact in most real economies, foreign

investment depends on the availability of labour. In other words, it is reasonable to assume that foreign investment is endogenous and hence labour inflow/outflow has implications for foreign investment. The studies where foreign investment is endogenous include Din (1996). However, his work does not consider the issue of wage inequality. Chao and Yu (1997) and Das (2002) utilise models that allow one to distinguish between the shortrun and the longrun effects but they do not consider the impact of labour inflow/outflow.¹

By combining various aspects of Din (1996), Chao and Yu (1997), Marjit and Kar (2005) and Anwar (2006), this paper focuses on the impact of labour inflow and increase in the supply of sector specific domestic capital on wage inequality, foreign investment and welfare both in the shortrun and longrun. The paper utilises a simple general equilibrium model of a small open economy that produces one industrial good and one agricultural good and where foreign investment takes place in the industrial sector. In addition to skilled labour and foreign capital, the industrial sector also utilises varieties of producer services. Due to the presence of internal economies within the services sector, production of the industrial good is subject of external economies of scale. Domestic capital and unskilled labour are used in the production of the agricultural good whereas varieties of producer services are produced by means of domestic capital and skilled labour. The paper assumes that income share of skilled labour in the services sector is greater than (or equal to) the income share of unskilled labour in the agricultural sector.

It is shown that inflow of skilled (unskilled) labour increases wage inequality and its effect on foreign investment and welfare in the shortrun is positive (negative) as long as the positive (negative) impact on the output of varieties produced is sufficiently large. An increase in the supply of sector specific domestic capital decreases wage inequality and its effect on foreign investment and welfare in the shortrun is positive as long as the positive impact on the output of varieties produced is sufficiently large. The magnitude of the longrun effect depends on the size of external economies in the industrial sector. Inflow of skilled labour leads to an unambiguous increase in foreign investment, wage inequality and welfare in the longrun, whereas inflow of unskilled labour decreases foreign investment and its effect on wage

¹ Das (2002) and Marjit and Kar (2005) consider wage inequality in developing economies.

inequality and welfare is negative as long as the size of external economies in the industrial sector is sufficiently large. An increase in the supply of domestic capital increases foreign investment and its effect on wage inequality and welfare in the longrun is positive as long as the size of external economies is sufficiently large.

The rest of this paper unfolds as follows. A simple general equilibrium model of a small open-economy is presented in section two. The impact of labour inflow and increase in the supply of domestic capital on wage inequality, foreign investment and welfare in the shortrun as well as the longrun is examined in section three. The last section offers some concluding remarks.

2. A Simple General Equilibrium Model

Consider a small open-economy that produces two traded goods (Y and Z). Y is an industrial good whereas Z is an agricultural good. The industrial good is produced by means of foreign capital, skilled domestic labour and a large number of varieties of producer services.² Each variety of the non-traded producer services is produced by means of domestic capital and skilled domestic labour. The agricultural good is produced by means of domestic capital and unskilled domestic labour. In other words, capital is sector specific and foreign investment takes place in the production of the industrial good only.³ This is not an unrealistic assumption since the industrial sectors attract most foreign investment in most real economies.⁴ This paper captures differences in factor intensities across sectors in an extreme manner – the industrial good sector is foreign capital intensive whereas the agricultural good sector is domestic capital intensive. The production functions for Y and Z are as follows:

² Such services include consulting, auditing, engineering, architectural and legal services. These services are primarily utilised by the industrial sector and therefore they do not enter as input in the production of non-industrial goods. A number of existing studies such as Markusen (1989), Marrewijk, Sitobra, Vaal and Viaene (1997), Markusen and Venables (1999) and Reddings and Venables (2004) have highlighted the role played by the services sector in real economies. Eswaran and Kotwal (2002) have examined the role of services produced under monopolistic competition on the process of economic development.

³ It can be easily confirmed that the results presented in this paper would be unaffected if domestic supply of the capital utilised in the industrial good sector is not zero.

⁴ This aspect of the model is also consistent with Das (2002). Das has developed a model where foreign investment takes place in industrial sector only.

$$Y = (L_{sy}^{1-\beta} K_{fy}^\beta)^{1-\alpha} \left(\sum_{i=1}^n x_i^\delta \right)^{\frac{\alpha}{\delta}}$$

$$Z = L_{uz}^{1-\gamma} K_{dz}^\gamma$$

Where α , β , γ and δ are parameters in the range $[0,1]$; x_i is the output of the i -th variety produced by the services sector; n is the number of varieties produced; L_{sy} and L_{uz} respectively are skilled and unskilled labour used in the production of Y and Z ; K_{fy} and K_{dz} respectively are foreign and domestic capital used in the production of Y and Z .

Production of both final goods is subject to constant returns to scale, which implies that the average cost equals the marginal cost. On the other hand, the producer services sector is subject to internal economies of scale. Accordingly, each firm specialises in the production of a single variety. The cost function of the i th variety is as follows:⁵

$$c(w_s, r, x_i) = [\mu + \lambda x_i] w_s^{1-\theta} r^\theta$$

Where \bar{r} and w_s respectively are the price of foreign capital and the skilled wage rate; θ is a parameters in the range $[0, 1]$; λ and μ are positive constants; \bar{r} is determined in the international market; $[\mu] w_s^{1-\theta} r^\theta$ is the fixed cost whereas $[\lambda x_i] w_s^{1-\theta} r^\theta$ is the variable cost.

Following the existing literature, this paper focuses on a symmetric equilibrium where all varieties produced are equally priced. In a symmetric equilibrium, the aggregate production of the services sector, X , equals nx and hence the industrial good production function can be written as follows:

$$Y = K_{fy}^{\beta(1-\alpha)} L_{sy}^{(1-\alpha)(1-\beta)} X^\alpha n^{\frac{\alpha(1-\delta)}{\delta}}$$

From the point of view of each firm in Y industry, the number of varieties supplied is given. Accordingly, there are constant returns at the firm level (i.e., the exponents of K_{fy} , L_{sy} and X add up to

⁵ It is well-known that the production function corresponding to the specified cost function is non-homogenous; otherwise the system of equations that describes equilibrium would be over determined (see Helpman, 1981 and Das, 1982).

unity) but for the industry as a whole there are economies of scale. The degree of external economies of scale is measured by the size of $\frac{\alpha(1-\delta)}{\delta}$ which is positive but less than unity. The size of external economies approaches zero as $\delta \rightarrow 1$. The industrial and the agricultural goods are produced under conditions of perfect competition. Because the services sector produces a large number of varieties, the price elasticity of demand for each variety is $\frac{1}{1-\delta}$.⁶ Varieties of producer services are produced under conditions of monopolistic competition. It is well-known that, due to free entry and exit of firms, each firm earns zero economic profit in the longrun. On the other hand, in the shortrun the number of firms is exogenous and hence the economic profit may not be zero.⁷

2.1 Shortrun Equilibrium

The following condition determines the equilibrium output of the industrial good industry where p is the price of producer services.

$$1 = \Theta \left[w_s^{1-\alpha-\beta(1-\alpha)} \right] \left[\bar{r}^{\beta(1-\alpha)} \right] \left[\frac{p^\alpha}{n^{\frac{\alpha(1-\delta)}{\delta}}} \right] \quad (1)$$

Where $\Theta = \alpha^{-\alpha} \beta^{-\beta(1-\alpha)} (1-\alpha)^{-(1-\alpha)} (1-\beta)^{-(1-\alpha)(1-\beta)} > 0$

The right-hand side of equation (1) is the unit cost of production whereas the left-hand side is the price of the industrial good. The industrial good is the numéraire and hence its price has been set equal to unity. An increase in the number of varieties decreases the effective price of producer services and hence average cost of the industrial good decreases.

If the services sector is active in equilibrium then the following first order condition must hold

$$\delta p = \lambda w_s^{1-\theta} r^\theta \quad (2)$$

⁶ These assumptions are used by a number of existing studies that include Helpman and Krugman (1985), Rodrik (1996), Marrewijk, Sitobra and Viaene (1997), Markusen (2002) and Rivera-Batiz and Rivera-Batiz (2003).

⁷ For a discussion of the shortrun and longrun equilibria, see Chao and Yu (1997) and Das (2002).

Equation (2) is the usual profit maximisation condition which shows that marginal revenue equals marginal cost. As indicated earlier, the number of firms in the shortrun is exogenous and hence the economic profit within the services sector may not be non-zero.

The output of the agricultural good is determined by the following zero profit condition where q , which is the price of the agricultural good, is determined in the international market.

$$q = \left[\gamma^{-\gamma} (1-\gamma)^{-(1-\gamma)} \right] w_u^{1-\gamma} r^\gamma \quad (3)$$

The market clearing condition for skilled labour, which is assumed to be in fixed supply (L_s), is as follows:

$$n[\mu + \lambda x](1-\theta) \left[\frac{w_s}{r} \right]^{-\theta} + \Theta(1-\alpha)(1-\beta) \left[\frac{w_s}{\bar{r}} \right]^{-\beta(1-\alpha)} \left[\frac{w_s}{p} \right]^{-\alpha} \left[\frac{Y}{n \frac{\alpha(1-\delta)}{\delta}} \right] = L_s \quad (4)$$

The first and the second terms on the left-hand side of equation (4), respectively, are the demand for skilled labour in the services and industrial good sector.

The market clearing condition for unskilled labour, which is assumed to be in fixed supply (L_u) is as follows, where the left hand side is the demand for unskilled labour in the agricultural sector.

$$\left[\frac{\gamma}{1-\gamma} \right]^{-\gamma} \left[\frac{w_u}{r} \right]^{-\gamma} Z = L_u \quad (5)$$

The market clearing condition for domestic capital, which is assumed to be in fixed supply (K_d) is as follows, where the first and the second terms on the left-hand side of equation (6), respectively, are demand for capital in the agricultural and the services sector.

$$\left[\frac{\gamma}{1-\gamma} \right]^{1-\gamma} \left[\frac{w_u}{r} \right]^{1-\gamma} Z + n\theta[\mu + \lambda x] \left[\frac{w_s}{r} \right]^{1-\theta} = K_d \quad (6)$$

As indicated earlier, the price of foreign capital (\bar{r}) is determined in the international market. Accordingly the demand for foreign capital determines its supply (K_f). The equilibrium condition is as follows, where the left-hand side of equation (7) is the demand for foreign capital in the industrial sector.

$$\Theta[\beta(1-\alpha)] \left[\frac{w_s}{\bar{r}} \right]^{1-\beta(1-\alpha)} \left[\frac{w_s}{p} \right]^{-\alpha} \left[\frac{Y}{n \frac{\alpha(1-\delta)}{\delta}} \right] = K_f \quad (7)$$

The market clearing condition for the output of the services sector is as follows, where the left-hand side of equation (8) is the demand for producer services and the right hand side is the aggregate supply.

$$(\Theta\alpha) \left[\frac{w_s}{\bar{r}} \right]^{-\beta(1-\alpha)} \left[\frac{w_s}{p} \right]^{1-\alpha} \left[\frac{Y}{n^{\frac{\alpha(1-\delta)}{\delta}}} \right] = nx \quad (8)$$

It is well-known that the welfare of a small open economy can be measured by its net income (I) as follows:⁸

$$I = w_u L_u + w_s L_s + rK_d + n\pi \quad (9)$$

The above equation shows that net income consists of the income of domestic capital and labour and profit earned by firms operating in the services sector. π is the profit of a firm operating in the services sector, which equals $px - [\mu + \lambda x] w_s^{1-\theta} r^\theta$. By making use of equation (2), the expression for profit can be re-written as follows:

$$\pi = px - [\mu + \lambda x] w_s^{1-\theta} r^\theta = (1-\delta)px - \left[\frac{\mu\delta p}{\lambda} \right] = \left[\frac{\lambda(1-\delta)x - \mu\delta}{\lambda} \right] p$$

It is clear that profit exists as long as $x > \left[\frac{\mu\delta}{\lambda(1-\delta)} \right]$. This completes the description of the

shortrun equilibrium where equations (1) to (9) are nine equations in nine endogenous variables; $Y, Z, K_f, I, x, w_s, w_w, r$ and p . \bar{r}, q, n, K_d, L_s and L_u are exogenous variables.

2.2 Longrun Equilibrium

The longrun equilibrium is characterised by free entry and exit of firms in the services sector where monopolistic competition prevails. Because of free entry and exit, the price of each variety of producer services will just cover average cost. By making use of equation (2), the zero profit condition, which determines the equilibrium number of firms (n) in the services industry can be written as follows:

$$(1-\delta)px = \mu w_s^{1-\theta} r^\theta \quad (10)$$

⁸ For example, see Wong (1995) and Rivera-Batiz and Rivera-Batiz (2003) and references therein.

Due to zero economic profit in the services sector, the net income of the small open economy under consideration consists of labour and capital income as follows:

$$I = w_u L_u + w_s L_s + r K_d \quad (11)$$

The longrun equilibrium is characterised by equations (1)-(8) and (10)-(11). These are ten equations in ten endogenous variables; $Y, Z, K_f, I, x, n, w_u, w_s, r$ and p . \bar{r}, q, K_d, L_s and L_u are exogenous variables.

3. Analysis of the Model

In the shortrun, the number of firms in the services industry is exogenous but the output of each variety depends on relative prices and the availability of primary factors. On the other hand, in the longrun, the number of firms within the services sector is endogenous and hence the economic profit is zero but the output of each variety is fixed. By combining equations (2) and (10), it can be confirmed that the longrun output of each variety, x , equals $\frac{\mu\delta}{\lambda(1-\delta)}$.

3.1. Analysis of the Shortrun Model

This section focuses on the impact of labour inflow and increase in the supply of domestic capital on wage inequality between the skilled and unskilled labour, foreign investment in the industrial sector and welfare. Wage inequality is measured by the skilled to unskilled wage ratio. By making use of equations (1) to (3), variations in wage inequality can be linked to variations in the unskilled wage rate as follows, where a circumflex is used to denote proportional changes.

$$[\hat{w}_s - \hat{w}_u] = - \left[\frac{\chi}{\gamma\sigma} \right] \hat{w}_u \quad (12)$$

Where $\chi = \gamma[1 - \beta(1 - \alpha)] - \alpha\theta$; $\sigma = 1 - \beta(1 - \alpha) - \alpha\theta > 0$ ⁹

⁹ By making use of the properties of cost functions, it can be confirmed that σ is positive.

The above equation shows that an increase in the unskilled wage rate decreases wage inequality as long as χ is positive. By making use of the properties of cost functions, it can be confirmed that χ is positive as long $\gamma \geq \theta$, which implies that $(1 - \gamma) \leq (1 - \theta)$. In other words, χ is positive as long as the income share of skilled labour in the services sector is greater than (or equal to) the income share of unskilled labour in the agricultural sector.¹⁰ The rest of this paper assumes that $\gamma \geq \theta$ and hence χ is positive.

Equation (12) shows that labour inflow and increase in the supply of domestic capital affect wage inequality through their impact on unskilled wage rate. The results presented in the following are derived by totally differentiating equations (1) to (8).

$$[\hat{w}_s - \hat{w}_u] = \left[\frac{\mu L_y + (\lambda x) L_s}{\mu + \lambda x} \right] \left[\frac{\chi L_u}{\Delta} \right] \hat{L}_u + \left[\frac{n K_x (\lambda x)}{\mu + \lambda x} \right] \left[\frac{\chi L_s}{\Delta} \right] \hat{L}_s - \left[\frac{\mu L_y + (\lambda x) L_s}{\mu + \lambda x} \right] \left[\frac{\chi K_d}{\Delta} \right] \hat{K}_d \quad (13)$$

Where $\Delta = [\Phi \sigma K_z + (1 - \gamma) \{1 - \beta(1 - \alpha)\} \{(1 - \theta) \mu L_y + (\lambda x) L_s\} n K_x] > 0$

Equation (13) shows that a small inflow of either the skilled or unskilled labour increases wage inequality as long as the income share of skilled labour in the services sector is greater than (or equal to) the income share of unskilled labour in the agricultural sector. This result is consistent with Marjit and Kar (2005). While an inflow of unskilled labour decreases the wage rate for both skilled and unskilled labour, its effect on unskilled wage rate is larger and hence wage inequality increases (see appendix). Inflow of skilled labour decreases both the skilled and unskilled wage rate but its impact on unskilled wage rate is larger (see appendix).

Equation (13) shows that an increase in the supply of sector specific domestic capital decreases wage inequality. This follows from the fact that an increase in the supply of domestic capital increases the skilled and unskilled wage rate but its impact on the skilled wage rate is larger (see appendix). It is interesting to note that, in the shortrun, the size of external economies in the industrial sector does not

affect the link between factor mobility and wage inequality. This follows from the fact, in the shortrun, the number of varieties produced by the services sector is fixed and hence variations in the supply of labour and/or capital have no implications for the degree of external economies in the industrial sector.

The shortrun impact of labour inflow and increase in the supply of domestic capital on foreign investment in the industrial sector can be examined by means of equation (14) as follows:

$$\hat{K}_f = \hat{Y} = \hat{x} + \hat{p} = \hat{x} - \left[\frac{(1-\alpha)(1-\beta)}{\alpha} \right] \hat{w}_s \quad (14)$$

Equation (14) is derived by making use of equations (1) and (7). It is clear from equation (14) that there is one-to-one correspondence between changes in foreign investment and production of the industrial good. This is not surprising because foreign investment takes place in the industrial sector only. The above equation shows that foreign investment in the industrial sector responds to variations in the output of varieties produced by the services sector and the price of each variety. Equation (1) shows that, in the shortrun, the equilibrium price of each variety is negatively related to the skilled wage rate. An inflow of skilled labour increases the output of each variety and its impact on the skilled wage rate is negative (see appendix). Accordingly, an inflow of skilled labour leads to an unambiguous increase in foreign investment.

An inflow of unskilled labour decreases the skilled wage rate as well as the output of varieties produced by the services sector and hence its overall effect on foreign investment cannot be unambiguously determined. However, it is clear that inflow of unskilled labour decreases foreign investment as long as its negative effect on the output of varieties produced is sufficiently large.

An increase in the supply of domestic capital increases both the production of each variety and the skilled wage rate and hence its overall impact on foreign investment cannot be unambiguously determined. Increase in the supply of domestic capital increases foreign investment in the shortrun as long as its effect on the output of varieties produced is sufficiently large.

¹⁰ Since the services sector utilises skilled labour and domestic capital whereas the agricultural sector utilises unskilled labour and domestic capital, it is not possible to compare relative physical factor intensities. It is however possible to compare factor intensities in value terms; $\gamma \geq \theta$ implies that $\frac{w_s L_x}{rK_x} \geq \frac{w_u L_z}{rK_z}$.

The impact of labour inflow and increase in the supply of domestic capital on welfare of the residents of the small open economy can be examined by means of (15) as follows:

$$\hat{I} = \left[\frac{(1-\theta)n\pi + w_s L_s}{I} \right] \hat{w}_s - \left[\frac{(w_u L_z) \{ \theta(n\pi) + r(nK_x) \}}{I(rK_z)} \right] \hat{w}_u + \left[\frac{n\pi}{I} \right] \left[\frac{\lambda(1-\delta)x}{\lambda(1-\delta)x - \mu\delta} \right] \hat{x} \quad (15)$$

Equation (15) shows that variations in the skilled and unskilled wage rates and the output of varieties produced affect welfare. Variations in the output of varieties produced will have no effect on welfare if the size of economic profit within the services sector (i.e., π) was zero. An inflow of skilled labour decreases both the skilled and unskilled wage rate but its effect on the output of varieties produced is positive. The overall impact of skilled labour inflow on welfare is positive as long as economic profit in the services sector is non-zero and its positive effect on the output of varieties produced is sufficiently large.

Inflow of unskilled labour decreases both the skilled and unskilled wage rates and its impact on the output of varieties produced is also negative. The overall impact of unskilled labour inflow on welfare is negative as long as economic profit in the services sector is non-zero and its negative effect on the output of varieties produced is sufficiently large.

An increase in the supply of domestic capital increases both the skilled and unskilled wage rates and its effect on the output of varieties is also positive. The overall impact of an increase in the supply of domestic capital on welfare is positive as long as economic profit in the services sector is non-zero and its positive effect on the output of varieties produced is sufficiently large.¹¹

3.2 Analysis of the Longrun Model

As indicated earlier, because of free entry and exit, the number of firms based in the services sector in the longrun is endogenous and hence the output of each firm (i.e., each variety) is invariant to changes in exogenous variables. This can be confirmed by making use of equations (2) and (10). The

¹¹ Chao and Yu (1997) have shown that, in the presence of imperfect competition, the shortrun effects are often ambiguous.

impact of labour inflow and increase in the supply of domestic capital on the number of varieties can be examined by differentiating equilibrium conditions (1) to (7) and (8)-(9) as follows:

$$\hat{n} = - \left[\frac{\theta(1-\gamma)\{1-\beta(1-\alpha)\}K_z}{\Delta} \right] \hat{L}_u + \left[\frac{\sigma K_z + (1-\gamma)(1-\theta)\{1-\beta(1-\alpha)\}nK_x}{\Delta} \right] \hat{L}_s + \left[\frac{\theta(1-\gamma)\{1-\beta(1-\alpha)\}K_d}{\Delta} \right] \hat{K}_d \quad (16)$$

Where $\Delta = -\theta\alpha\left(\frac{1-\delta}{\delta}\right)K_z + (1-\gamma)\{1-\beta(1-\alpha)\}nK_x + \sigma K_z$

The sign of equation (16) depends on the sign of Δ which depends on the size of external economies within the industrial good sector. As indicated earlier, the size of external economies approaches zero as $\delta \rightarrow 1$. It can be easily confirmed that one of the Routh-Hurwitz stability conditions requires Δ being positive which ensures that price-output responses are normal. The rest of this paper assumes that Δ is positive, which ensures stability.¹²

Equation (16) shows that inflow of unskilled labour decreases the number of varieties produced due to its negative impact on production of the industrial good. On the other hand, inflow of skilled labour increases the number of varieties produced due to its positive effect on production of the industrial good. An increase in the supply of domestic capital increases the production of the industrial good and hence the number of varieties produced increases.

Equation (17) shows that, in the longrun, wage inequality can be linked to variations in the unskilled wage rate and the number of varieties produced by the services sector as follows:

$$\left[\hat{w}_s - \hat{w}_u \right] = \left[\frac{\alpha(1-\delta)}{\sigma\delta} \right] \hat{n} - \left[\frac{\chi}{\gamma\sigma} \right] \hat{w}_u \quad (17)$$

The above equation shows that an increase in the number of varieties produced increases wage inequality. This follows from the fact that increase in the number of varieties enhances the productivity of skilled labour in the industrial sector. The overall impact of labour inflow and increase in the supply of domestic capital on wage inequality in the longrun can be examined by means of equation (18) as follows:

$$\begin{aligned}
[\hat{w}_s - \hat{w}_u] = & \left[\gamma \{1 - \beta(1 - \alpha)\} - \alpha\theta - \theta \left\{ \frac{\alpha(1 - \delta)}{\delta} \right\} \right] \left[\frac{K_z}{\Delta} \right] \hat{L}_u \\
& + \left[\left\{ \frac{\alpha(1 - \delta)}{\delta} \right\} \{K_d - \theta n K_x\} + \{ \gamma \{1 - \beta(1 - \alpha)\} - \alpha\theta \} n K_x \right] \left[\frac{1}{\Delta} \right] \hat{L}_s \\
& - \left[\gamma \{1 - \beta(1 - \alpha)\} - \alpha\theta - \theta \left\{ \frac{\alpha(1 - \delta)}{\delta} \right\} \right] \left[\frac{K_d}{\Delta} \right] \hat{K}_d
\end{aligned} \tag{18}$$

Equation (18) shows that, in the longrun, the size of external economies in the industrial sector affects the magnitude of wage inequality arising from the inflow of labour and increase in the supply of domestic capital. This follows from the fact that number of varieties produced by the services sector in the longrun is endogenous. Accordingly, as indicated by equation (16), labour inflow and increase in the supply of domestic capital affects the number of varieties produced which has implications for the magnitude of external economies in the industrial sector. Equation (18) shows that inflow of skilled labour increases wage inequality as long as the income share of skilled labour in the services sector is greater than (or equal to) the income share of unskilled labour in the agricultural sector (i.e., $\gamma \geq \theta$).¹³ This follows from the fact that inflow of skilled labour decreases the unskilled wage rate and its effect on the skilled wage rate may not be negative (see appendix).

Because of the presence of external economies, inflow of unskilled labour leads to a larger decrease in the skilled wage rate but its effect on the unskilled wage rate may not be negative. Accordingly, the impact of unskilled labour inflow on wage inequality cannot be unambiguously determined. However it is clear that unskilled labour inflow decreases wage inequality as long as

$$\gamma = \frac{\alpha\theta}{1 - \beta(1 - \alpha)}. \text{ This condition also ensures that increase in the supply of domestic capital increases}$$

wage inequality.

It is clear that the presence of external economies in the industrial sector plays a significant role in determining the longrun impact of factor mobility on wage inequality. For example, due to the

¹² It is well-known that the presence of economies of scale gives rise to stability problem. See Wong (1995) for a further discussion of the stability condition.

¹³ Because $\frac{\alpha}{1 - \beta(1 - \alpha)} < 1$, $\gamma \geq \theta \Rightarrow \gamma \{1 - \beta(1 - \alpha)\} - \alpha\theta > 0$

presence of external economies, inflow of skilled labour leads to a larger increase in wage inequality. An inflow of unskilled labour may decrease wage inequality if the size of external economies is sufficiently large.

Equation (19) indicates that an increase in the number of varieties produced increases foreign investment in the industrial sector in the longrun, whereas an increase in the skilled wage rate has the opposite effect.

$$\hat{K}_f = \hat{Y} = \hat{n} + \hat{p} = \left[\frac{1}{\delta} \right] \hat{n} - \left[\frac{(1-\alpha)(1-\beta)}{\alpha} \right] \hat{w}_s \quad (19)$$

As noted earlier, inflow of skilled labour increases the number of varieties produced. However, due to the presence of external economies, its effect on the skilled wage rate is small. The impact of labour inflow and increase in the supply of domestic capital on foreign investment in the longrun can be examined by means of equation (20) as follows:

$$\begin{aligned} \hat{K}_f = & - \left[\frac{\alpha\theta(1-\gamma)K_z}{\delta\Delta} \right] \hat{L}_u + \left[\frac{\alpha\theta(1-\gamma)L_z}{\delta\Delta} \right] \hat{K}_d + \\ & \left[(1-\alpha)(1-\beta) + \frac{\alpha(1-\theta)}{\delta} \right] \left[\frac{(1-\gamma)nK_x + K_z}{\Delta} \right] \hat{L}_s \end{aligned} \quad (20)$$

Equation (20) shows that the overall impact of skilled labour inflow on foreign investment is positive. An inflow of unskilled labour decreases both the number of varieties produced and the skilled wage rate. While the skilled wage effect on foreign investment is positive, the overall impact on foreign investment is negative. An increase in the supply of domestic capital increases both the number of varieties and the skilled wage rate and its overall impact on foreign investment is positive. In fact, in all cases the effect on the number of varieties dominates the skilled wage rate effect. It is also clear that the size of external economies in the industrial sector has implications for the size of overall effect on foreign investment.¹⁴

¹⁴ The size of the comparative static response will be smaller if external economies were not present.

The impact of labour inflow and increase in the supply of capital on welfare of the residents can be discussed by re-examining equation (15). In the longrun, economic profit earned by firms within the services sector is zero (i.e., $\pi = 0$) and hence equation (15) reduces to

$$\hat{I} = \left[\frac{n(rK_x)}{I} \right] \left\{ \left[\frac{w_s(nL_x + L_y)}{n(rK_x)} \right] \hat{w}_s - \left[\frac{w_u L_z}{rK_z} \right] \hat{w}_u \right\} \quad (21)$$

Equation (21) shows that labour inflow and increase in the supply of domestic capital influence welfare through their impact on the skilled and unskilled wage rates. An inflow of skilled labour reduces the unskilled wage and its impact on the skilled wage is positive as long as the external economies in the industrial sector are sufficiently large (see appendix). This implies that inflow of skilled labour can increase welfare in the longrun as long as the external economies are sufficiently large. Because of the presence of external economies, inflow of unskilled labour may not reduce the unskilled wage rate but and its impact on the skilled wage rate is unambiguously negative. In overall terms, an inflow of unskilled labour decreases welfare, as long the external economies are sufficiently large. An increase in the supply of domestic capital increases the skilled wage rate and its impact on unskilled wage rate is non-positive zero as long as $\delta \leq \frac{\alpha\theta}{1 - \beta(1 - \alpha)}$. Accordingly, an increase in the

supply of domestic capital leads to an unambiguous increase in welfare as long as $\delta \leq \frac{\alpha\theta}{1 - \beta(1 - \alpha)}$.

Based on the results presented in this section, it is clear that the shortrun and longrun effects on foreign investment, wage inequality and welfare can be significantly different and hence the on going debate regarding the cost and benefit of factor mobility has to be placed in the proper context (i.e., shortrun versus the longrun).

4. Concluding Remarks

This paper focuses on the impact of labour inflow and increase in the supply of sector specific domestic capital on wage inequality, foreign investment and welfare. The results presented in this paper are based on a simple general equilibrium model of a small open economy that produces one industrial

good and one agricultural good. The industrial good is produced by means of varieties of producer services, foreign capital and skilled labour. Varieties of producer services are produced by means of domestic capital and skilled labour whereas the agricultural good is produced by means of unskilled labour and domestic capital. Due to the presence of internal economies in the services sector, the production of industrial good is subject to external economies of scale. The results presented in this paper are based on the assumption that the income share of skilled labour in the services sector is larger than (or equal to) the income share of unskilled labour in the agricultural sector. The paper attempts to extend the existing literature by considering the shortrun as well as the longrun equilibrium.

Analysis of the shortrun equilibrium allows one to conclude that foreign investment in the industrial sector responds to variations in the output of varieties of producer services and the skilled wage rate – an increase in the output of each variety increases foreign investment whereas an increase in the skilled wage rate has the opposite effect. An increase in the skilled (unskilled) wage rate increases (decreases) welfare whereas increase in the output of each variety increases welfare only if the economic profit within the services sector is positive. Inflow of labour and increase in the supply of domestic capital affects wage inequality, foreign investment and welfare in the shortrun through its impact on the skilled wage rate, unskilled wage rate and the output of each variety. Inflow of skilled labour increases wage inequality and its impact on foreign investment and welfare is positive as long as the increase in the output of varieties is sufficiently large. Inflow of unskilled labour increases wage inequality and its effect on foreign investment and welfare is negative as long as the decrease in the output of varieties is sufficiently large. An increase in the supply of domestic capital decreases wage inequality and its impact on foreign investment and welfare is positive as long as the increase in the output of varieties is sufficiently large.

In the longrun, the number of varieties produced is endogenous and the output of each variety does not respond to labour inflow and/or increase in the supply of domestic capital. Consequently, the size of external economies in the industrial sector plays a crucial role in the longrun. Inflow of skilled labour leads to an unambiguous increase in wage inequality, foreign investment and welfare – the longrun effects are larger due to the presence of external economies. Inflow of unskilled labour decreases foreign investment and its impact on wage inequality and welfare is negative as long as the size of external

economies is sufficiently large. An increase in the supply of domestic capital increases foreign investment and its effect on wage inequality and welfare is positive as long as the size of external economies is sufficiently large.

Appendix

The impact of factor mobility on skilled and unskilled wage rate and the output of varieties of producer services in the shortrun can be examined by means of the following equations.

$$\begin{aligned} \hat{w}_s = & - \left[\frac{\alpha\theta(1-\gamma)}{\Delta} \right] \left[\frac{\{\mu L_y + (\lambda x)L_s\}K_z}{\mu + \lambda x} \right] \hat{L}_u - \left[\frac{\alpha\theta(1-\gamma)}{\Delta} \right] \left[\frac{nK_x(\lambda x)L_s}{\mu + \lambda x} \right] \hat{L}_s \\ & + \left[\frac{\alpha\theta(1-\gamma)}{\Delta} \right] \left[\frac{\{\mu L_y + (\lambda x)L_s\}K_d}{\mu + \lambda x} \right] \hat{K}_d \end{aligned} \quad (22)$$

$$\begin{aligned} \hat{w}_u = & - \left[\frac{\gamma\sigma}{\Delta} \right] \left[\frac{\{\mu L_y + (\lambda x)L_s\}K_z}{\mu + \lambda x} \right] \hat{L}_u - \left[\frac{\gamma\sigma}{\Delta} \right] \left[\frac{nK_x(\lambda x)L_s}{\mu + \lambda x} \right] \hat{L}_s \\ & + \left[\frac{\gamma\sigma}{\Delta} \right] \left[\frac{\{\mu L_y + (\lambda x)L_s\}K_d}{\mu + \lambda x} \right] \hat{K}_d \end{aligned} \quad (23)$$

$$\begin{aligned} \hat{x} = & - \left[\theta(1-\gamma)\{1-\beta(1-\alpha)\} \right] \left[\frac{K_z L_s}{\Delta} \right] \hat{L}_u \\ & + \left[\gamma\sigma K_z + (1-\gamma)\{\sigma(K_d - \theta nK_x) + \alpha\theta(1-\theta)nK_x\} \right] \left[\frac{L_s}{\Delta} \right] \hat{L}_s \\ & + \left[\theta(1-\gamma)\{1-\beta(1-\alpha)\} \right] \left[\frac{K_d L_s}{\Delta} \right] \hat{K}_d \end{aligned} \quad (24)$$

The impact of factor mobility on skilled and unskilled wage rate in the longrun can be examined by means of the following equations.

$$\begin{aligned} \hat{w}_u = & \left[\alpha\theta - \delta\{1-\beta(1-\alpha)\} \right] \left[\frac{\gamma K_z}{\delta\Delta} \right] \hat{L}_u - \left[\alpha \left(\frac{1-\delta}{\delta} \right) (1-\theta) + \sigma \right] \left[\frac{nK_x \gamma L_s}{\delta\Delta} \right] L_s \\ & - \left[\alpha\theta - \delta\{1-\beta(1-\alpha)\} \right] \left[\frac{\gamma K_d}{\delta\Delta} \right] \hat{K}_d \end{aligned} \quad (25)$$

$$\begin{aligned} \hat{w}_s = & \left[\frac{\alpha(1-\delta)}{\delta} \{ (1-\theta)(1-\gamma)nK_x + K_z \} - \alpha\theta(1-\gamma)nK_x \right] \left[\frac{L_s}{\Delta} \right] \hat{L}_s \\ & - \left[\frac{\alpha\theta(1-\gamma)K_z}{\delta\Delta} \right] \hat{L}_u + \left[\frac{\alpha\theta(1-\gamma)K_d}{\delta\Delta} \right] \hat{K}_d \end{aligned} \quad (26)$$

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