


Economic Reform, Skill Formation and Foreign Capital

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1. INTRODUCTION

 OVER the last two decades, official aid to developing countries has been increasingly replaced by movements of private capital, mainly in the form of foreign direct investments (FDI) by multinational enterprises (MNEs). The literature reveals that, among other important issues, growth and welfare implications of FDI for the recipient developing countries have attracted considerable attention from researchers and policymakers alike. A number of studies, which consider this issue include – although not limited to – those by Jones (1984); Beladi and Marjit (1992); Chao and Yu (1994a and 1994b); Marjit and Beladi (1996); Olarreaga (1996); Marjit et al. (1997); and Chaudhuri (2003a and 2003b), etc. These studies show that the growth and welfare-related implications of FDI would be different depending on the importance of factors such as capital gains repatriation, technology transfer, productivity, wage and export spillovers, the depths of political and economic involvements of MNEs, and the often invoked political question of ‘threats to national sovereignty’.

These studies have by and large bypassed another central issue: the role of MNEs in proliferating FDI flows and subsequently affecting growth and welfare. The discourse propagates along various dimensions with virtually unlimited contributions in each, for example, on *technology transfer* (Blomstrom et al., 1994; Marjit and Beladi, 1999; Xu, 2000; Driffield and Taylor, 2002; Chaudhuri, 2003a; Kabiraj and Marjit, 2003; and many others); effects of *productivity, wage and export spillovers* (Aitken et al., 1997; Aitken and Harrison, 1999; Blomstrom and Sjöholm, 1999; Fosfuri et al., 2001; Gorg and Strobl, 2001 etc.; and of course Gorg and Greenaway, 2004, for the most exhaustive survey); on the *economic and political importance of MNEs* (Bhagwati, 1972; Datta, 1979; Eden and Potter, 1993; and Vernon, 1993 etc.); *MNE activities in regime of economic reforms* in the poor countries and its implications on economic growth (Yu, 1982; Batra, 1986; Chao and Yu, 1994 and 1995; Beladi and Marjit, 1999; Graham and Wada, 2003; Kohpaiboon, 2003; and Nunnenkamp and Spatz, 2003), and so on.

Compared to these categories, the interaction between FDI flows and the labour markets of the recipient countries is a relatively new area of research, although its crucial connections with economic growth have been recognised (see Greenaway and Nelson, 2001).¹ In fact, a number of recent studies go on to discuss the impact of foreign capital on the demand for skill in the recipient countries, e.g. Berman et al. (1994 and 1998), Head and Ries (2002) and Pavcnik (2003). These and some of the other findings suggest that in countries well-endowed with human capital to start with, foreign capital flows in to use this stock, eventually bringing about skill-biased adjustments in sector-wise capital-labour ratios. Borensztein et al. (1998), Xu (2000), Noorbakhsh et al. (2001), Darrat et al. (2002), Das, G. (2002), Miyamoto (2002), and Yussof and Ismail (2002), etc., further conclude that FDI is positively associated with growth, but only where human capital is sufficiently high or is above a critical level to absorb technology diffusions.

Furthermore, Slaughter (2002) refers to empirical evidence on the positive relationship between FDI and the demand for skill, indicating that the process works mainly within the MNEs rather than through knowledge spillovers to domestic firms (see Kathuria, 2000, for empirical evidence on India broadly in accord with this hypothesis). In a nutshell, therefore, most studies in this genre account for the changes in demand for skill at the workplace when foreign capital flows in.

On the other hand, however, there seems to be little understanding of how inward FDI influences the supply of human capital in the developing countries (Ritchie, 2002; and Slaughter, 2002). We realise that this is an area of research in need of well-structured theoretical and empirical analyses, which undoubtedly should contribute towards a more comprehensive knowledge on the subject.

Our motivation to provide a positive and a fairly generalised theory of how foreign capital might influence the supply of skill in a poor country has been further strengthened by recent suggestions by Slaughter (2002). It hints at two different modes by which MNEs can positively contribute towards investment in human capital. One is the short-term firm-level activity whereby the host country labour force acquires skill from within the foreign firm, or through support extended by such firms to local educational institutions. MNEs can directly affect the supply of skilled labour as their transferred knowledge might

¹ This paper provides an elegant and comprehensive discussion of the large literature concerning foreign capital inflow in the developing countries. Section VI, in particular, provides an intriguing note on the labour market consequences of FDI in the developing countries, and discusses the trade-related wage gap debate at length. However, Baldwin (1995), Feenstra and Hanson (1996 and 1998), Markusen and Venables (1997), Davis (1998), Das, S. (2002) and Acemoglu (2003), also contribute to the FDI-related wage gap debate.

boost the skills of their own employees and of others in the domestic firms via spillovers.² The other method is the creation of a long-term macro environment to the extent that MNEs and their affiliates raise the demand for and the wages of skilled workers through technology transfer and capital investment, which in turn provides positive incentives for skill formation. Finally, if foreign firms grow, and if that yields larger tax revenue for the government, then state-funded education may benefit.³

Thus, we focus exclusively on the possible interactions between foreign capital inflow and skill formation, when a poor country initiates a regime of economic reforms. Interestingly, the demand for foreign capital is endogenous in our model and is determined simultaneously with the level of skill formation, so that the degree of complementarity between the two is suitably accounted for. Furthermore, observing that the debate on skilled-to-unskilled wage gap in the poor countries is rather inconclusive in nature, we reflect on the issue as a natural derivative of the central question.

In a regime of economic reforms, trade liberalisation often takes the centre stage and broadly includes tariff reduction in the manufacturing sector, agricultural trade liberalisation and a realignment of the national currency (which usually takes the form of currency devaluation). We address three specific questions when such a reform package is instrumented: first, does *trade liberalisation* promote skill formation and boost inflow of foreign capital in the economy? Second, how do incentives offered to foreign capital affect skill formation and skilled-unskilled wage inequality? Finally, is an increase in agricultural export price counterproductive for skill formation and foreign capital inflow? We assert that the question of trade openness and foreign capital inflow, in particular, is still rather important in the prevailing domain of international trade relations.

The remaining study is organised as follows. In Section 2 we present a model. Section 3 provides results from comparative static experiments and Section 4 concludes. Algebraic proofs in support of our main findings are relegated to the appendices.

² Hanson (2000) reports that Intel Corp. established a large assembly and testing facility in Costa Rica to expand high-school training in electronics and English under a mutual agreement with the government there.

³ Also see Dollar and Kraay (2000) for empirical findings along this line. However, both long-term and short-term prospects of skill acquisition driven by foreign capital inflow, as discussed here, may face insurmountable problems. While the short-term prospect is undoubtedly laden with standard problems of 'free-riding' associated with on-the-job training facilities and thus may not be a viable strategy for any firm to undertake, the long-term plan may face more severe difficulties. It is well known that MNEs employ various tools to avoid paying local taxes and to ensure full repatriation of capital gains, thus jeopardising the prospects of tax-led development financing in the host country.

2. THE MODEL

A representative economy comprises a traditional heavy import-competing sector X , an export sector Y that uses foreign capital, a skill formation sector S in which unskilled workers are trained to become skilled workers, and an agricultural export sector Z .⁴ Factor inputs are sector specific (an extension of Jones, 1971), in that X uses skilled labour and domestic capital, Y uses skilled labour and foreign capital, S uses unskilled labour and domestic capital while Z uses unskilled labour and land. Throughout the study we assume that sector Y , considered as the 'new technology' sector, is skill intensive compared to sector X .

The following symbols are used:

a_{ij}	= Input-output ratio in sector j , $j = X, Y, S, Z$
w_S	= Skilled wage
w	= Unskilled wage
r, r^*	= Rate of return on domestic and foreign capital respectively
π	= Premium on foreign capital
τ	= Rate of return on land
P_j^*	= World price of j th good
t	= Tariff rate in sector X
$\bar{U}, \bar{T}, \bar{K}$	= Stock of unskilled workers, land and domestic capital
K^*	= Foreign capital
S	= Skilled labour
'^'	= Percentage change.

The competitive (zero-profit, per unit cost equals per unit price) and full-employment conditions of this economy are as follows. Notations typically follow Jones (1965 and 1971).

$$a_{SX}w_S + a_{KX}r = P_X^*(1 + t) \quad (1)$$

$$a_{SY}w_S + a_{K^*Y}r^* = P_Y^* \quad (2)$$

$$a_{US}w + a_{KS}r = w_S \quad (3)$$

$$a_{UZ}w + a_{TZ}\tau = P_Z^* \quad (4)$$

⁴ It is considered a poor country, because it has a lower capital-labour ratio compared to the rest of the world. This further implies that it may be willing to offer a high premium per unit of foreign capital, as we have assumed.

$$a_{SX}X + a_{SY}Y = S \quad (5)$$

$$a_{US}S + a_{UZ}Z = \bar{U} \quad (6)$$

$$a_{KX}X + a_{KS}S = \bar{K} \quad (7)$$

$$a_{K^*Y}Y = K^* \quad (8)$$

$$a_{TZ}Z = \bar{T}. \quad (9)$$

The capital-scarce country offers a risk premium to every unit of foreign capital that flows into the country. We assume that the government offers ‘ πr ’ to every unit of foreign capital, either directly or as a subsidy to firms which hire foreign capital, where, $\pi > 1$.⁵ For example, foreign capital in the power sector in India demands a 16 per cent post-tax return in dollar terms, while NTPC (National Thermal Power Corporation of India) does not get any guaranteed rate (Kumar, 1999, p. 1002). Thus, if domestic capital gets a return of eight per cent, then the government sets $\pi = 2$ per unit of foreign capital. A higher return offered to foreign capital may also be driven by another important factor, often used in related analyses, that foreign capital and domestic capital are not homogeneous in characteristics. If foreign capital brings with it the advanced technology specifically needed for the sector, then π can be reinterpreted as the technology premium offered to foreign capital. In other words, this implies imperfect substitutability between domestic and foreign capital and is a direct manifestation of Jones (1971), where capital is similarly assumed to be sector specific, while labour is homogeneous and freely mobile.

The exact magnitude of π may be decided by negotiations between the government and the foreign investors. In practice, the magnitude of π negotiated may depend on the investor’s bargaining power and the host country’s rank in the risk index formulated by credit-rating agencies (viz. Moody’s) and sometimes those by the World Bank and the IMF. In the initial stage of attracting foreign capital, countries usually offer a high π and over time with sufficient inflow of capital they tend to reduce their offers. In this short-run model, π is, however, unique

⁵ Committing on an $r^* > r$ is standard practice for capital-scarce developing countries at least in the short run. Essentially, even if r^* is set equal to the domestic market-determined interest rate, favourable tax policy towards foreign capital – or similar other policies – may ensure real (net of tax) $r^* > r$. Alternatively, interpret the return on foreign capital as $r^* = r + \pi$, with $\pi > 0$ as the risk premium for every unit of foreign capital invested in the country. Interestingly, even if $\pi < 0$ (equivalent to $\pi < 1$ in the other case), it implies that government imposes a tax on each unit of foreign capital and yet foreign capital may flow in, since the limiting case for foreign capital inflow is $r^* < r_w$, where r_w is guaranteed outside option for the foreign capital. Therefore, even if $\pi < 0$, inflow of foreign capital is possible as long as, $r^* \geq r_w$.

and exogenous.⁶ Substituting $r^* = \pi r$ (or $r^* = r + \pi$) in equation (2) not only helps to determine the system, but also provides an added instrument, which the policy-maker might choose to manipulate when the interest rate is endogenous.

The nine equations above solve for nine input prices and quantity output variables (w_s, w, r, τ and X, Y, Z, S, K^*). Input coefficients, i.e. a_{ij} 's, are functions of factor prices and are determined once the factor prices are obtained. This is a full-employment model with perfectly competitive markets. Production functions follow standard neoclassical assumptions, such as constant returns to scale and diminishing returns to factor inputs. Thus, given π and commodity prices, determine w_s and r , simultaneously from equations (1) and (2). Substituting r and w_s in (3) determines w . Finally, from (4) obtain τ .

On the production side, equation (9) determines Z , given the total land resources available. As the stock of unskilled labour is also given exogenously, the equilibrium level of skill formation, S , is known from equation (6).⁷ Now, when S is determined, X is obtained from (7) and, subsequently, Y from (5). Finally, equation (8) determines K^* as a function of the level of output in Y , factor prices and technological coefficients.

3. CHANGES IN POLICY

Let us suppose that three mutually exclusive policy instruments are implemented in this economy. These include a tariff cut on the import-competing sector, an increment in π and an increase in the price of the agricultural export good, by order of appearance in subsections *a*, *b* and *c*. Subsection *d* additionally incorporates the policy of currency devaluation along with a tariff cut and an increment in π .

a. Tariff Reduction in the Protected Sector

Proposition 1: A tariff cut in the import-competing sector unambiguously promotes skill formation, induces greater inflow of foreign capital and reduces wage inequality between the skilled and the unskilled.

⁶ It is quite possible that π is a function of the critical level of risk determined endogenously when production takes place. This requires modelling the risk component of production explicitly and may be considered as a possible extension. In this case, however, the foreign investors and the government negotiate on an *ex-ante* level of risk and determine π .

⁷ One could think of a system of lottery for allocating unskilled workers between the skill formation sector and the agricultural production sector. In India, for example, state-run secondary schools operate a system of lottery for entry at the basic level. Obviously, those who cannot override the system by going to private facilities must wait for their turn. Thus, skill formation in this model is not the outcome of an individual's optimisation decision. Slaughter (2002) provides further discussion on incentives for skill formation.

Proof: An intuitive explanation is provided below while detailed technical derivations are contained in Appendix A.

Suppose that the government introduces trade liberalisation in the form of a lower tariff rate on the protected sector, so that, $\hat{t} < 0$, which immediately contracts output and employment in X . As sector X shrinks and return to domestic capital falls in this sector, capital moves to sector S and skilled labour to sector Y .⁸ Consequently, unskilled wage increases and the return to land falls. Both output and employment fall in the agricultural sector, and unskilled labour is released to join the skill formation sector. As skill turnouts from S increases, skill employment and output in sector Y increase and the demand for foreign capital increases. Thus, although the return to skill does not change, the wage gap between the skilled and the unskilled falls.

Essentially, therefore, a tariff cut in the import-competing sector lowers the wage inequality between the skilled and the unskilled, promotes skill formation and mobilises greater flow of foreign capital into the economy. Interestingly, none of these results depend on the factor intensity assumption across sectors, and should therefore be considered fairly general.

b. Increase in r^ ($\hat{\pi} > 0$)*

Proposition 2: A *ceteris paribus* increase in the interest rate offered to foreign capital reduces the rate of skill formation, lowers the rate of foreign capital inflow and lowers the wage gap, if sector Y is more skill-intensive compared to sector X .

Proof: An intuitive explanation is given below. See Appendix B for algebraic proof.

Suppose that due to lobbying by the MNEs or believing that this would attract more investments, the government upwardly revises the negotiated interest rate offered to foreign capital. This in practice can be a decision in favour of the longer tax holidays offered, exemption from meeting social obligations (foreign banks in most developing countries are exempt from priority sector lending obligations) etc. that effectively increases the return to foreign capital. To provide a tractable analysis, we use $\hat{\pi} > 0$ to reflect such renegotiation.

Interestingly, this generates a number of counterproductive results under the assumption that sector Y is more skill-intensive in comparison to sector X . An increase in π lowers the return to skill in sector Y at an unchanged price level.

⁸ This is broadly in agreement with the empirical evidences in many post-reform economies, where the traditional import-competing sectors have contracted. Moreover, the financial institutions in the post-reform decades have started offering substantial amounts of higher-education-related loans that were not available earlier.

Skilled workers relocate themselves in the traditional import-competing sector, where w_s falls consequently, and r rises. Domestic capital from sector S finds it more rewarding to relocate in sector X , leading to an increase in the equilibrium r in the former. Under competitive conditions, this implies a fall in w , so that unskilled labour moves back to sector Z , causing an expansion in employment and output there. Therefore, an upward revision of π increases output and employment in X and Z at the cost of both the new technology sector and the skill formation sector. Consequently, the demand for foreign capital falls in the economy.

The moral of the story is that by offering higher incentives to per unit foreign capital, the policy actually penalises sector Y . The contraction of output in sector Y lowers the demand for foreign capital into the country – an outcome contrary to expectations and often not internalised when policies yield to lobbying pressures.

*c. Increase in the World Price of the Agricultural Commodity –
A Rise in P_Z^**

Proposition 3: A *ceteris paribus* increase in the export price of agricultural good causes a drop in skill formation and lowers the rate of inflow of foreign capital into the country.

Proof: An intuitive proof is given below and see Appendix C for details.

A rise in the world price of agricultural good (due to, say, liberalisation of trade in agriculture in the poor countries or the removal of farm subsidy in the OECD countries) will neither favour skill formation in the economy, nor reduce the existing wage gap between the skilled and the unskilled. Since return to land alone increases and agricultural output grows, skill turnout must suffer. Thus capital is released from this sector and relocates in sector X , which expands by drawing labour away from Y . Consequently, output falls in this sector and the rate of foreign capital inflow must also fall. However, the state of existing wage inequality between the skilled and the unskilled does not change.

d. A Generalised Result with Exchange Rate Devaluation

Proposition 4: If sector Y is relatively skill-intensive compared to sector X , then the proposed rate of currency devaluation must lie within two critical bounds for positive skill formation, larger foreign capital inflows and lower wage inequality in the country:

$$\frac{\theta_{SY}}{\theta_{SX} - \theta_{SY}} \left[\alpha \hat{t} + \frac{\theta_{SX}}{\theta_{SY}} \theta_{K^*Y} \hat{\pi} \right] < \hat{e} < \frac{\theta_{K^*Y}}{\theta_{KX} - \theta_{K^*Y}} \left[\alpha \hat{t} + \theta_{KX} \hat{\pi} \right].$$

Proof: An intuitive explanation is provided below and Appendix D offers detailed proof.

Since most economic reforms, at least in the recent past, have been undertaken as a package where more than one instrument of change has been implemented simultaneously, we offer a similar experiment, where the representative country lowers the tariff rate ($\hat{t} < 0$), offers higher incentive to foreign capital ($\hat{\pi} > 0$) and performs a currency devaluation at the same time. In order to accommodate these simultaneous changes, a partial reformulation of the general equilibrium set of equations is required, in that all international prices are expressed in domestic terms, where $P_j = eP_j^*$, with e as the exchange rate between international and domestic currencies. The exchange rate devaluation implies $\hat{e} > 0$.

If the proposed rate of currency devaluation lies within two critical bounds characterised by a linear combination of $\hat{t} < 0$ and $\hat{\pi} > 0$, then this unambiguously leads to an increase in the skilled wage, a fall in the domestic interest rate, relatively greater increase in unskilled wage and a fall in the return to land. Consequently, a contraction in the agricultural sector would be followed by an increase in the level of skill formation, a contraction in X and finally an increase in Y . The demand for foreign capital would eventually increase in the economy. The interesting implication of the result (which can be enriched further by bringing in liberalisation of agricultural trade) is that the outcomes may be quite different if the rate of devaluation lies outside the critical bounds. This further indicates that unless the decisions are strongly centralised and there exists perfect coordination between the different policy-making units, the outcomes may easily bypass the target.

4. CONCLUDING REMARKS

This study attempts to explore the link between foreign capital inflow and skill formation in a small open economy, which undertakes a policy of economic reforms. Generally speaking, this study should be useful in understanding the degree of complementarity between foreign capital inflow and skill formation in an economy when exogenous policy shocks develop. The exogenous changes we have accounted for include liberalising industrial imports, offering higher incentives to foreign capital for promoting exports and liberalising agricultural trade. We also consider currency devaluation, a policy which many developing countries have used in the recent past and might resort to in the future.

The main findings of this study should be able to attract reasonable attention from policymakers in the developing countries. We show that liberalisation of the import-competing sector unambiguously increases the level of skill formation, increases output in the new technology sector with improved prospect for exports and creates greater demand for foreign capital. On the other hand, a *ceteris paribus*

increment in the rate of return to foreign capital proves counterproductive in the sense that it actually contracts the export sector and lowers the demand for foreign capital. Furthermore, growth in agricultural exports may also hurt the modern export sector. A growing agricultural sector employs more unskilled labour, reduces the level of skill formation and causes capital to relocate away from S to the protected import-competing sector. As more capital flows into sector X , it draws skilled workers away from the modern export sector. Finally, the country is assumed to implement a policy of currency devaluation alongside trade liberalisation. We obtain a critical bound within which the rate of currency devaluation must exist, in order for the country to experience higher skill formation, higher export growth and lower wage inequality. In addition throughout the study, we have tried to emphasise the effect of foreign capital inflow and skill formation on the level of skilled-to-unskilled wage inequality. We show that import liberalisation can easily be treated as the first-best policy, not only because of its positive impacts on skill formation and export growth, but also because of its unambiguous role in lowering wage inequality. However, wage inequality may be still lower when foreign capital receives a higher negotiated return, only if the 'new' export sector is more skill-intensive than the import-competing sector. Agricultural trade liberalisation leaves the state of wage inequality unchanged, while currency devaluation can lower wage inequality, but only under very restrictive conditions.

However, none of these results have any further normative implications associated with it, except that on wage inequality. We believe that a full-fledged welfare analysis of the present exercise should be of considerable importance to concerned institutions. There is also little doubt that skill formation, being essentially a dynamic concept, would methodologically be better dealt with in a model with continuous time. Extending this concept along these lines might be a fairer treatment of the problem, although the basic outcomes may not be much different.

APPENDIX A

Notations and derivations follow Jones (1965). Applying the Envelope Theorem on equations (1)–(4), we obtain the following changes, with $\theta_{ij} = a_{ij}w_i/P_j$, i.e. the income share of the i th factor in the j th sector, and $\lambda_{ij} = a_{ij}X_j/L_i$, i.e. input share of the j th commodity in the i th factor.

$$\text{From (1)} \quad \theta_{SX}\hat{w}_S + \theta_{KX}\hat{r} = \alpha\hat{t} < 0, \quad \text{where } \alpha = \frac{t}{1+t}$$

$$\text{From (2)} \quad \theta_{SY}\hat{w}_S = 0$$

$$\text{From (3)} \quad \theta_{US}\hat{w} + \theta_{KS}\hat{r} = \hat{w}_S$$

$$\text{From (4)} \quad \theta_{UZ}\hat{w} + \theta_{TZ}\hat{t} = 0.$$

These solve for the factor prices:

$$[\hat{w}_s = 0]; \quad [\hat{r} = (\alpha\hat{t}/\theta_{KX}) < 0]; \quad \left[\left(\hat{w} = -\frac{\theta_{KS}}{\theta_{US}\theta_{KX}}\alpha\hat{t} \right) > 0 \right];$$

$$\left[\left(\hat{t} = \frac{\theta_{UZ}}{\theta_{TZ}}\frac{\theta_{KS}}{\theta_{US}\theta_{KX}}\alpha\hat{t} \right) < 0 \right] \text{ as } \hat{t} < 0 \quad \text{(AI.1)}$$

Evidently, $(\hat{w}_s - \hat{w}) < 0$.

Differentiating (9) and using relations in (A.1):

$$\hat{Z} = -\hat{a}_{TZ} = [-\sigma_z\theta_{UZ}(\hat{w} - \hat{t})] < 0.$$

Thus production in the agricultural sector falls and employment in that sector falls as well, $\hat{U}_z < 0$. Thus more unskilled labour can be accommodated in the skill formation sector, especially when capital also flows in from the contracting import-competing sector. So, using equation (6):

$$\hat{S} = \left[-\frac{\lambda_{UZ}}{\lambda_{US}}\hat{Z} + \sigma_s\theta_{KS}(\hat{w} - \hat{r}) + \frac{\lambda_{UZ}}{\lambda_{US}}\sigma_z\theta_{TZ}(\hat{w} - \hat{t}) \right] > 0.$$

Again, from (7),

$$\hat{X} = \left\{ -\frac{\lambda_{KS}}{\lambda_{KX}}[\hat{S} + \sigma_s\theta_{US}(\hat{w} - \hat{r})] - \sigma_x\theta_{SX}(-\hat{r}) \right\} < 0 \quad \text{and} \quad \hat{S}_x < 0.$$

Now, using equation (5),

$$\hat{Y} = \left\{ \frac{1}{\lambda_{SY}}\hat{S} - \frac{\lambda_{SX}}{\lambda_{SY}}[\hat{X} - \sigma_x\theta_{KX}(-\hat{r})] \right\} > 0.$$

Expansion of sector Y would now initiate greater flow of foreign capital into the economy.

$$\hat{K}^* = \lambda_{K^*Y}[\sigma_Y\theta_{SY}(\hat{w}_s - \hat{r}^*) + \hat{Y}] = \lambda_{K^*Y}\hat{Y} > 0. \quad \text{Q.E.D.}$$

APPENDIX B

Suppose we rewrite equation (2) as:

$$a_{SY}w_s + a_{K^*Y}(r + \pi) = P_{\hat{Y}}^* \quad (2)'$$

and $\hat{\pi} > 0$ implies:

$$\hat{r}^* = \hat{r} + \hat{\pi}.$$

$$\text{Thus from (2)'} \quad \theta_{SY}\hat{w}_S + \theta_{K^*Y}(\hat{r} + \hat{\pi}) = 0$$

$$\text{Also, from (1)} \quad \theta_{SX}\hat{w}_S + \theta_{KX}\hat{r} = 0$$

$$\text{From (3)} \quad \theta_{US}\hat{w} + \theta_{KS}\hat{r} = \hat{w}_S$$

$$\text{From (4)} \quad \theta_{UZ}\hat{w} + \theta_{TZ}\hat{r} = 0.$$

Using (1) and (2)' above and applying Cramer's rule:

$$\begin{bmatrix} \theta_{SY} & \theta_{K^*Y} \\ \theta_{SX} & \theta_{KX} \end{bmatrix} \begin{bmatrix} \hat{w}_S \\ \hat{r} \end{bmatrix} = \begin{bmatrix} -\theta_{K^*Y}\hat{\pi} \\ 0 \end{bmatrix}$$

solves for \hat{r} and \hat{w}_S .

$\hat{w}_S = (-\theta_{K^*Y}\theta_{KX}\hat{\pi}/\Delta) < 0$, where $\Delta = (\theta_{SY}\theta_{KX} - \theta_{SX}\theta_{K^*Y}) > 0$, which measures the difference between skill-to-capital shares between sectors X and Y. Sector Y has a larger skill-to-capital share by assumption.

Similarly,

$$\hat{r} = \frac{\theta_{K^*Y}\hat{\pi}}{\Delta} > 0.$$

Using equation (3),

$$\hat{w} = -\frac{\theta_{K^*Y}\hat{\pi}}{\theta_{US}\Delta}(\theta_{KX} + \theta_{KS}) < 0.$$

Thus,

$$\frac{\hat{w}}{\hat{w}_S} > 1, \quad \text{iff} \quad \frac{1}{\theta_{US}} \left[1 + \frac{\theta_{KS}}{\theta_{KX}} \right] > 1.$$

Reformulating, $[1 + (\theta_{KS}/\theta_{KX}) > \theta_{US}]$, with $\theta_{US} \leq 1$, $(\theta_{KS}/\theta_{KX}) > 0$ and the condition is always satisfied such that wage inequality must fall.

Finally, $\hat{\tau} > 0$.

Following the above procedure, the changes in output for sectors X, Y, S and Z follow:

$$\hat{Z} > 0, \quad \hat{S} < 0, \quad \hat{X} > 0, \quad \hat{Y} < 0, \quad \hat{K}^* < 0. \quad (\text{B.1})$$

Q.E.D.

APPENDIX C

In this particular case, the only beneficiary is the specific factor in the agricultural sector:

$$[\hat{w}_S = 0]; \quad [\hat{r} = 0]; \quad [\hat{r}^* = 0]; \quad [\hat{w} = 0]; \quad \left[\left(\hat{\tau} = \frac{\hat{P}_Z^*}{\theta_{TZ}} \right) > 0 \right].$$

On the other hand, sectors Z and X benefit from higher agricultural price level, while Y and S suffer unambiguously:

$$\hat{Z} > 0, \quad \hat{S} < 0, \quad \hat{X} > 0, \quad \hat{Y} < 0, \quad \hat{K}^* < 0. \tag{AII.1}$$

Q.E.D.

APPENDIX D

From (1) $\theta_{SX}\hat{w}_S + \theta_{KX}\hat{r} = \hat{e} + \alpha\hat{t}$

From (2)' $\theta_{SY}\hat{w}_S + \theta_{K^*Y}(\hat{r} + \hat{\pi}) = \hat{e}$

From (3) $\theta_{US}\hat{w} + \theta_{KS}\hat{r} = \hat{w}_S$

From (4) $\theta_{UZ}\hat{w} + \theta_{TZ}\hat{\tau} = \hat{e}$.

Using (1) and (2)' applying Cramer's rule:

$$\begin{bmatrix} \theta_{SX} & \theta_{KX} \\ \theta_{SY} & \theta_{K^*Y} \end{bmatrix} \begin{bmatrix} \hat{w}_S \\ \hat{r} \end{bmatrix} = \begin{bmatrix} \hat{e} + \alpha\hat{t} \\ \hat{e} - \hat{\pi}\theta_{K^*Y} \end{bmatrix}$$

solves for \hat{w}_S and \hat{r} , as:

$$\hat{w}_S = \frac{\theta_{K^*Y}(\hat{e} + \alpha\hat{t}) - \theta_{KX}(\hat{e} - \theta_{K^*Y}\hat{\pi})}{\Delta},$$

where $\Delta = (\theta_{SX}\theta_{K^*Y} - \theta_{SY}\theta_{KX}) < 0$ and

$$\hat{r} = \frac{-\theta_{SY}(\hat{e} + \alpha\hat{t}) + \theta_{SX}(\hat{e} - \theta_{K^*Y}\hat{\pi})}{\Delta}.$$

Thus:

$$\hat{w}_S > 0 \text{ and } \hat{r} < 0, \quad \text{iff } \frac{\theta_{SY}}{\theta_{SX} - \theta_{SY}} \left[\alpha\hat{t} + \frac{\theta_{SX}}{\theta_{SY}} \theta_{K^*Y} \hat{\pi} \right] < \hat{e} < \frac{\theta_{K^*Y}}{\theta_{KX} - \theta_{K^*Y}} [\alpha\hat{t} + \theta_{KX}\hat{\pi}], \tag{D.1}$$

where $\hat{e} > 0$, $\hat{t} < 0$, $\hat{\pi} > 0$.

Subject to fulfilment of condition (AIII.1), $\hat{w}_S > 0$, $\hat{r} < 0$, $\hat{w} > 0$, $\hat{t} < 0$. Consequently, $\hat{Z} < 0$, $\hat{S} > 0$, $\hat{X} < 0$, $\hat{Y} > 0$ and $\hat{K}^* > 0$.

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