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South–South Trade and Skill Premia

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1. INTRODUCTION

THE 2 × 2 × 2 Heckscher–Ohlin model predicts that trade openness induces countries to export the good that intensively uses the relatively abundant factor of production and import the good that intensively uses the relatively scarce factor of production. Accordingly, skill-abundant developed countries are expected to export the good that intensively uses skilled workers. Thus, trade liberalisation contributes to an increase in the relative price of the skilled-intensive good, a rise in the relative demand for skilled workers and consequently an increase in the skill premium, while skill-scarce developing countries are expected to export the good that intensively uses unskilled workers. Thus, trade liberalisation contributes to an increase in the relative price of the unskilled-intensive good, a rise in the relative demand for unskilled workers and consequently a decrease in the skill premium. Theoretical predictions, however, are not supported by empirical evidence. Some developing countries experienced an increase in the skill premium, while others witnessed a decline after trade liberalisation. The evidence is documented by Hanson and Harrison (1995), Robbins (1996), Wood (1997), Freeman and Oostendorp (2001) and Goldberg and Pavcnik (2004). Figure 1(a–e) also shows the skill premium decreasing with openness in some countries, while Figure 1(f–j) shows the skill premium increasing with openness in other countries.[1]

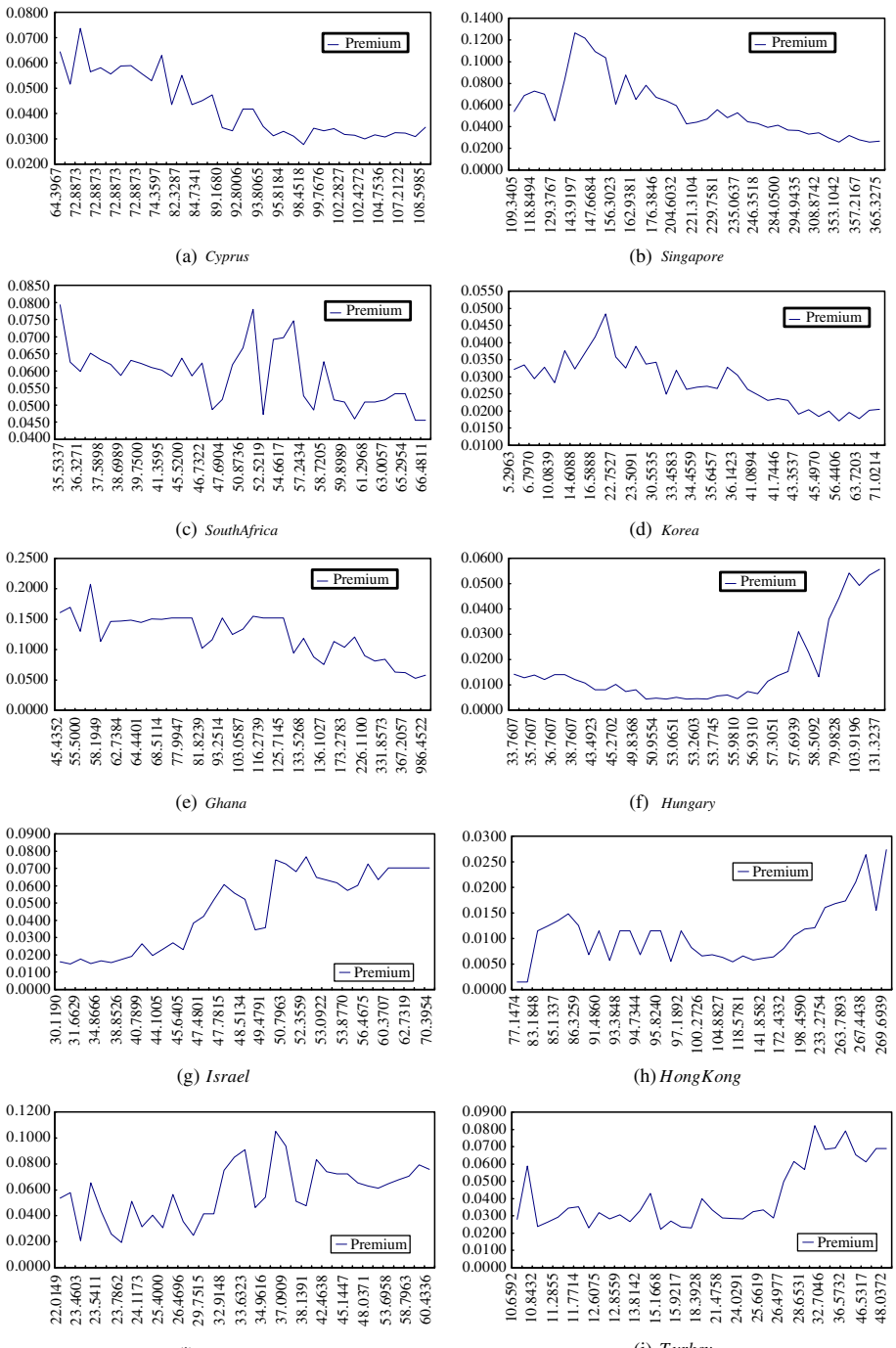
Several studies attempted to address this puzzle to resolve the inconsistency between the predictions of the theory and the empirical evidence. The first stream attributed the increase in the skill premium in the South to outsourcing and technology transfer. For instance, Feenstra and Hanson (1995) argue that outsourcing shifts a portion of input production from the North to the South. As this portion is the most skilled-intensive in the South, outsourcing increases relative skill demand and the skill premium in both countries. Similarly, Zhu (2004), and Zhu and Trefler (2005) argue that if the North loses competitiveness in unskilled-intensive products, a process of technology transfer is induced where the production of unskilled-intensive goods is relocated to the South. The relocated goods are the most skilled-intensive by Southern standards. This Southern catch-up raises the relative demand for skilled workers and thus exacerbates wage inequality.

Xu (2003) shows that in a framework, where there are non-traded goods whose range is endogenously determined by the level of trade barriers, a tariff reduction causes an expansion in the South's import range, which increases the demand for skilled workers in the North. This causes an increase in the North's skilled labour cost which leads the South to expand its export range. The increase in the export ranges of both countries leads to an increase in skill demand and wage inequality. In addition, Beaulieu et al. (2004) argue that a reduction in

I thank Firat Demir and Sherine El Hag. Remaining errors are my own.

[1] The skill premium data are compiled by the University of Texas Inequality Project. The trade data are compiled by the United Nations Commodity Trade Statistics Database.

FIGURE 1
Trade Openness and the Skill Premium in Developing Countries



(a) *Cyprus* (b) *Singapore*

(c) *SouthAfrica* (d) *Korea*

(e) *Ghana* (f) *Hungary*

(g) *Israel* (h) *HongKong*

(i) *Chile* (j) *Turkey*

trade barriers within the high-tech sector can raise the demand for these products in both countries and increase the demand for skilled labour and in wage inequality.

Other studies argued that trade induces skill-biased technological change. Acemoglu (2002, 2003) shows that trade creates a tendency for the relative price of skilled-intensive goods to increase in the North. This change makes the technologies used in the production of these goods more profitable to develop and encourages skill-biased technical change, which contributes to the increase in wage inequality. Since the South imitates the North technologies that are becoming more skill-biased, it experiences an increase in the skill premium as well. Thoenig and Verdier (2003) argue that when globalisation triggers an increased threat of technological leapfrogging, firms respond by biasing the direction of their innovations towards skilled-intensive technologies. In a model where only the North innovates and the South imitates, openness causes defensive skill-biased technical change in the North and technical upgrading in the production of the imitated goods in the South to more skilled-intensive ones. This generates an increase in wage inequality in the North and in the South.

As much as these studies provide insights on the factors generating an increase in the skill premium in the North and in the South, they do not address the asymmetry of the response of the skill premium to trade openness between developing countries. This paper attempts to reconcile the empirical evidence with the theoretical predictions by introducing a model where the direction of trade can produce the observed patterns of skill premia in the South. The model developed in this paper is an extension of Xu (2003) to consider the aspect of South–South trade. In this context of endogenously determined non-traded goods, South–South trade expands the import range of the country that reduces the tariff. This increases the demand for and the cost of skilled workers in the other country. This increase in the cost of skilled workers in the other country leads the country that reduces the tariff to expand its export range and reduce its import range. Therefore, the country that reduces the tariff experiences an increase in its export range, which leads to an increase in the skill premium. As the impact on the import range is ambiguous, it is possible that the other country experiences a decline in the skill premium.

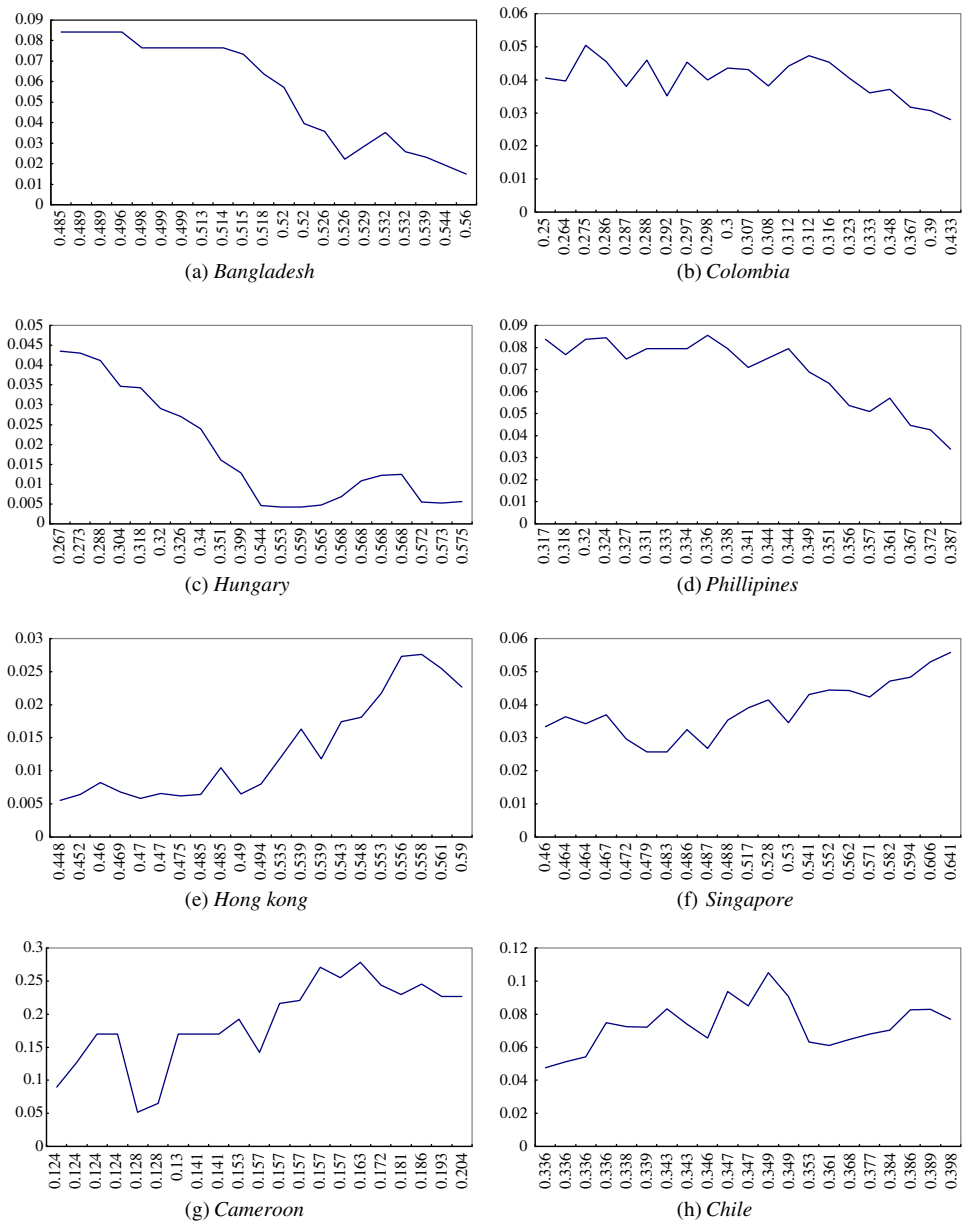
The remainder of the paper is organised as follows: Section 2 includes the observations on South–South trade, Section 3 includes the model, and Section 4 concludes.

2. SOUTH–SOUTH TRADE

This paper attempts to reconcile the empirical evidence with the theoretical predictions by considering the aspect of the South–South trade. Some studies provided evidence as to the increase in trade linkages between developing countries and the increasing significance of South–South trade. Dahi and Demir (2008) show that South–South trade in manufactures grew at an annual rate of 18.3 per cent during the period from 1970 to 2003. The authors also use the United Nations Commodity Trade Statistics to show that the share of the South in world manufactures exports increased from 5 per cent in 1978 to 36 per cent in 2005, while the share of the South–South manufactures exports increased to 16 per cent in 2005 from 2 per cent in 1978. In addition, Dahi and Demir (2008) show that the Southern share of skill-intensive manufactures reached 35 per cent in 2005 compared to 2 per cent in 1978, with an average annual growth rate of 10 per cent. The data also show that more than half of Southern skill-intensive manufactures exports are destined for the South.

This evidence show the growing significance of South–South trade in world trade. Figure 2 shows the relationship between the skill premium and the share of South–South trade out of

FIGURE 2
South–South Trade Openness and the Skill Premium in Developing Countries



total trade in each country. The trade data are extracted from the United Nations Commodity Trade Statistics Database. The skill premium data are compiled by the University of Texas Inequality Project. Using this data, Figure 2(a–d) shows the skill premium decreasing with South–South trade openness in some countries, while Figure 2(e–h) show the skill premium

increasing with South–South trade openness in other countries. These observations indicate a relationship between South–South trade and the asymmetric response of the skill premium to trade openness in developing countries.

3. MODEL

Consider a model with three countries, indexed by $i \in (1,2,3)$. Country 3 is considered the North, while countries 1 and 2 are considered the South. The countries produce a good modelled as a continuum over the interval $z \in [0,1]$. The production of these goods utilises skilled labour as input. One unit of good z requires $a_i(z)$ units of skilled labour in country i. Country i is endowed with H_i skilled labour. L_1 is the unskilled labour in country 1, and L_2 is the unskilled labour in country 2. There is no unskilled labour in country 3.

a. Traded and Non-traded Goods

Suppose country i imposes a uniform ad valorem tariff t_i on imports. Denote w_i^h as the wage of skilled labour in country i. With perfect competition, the price of good z in country 2 equals $a_2(z)w_2^h$ if domestically produced, and $(1 + t_2)a_3(z)w_3^h$ if imported from country 3. Thus, country 2 imports good z from country 3 if and only if $a_2(z)w_2^h \geq (1 + t_2)a_3(z)w_3^h$. The equality defines the borderline import good z_{23}^m as follows

$$\begin{aligned} a_2\left(z_{23}^m\right)w_2^h &= (1+t_2)a_3\left(z_{23}^m\right)w_3^h, \\ \frac{a_3\left(z_{23}^m\right)}{a_2\left(z_{23}^m\right)} &= \frac{w_2^h}{(1+t_2)w_3^h}. \end{aligned} \tag{1}$$

Assuming $(\partial(a_3(z)/a_2(z))/\partial z) < 0$, country 2 imports all goods $z \geq z_{23}^m$ from country 3.

Similarly, the price of good z in country 2 equals $a_2(z)w_2^h$ if domestically produced, and $(1 + t_2)a_1(z)w_1^h$ if imported from country 1. Thus, country 2 imports good z from country 1 if and only if $a_2(z)w_2^h \geq (1 + t_2)a_1(z)w_1^h$. The equality defines the borderline import good z_{21}^m as follows

$$\begin{aligned} a_2\left(z_{21}^m\right)w_2^h &= (1+t_2)a_1\left(z_{21}^m\right)w_1^h, \\ \frac{a_1\left(z_{21}^m\right)}{a_2\left(z_{21}^m\right)} &= \frac{w_2^h}{(1+t_2)w_1^h}. \end{aligned} \tag{2}$$

Assuming $(\partial(a_1(z)/a_2(z))/\partial z) > 0$, country 2 imports all goods $z \leq z_{21}^m$ from country 1.

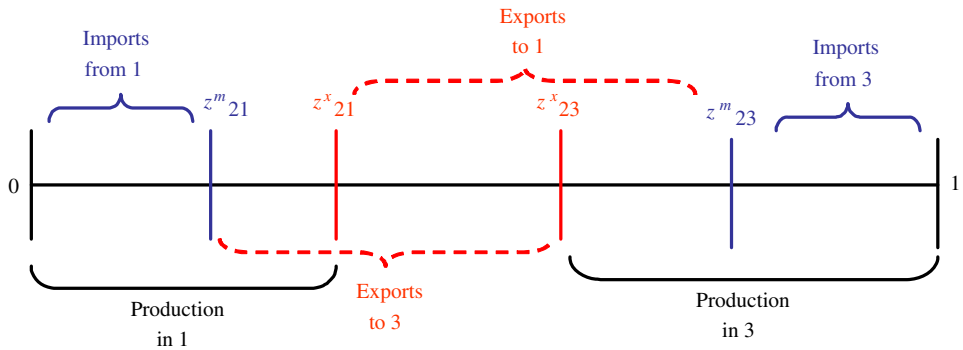
Country 2 exports good z to country 3 if and only if $(1 + t_3)a_2(z)w_2^h \leq a_3(z)w_3^h$. The equality defines the borderline export good z_{23}^x as follows

$$\begin{aligned} (1+t_3)a_2\left(z_{23}^x\right)w_2^h &= a_3\left(z_{23}^x\right)w_3^h, \\ \frac{a_3\left(z_{23}^x\right)}{a_2\left(z_{23}^x\right)} &= \frac{(1+t_3)w_2^h}{w_3^h}. \end{aligned} \tag{3}$$

Thus, country 2 exports all goods $z_{21}^m < z \leq z_{23}^x$ to country 3.

Similarly, country 2 exports good z to country 1 if and only if $(1 + t_1)a_2(z)w_2^h \leq a_1(z)w_1^h$. The equality defines the borderline export good z_{21}^x as follows

FIGURE 3
Endogenously Determined Traded and Non-traded Goods



$$(1+t_1)a_2\left(z_{21}^x\right)w_2^h = a_1\left(z_{21}^x\right)w_1^h,$$
$$\frac{a_1\left(z_{21}^x\right)}{a_2\left(z_{21}^x\right)} = \frac{(1+t_1)w_2^h}{w_1^h}. \tag{4}$$

Thus, country 2 exports all goods $z_{21}^x \leq z < z_{23}^m$ to country 1.

If either tariff, t_2 or t_3, is positive, then $z_{23}^m > z_{23}^x$, and if either tariff, t_1 or t_2, is positive, then $z_{21}^m < z_{21}^x$. Assume $z_{23}^x > z_{21}^x$, then Figure 3 shows the ranges of imports and exports of country 2. According to Figure 3, country 2 imports the goods in the range $\left[0, z_{21}^m\right]$ from country 1, exports the goods in the range $\left(z_{21}^m, z_{23}^x\right]$ to country 3, exports the goods in the range $\left[z_{21}^x, z_{23}^m\right)$ to country 1 and imports the goods in the range $\left[z_{23}^m, 1\right]$ from country 3. The domestic production in country 1 is in the range of $[0, z_{21}^x)$, while the domestic production in country 3 is in the range of $\left(z_{23}^x, 1\right]$. That implies that the goods in the range $\left(z_{21}^m, z_{21}^x\right)$ are non-traded between country 2 and country 1, while the goods in the range $\left(z_{23}^x, z_{23}^m\right)$ are non-traded between country 2 and country 3.

b. Labour Market

With inelastic factor supply, wages are determined by factor demand which is derived from commodity demand. Assume that consumers have identical Cobb-Douglas preferences, with λ being the expenditure share on the continuum of manufactured goods. Further assume that all manufactured goods receive an equal share in expenditure. Denote E_i as the total expenditure of country i.

(i) Country 2

Consumers in country 2 spend λE_2 on good z at the price $a_2(z)w_2^h$. So, they consume $\left(\lambda E_2/\left(a_2(z)w_2^h\right)\right)$ units of the good. Given that the unit skill requirement is $a_2(z)$, this consumption implies a skill demand of $\left(\lambda E_2/\left(a_2(z)w_2^h\right)\right)a_2(z)$. The range of goods consumed by consumers in country 2 is $\left[z_{21}^m, z_{23}^m\right]$. So, domestic consumption generates a total demand for country 2 skilled labour equals to $\left(\lambda E_2/w_2^h\right)\left(z_{23}^m - z_{21}^m\right)$.

Let E_3 be the total expenditure of country 3. Consumers in country 3 spend λE_3 on good z, exported by country 2, at a price of $(1 + t_3)a_2(z)w_2^h$. This implies that they consume $\lambda E_3/\big((1 + t_3)a_2(z)w_2^h\big)$ units of the good. Given that the unit skill requirement is $a_2(z)$, this consumption implies a skill demand of $\big(\lambda E_3/\big((1 + t_3)a_2(z)w_2^h\big)\big)a_2(z)$. The range of country 2 goods consumed by consumers in country 3 is $(z_{21}^m, z_{23}^x]$. So, consumption in country 3 generates a total demand for country 2 skilled labour equals to $\big(\lambda E_3/\big((1 + t_3)w_2^h\big)\big)\big(z_{23}^x - z_{21}^m\big)$.

Let E_1 be the total expenditure of country 1. Consumers in country 1 spend λE_1 on good z, exported by country 2, at a price of $(1 + t_1)a_2(z)w_2^h$. This implies that they consume $\lambda E_1/\big((1 + t_1)a_2(z)w_2^h\big)$ units of the good. Given that the unit skill requirement is $a_2(z)$, this consumption implies a skill demand of $\big(\lambda E_1/\big((1 + t_1)a_2(z)w_2^h\big)\big)a_2(z)$. The range of country 2 goods consumed by consumers in country 1 is $[z_{21}^x, z_{23}^m)$. So, consumption in country 1 generates a total demand for country 2's skilled labour equal to $\big(\lambda E_1/\big((1 + t_1)w_2^h\big)\big)\big(z_{23}^m - z_{21}^x\big)$.

Adding the domestic and foreign components of skill demand, the full employment condition for skilled labour in country 2 is given by

$$\left(\frac{\lambda E_2}{w_2^h}\right)\big(z_{23}^m - z_{21}^m\big) + \left(\frac{\lambda E_3}{(1+t_3)w_2^h}\right)\big(z_{23}^x - z_{21}^m\big) + \left(\frac{\lambda E_1}{(1+t_1)w_2^h}\right)\big(z_{23}^m - z_{21}^x\big) = H_2. \tag{5}$$

The demand for unskilled labour is generated by food consumption. Denote w_2^l as the unskilled wage in country 2. We choose units such that one unit of food requires one unit of unskilled labour. Using food as the numeraire, $w_2^l = 1$. Consumers in country 2 spend $(1 - \lambda)E_2$ on food at the price of one. Consumers in country 3 spend $(1 - \lambda)E_3$ on food at the price $(1 + t_3)$, and consumers in country 1 spend $(1 - \lambda)E_1$ on food at the price $(1 + t_1)$. Thus, the full employment condition for unskilled labour in country 2 is

$$(1-\lambda)E_2 + \frac{(1-\lambda)E_3}{(1+t_3)} + \frac{(1-\lambda)E_1}{(1+t_1)} = L_2. \tag{6}$$

Similarly, the full employment condition for unskilled labour in country 1 is

$$(1-\lambda)\frac{E_2}{(1+t_2)} + \frac{(1-\lambda)E_3}{(1+t_3)} + (1-\lambda)E_1 = L_1. \tag{7}$$

Dividing equation (5) by equation (6) yields the following expression for the skill premium in country 2.

$$\big[\big(z_{23}^m - z_{21}^m\big)\xi_2 + \big(z_{23}^x - z_{21}^m\big)\xi_3 + \big(z_{23}^m - z_{21}^x\big)\xi_1\big]\left(\frac{\lambda}{1-\lambda}\right)\frac{L_2}{H_2} = w_2^h, \tag{8}$$

where

$$\xi_2 = \frac{E_2}{E_2 + \frac{E_3}{(1+t_3)} + \frac{E_1}{(1+t_1)}},$$

is country 2 share of world income,

$$\xi_3 = \frac{\frac{E_3}{(1+t_3)}}{E_2 + \frac{E_3}{(1+t_3)} + \frac{E_1}{(1+t_1)}},$$

is country 3 share of world income, and $\xi_1 = (1 - \xi_2 - \xi_3)$ is country 1 share of world income.

(ii) Country 3

Consumers in country 2 spend λE_2 on good z, imported from country 3, at the price $(1 + t_2)a_3(z)w_3^h$. So, they consume $\lambda E_2/\left((1 + t_2)a_3(z)w_3^h\right)$ units of the good. Given that the unit skill requirement is $a_3(z)$, this consumption implies a skill demand of $\left(\lambda E_2/\left((1 + t_2)a_3(z)w_3^h\right)\right)a_3(z)$. The range of country 3 goods consumed by consumers in country 2 is $\left[z_{23}^m, 1\right]$. So, consumption in country 2 generates a total demand for country 3 skilled labour equals to $\left(\lambda E_2/\left((1 + t_2)w_3^h\right)\right)\left(1 - z_{23}^m\right)$.

Consumers in country 3 spend λE_3 on good z at a price of $a_3(z)w_3^h$. This implies that they consume $\lambda E_3/\left(a_3(z)w_3^h\right)$ units of the good. Given that the unit skill requirement is $a_3(z)$, this consumption implies a skill demand of $\left(\lambda E_3/\left(a_3(z)w_3^h\right)\right)a_3(z)$. The range of goods consumed by consumers in country 3 is $(z_{23}^x, 1]$. So, consumption in country 3 generates a total demand for country 3 skilled labour equal to $\left(\lambda E_3/w_3^h\right)\left(1 - z_{23}^x\right)$.

Consumers in country 1 spend λE_1 on good z, exported by country 3, at a price of $(1 + t_1)a_3(z)w_3^h$. This implies that they consume $\lambda E_1/\left((1 + t_1)a_3(z)w_3^h\right)$ units of the good. Given that the unit skill requirement is $a_3(z)$, this consumption implies a skill demand of $\left(\lambda E_1/\left((1 + t_1)a_3(z)w_3^h\right)\right)a_3(z)$. The range of country 3 goods consumed by consumers in country 1 is $\left[z_{23}^m, 1\right]$. So, consumption in country 1 generates a total demand for country 3 skilled labour equal to $\left(\lambda E_1/\left((1 + t_1)w_3^h\right)\right)\left(1 - z_{23}^m\right)$.

Adding the domestic and foreign components of skill demand, the full employment condition for skilled labour in country 3 is given by

$$\left(\frac{\lambda E_2}{(1+t_2)w_3^h}\right)\left(1 - z_{23}^m\right) + \left(\frac{\lambda E_3}{w_3^h}\right)\left(1 - z_{23}^x\right) + \left(\frac{\lambda E_1}{(1+t_1)w_3^h}\right)\left(1 - z_{23}^m\right) = H_3. \tag{9}$$

Dividing equation (9) by equation (6) yields the following expression for the skill premium in country 3.

$$\left[\left(1 - z_{23}^m\right)\frac{\xi_2}{(1+t_2)} + \left(1 - z_{23}^x\right)\xi_3(1+t_3) + \left(1 - z_{23}^m\right)\xi_1\right]\left(\frac{\lambda}{1-\lambda}\right)\frac{L_3}{H_3} = w_3^h. \tag{10}$$

(iii) Country 1

Consumers in country 2 spend λE_2 on good z, imported from country 1, at the price $(1 + t_2)a_1(z)w_1^h$. So, they consume $\lambda E_2/\left((1 + t_2)a_1(z)w_1^h\right)$ units of the good. Given that the unit skill requirement is $a_1(z)$, this consumption implies a skill demand of $\left(\lambda E_2/\left((1 + t_2)a_1(z)w_1^h\right)\right)a_1(z)$. The range of country 1 goods consumed by consumers in country 2 is $\left[0, z_{21}^m\right]$. So, consumption in country 2 generates a total demand for country 1 skilled labour equal to $\left(\lambda E_2/\left((1 + t_2)w_1^h\right)\right)z_{21}^m$.

Consumers in country 3 spend λE_3 on good z, exported by country 1, at a price of $(1 + t_3)a_1(z)w_1^h$. This implies that they consume $\lambda E_3/\left((1 + t_3)a_1(z)w_1^h\right)$ units of the good. Given that the unit skill requirement is $a_1(z)$, this consumption implies a skill demand of $\left(\lambda E_3/\left((1 + t_3)a_1(z)w_1^h\right)\right)a_1(z)$. The range of country 1 goods consumed by consumers in country 3 is $\left[0, z_{21}^m\right]$. So, consumption in country 3 generates a total demand for country 1 skilled labour equal to $\left(\lambda E_3/\left((1 + t_3)w_1^h\right)\right)z_{21}^m$.

Consumers in country 1 spend λE_1 on good z at a price of $a_1(z)w_1^h$. This implies that they consume $\lambda E_1/\left(a_1(z)w_1^h\right)$ units of the good. Given that the unit skill requirement is $a_1(z)$, this

consumption implies a skill demand of $\left(\lambda E_1/\left(a_1(z)w_1^h\right)\right)a_1(z)$. The range of goods consumed by consumers in country 1 is $[0, z_{21}^x)$. So, consumption in country 1 generates a total demand for country 1 skilled labour equal to $\left(\lambda E_1/\left(w_1^h\right)\right)z_{21}^x$.

Adding the domestic and foreign components of skill demand, the full employment condition for skilled labour in country 1 is given by

$$\left(\frac{\lambda E_2}{(1+t_2)w_1^h}\right)z_{21}^m + \left(\frac{\lambda E_3}{(1+t_3)w_1^h}\right)z_{21}^m + \left(\frac{\lambda E_1}{w_1^h}\right)z_{21}^x = H_1. \tag{11}$$

Dividing equation (11) by equation (7) yields the following expression for the skill premium in country 1.

$$\left[z_{21}^m\frac{\xi_2}{(1+t_2)} + z_{21}^m\xi_3 + z_{21}^x\xi_1(1+t_1)\right]\left(\frac{\lambda}{1-\lambda}\right)\frac{L_1}{H_1} = w_1^h. \tag{12}$$

The skilled wage ratio of country 2 to country 3 is given by

$$\upsilon_{23} = \frac{w_2^h}{w_3^h}. \tag{13}$$

The skilled wage ratio of country 2 to country 1 is given by

$$\upsilon_{21} = \frac{w_2^h}{w_1^h}. \tag{14}$$

c. Commodity Market

Assume balanced trade to simplify the analysis. Trade is balanced between country 2 and country 3 as follows

$$\left(1-z_{23}^m\right)\frac{\lambda E_2}{(1+t_2)} = \left(z_{23}^x - z_{21}^m\right)\frac{\lambda E_3}{(1+t_3)} + \frac{(1-\lambda)E_3}{(1+t_3)}. \tag{15}$$

Country 2 imports manufactures of value $\left(1 - z_{23}^m\right)(\lambda E_2/(1 + t_2))$ from country 3. Country 3 imports manufactures of value $\left(z_{23}^x - z_{21}^m\right)(\lambda E_3/(1 + t_3))$, and food of value $((1 - \lambda)E_3/(1 + t_3))$ from country 2. This can be rewritten as

$$\begin{aligned}\left(1-z_{23}^m\right)\frac{\lambda\xi_2}{(1+t_2)} &= \left[\left(z_{23}^x - z_{21}^m\right)\lambda + (1-\lambda)\right]\xi_3,\\ \frac{\xi_2}{\xi_3} &= \frac{\left[\left(z_{23}^x - z_{21}^m\right)\lambda + (1-\lambda)\right]}{\left(1-z_{23}^m\right)\lambda}(1+t_2).\end{aligned} \tag{16}$$

Similarly, trade is balanced between country 2 and country 1 as follows

$$z_{21}^m\frac{\lambda E_2}{(1+t_2)} = \left(z_{23}^m - z_{21}^x\right)\frac{\lambda E_1}{(1+t_1)}. \tag{17}$$

Country 2 imports manufactures of value $z_{21}^m(\lambda E_2/(1 + t_2))$ from country 1. Country 1 imports manufactures of value $\left(z_{23}^m - z_{21}^x\right)(\lambda E_1/(1 + t_1))$ from country 2. This can be rewritten as

$$z_{21}^{m}\frac{\lambda\xi_2}{(1+t_2)}=\left[\left(z_{23}^{m}-z_{21}^{x}\right)\lambda\right]\xi_1,$$
$$\frac{\xi_2}{\xi_1}=\frac{\left[\left(z_{23}^{m}-z_{21}^{x}\right)\lambda\right]}{z_{21}^{m}\lambda}(1+t_2). \tag{18}$$

d. General Equilibrium

The general equilibrium is characterised by the borderline good equations, the skill premium in country 1, 2 and 3, the wage gap between country 2 and 3, and between country 2 and 1, and the trade balance equations. The equilibrium contains 11 endogenous variables z_{23}^{m}, z_{21}^{m}, z_{23}^{x}, z_{21}^{x}, w_1^h, w_2^h, w_3^h, v_{21}, v_{23}, ξ_2, and ξ_3, which can be solved from the 11 equations. We simplify the equilibrium to allow for a graphical illustration of the model and then derive the effects of trade liberalisation in the form of tariff reduction.

e. Trade Liberalisation

First, consider trade liberalisation between country 2 and country 3. This reflects South–North trade openness. We obtain z_{23}^{m} as a function of v_{23} and t_2, such that $z_{23}^{m}=z_{23}^{m}(v_{23},t_2)$ where $\left(\partial z_{23}^{m}/\partial v_{23}\right)<0$ and $\left(\partial z_{23}^{m}/\partial t_2\right)>0$. That is, an increase in the wage ratio between the two countries, by shifting comparative advantage towards country 3, widens the import range of country 2. An increase in country 2 tariffs, by shifting comparative advantage towards country 2, narrows the import range of country 2. Similarly, we obtain z_{23}^{x} as a function of v_{23} and t_3, such that $z_{23}^{x}=z_{23}^{x}(v_{23},t_3)$ where $\left(\partial z_{23}^{x}/\partial v_{23}\right)<0$ and $\left(\partial z_{23}^{x}/\partial t_3\right)<0$. This says that the export range of country 2 decreases with both the wage ratio, and the tariff of country 3.

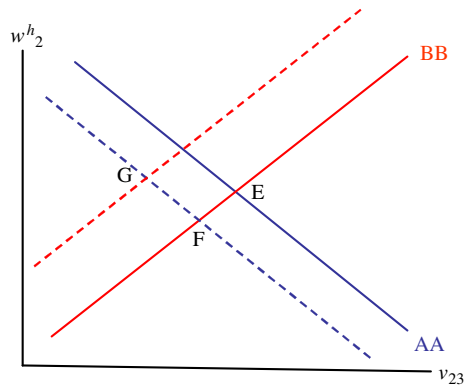
We derive an expression for country 2 share of world income, $\xi_2=\ \xi_2(v_{23},v_{21},t_2,t_3)$ from equation (16), where $(\partial\xi_2/\partial v_{23})<0$, $(\partial\xi_2/\partial v_{21})<0$, $(\partial\xi_2/\partial t_2)>0$, $(\partial\xi_2/\partial t_3)<0$. These partial derivatives imply that an increase in v_{23}, by shifting comparative advantage towards country 3, widens country 2 import range and narrows its export range. This causes country 2 to run a trade deficit, which is restored in equilibrium by a decrease in its share of world income. Second, an increase in v_{21}, by shifting the comparative advantage to country 1, narrows the export range of country 2. This causes country 2 to run a trade deficit which is restored in equilibrium by a decrease in its share of world income. Third, an increase in country 2 tariff narrows its import range implying a trade surplus. To restore trade balance, country 2 share of world income must rise in equilibrium. Fourth, an increase in country 3 tariff narrows country 2 export range implying a trade deficit. To restore trade balance, country 2 share of world income must fall in equilibrium. Substituting this into the skill premium in country 2 yields

$$\left\{\begin{array}{c}\left[z_{23}^{m}(v_{23},t_2)-z_{21}^{m}(v_{21},t_2)\right]\xi_2(v_{23},v_{21},t_2,t_3)\\+\left[z_{23}^{x}(v_{23},t_3)-z_{21}^{m}(v_{21},t_2)\right]\xi_3+\left[z_{23}^{m}(v_{23},t_2)-z_{21}^{x}(v_{21},t_1)\right]\xi_1\end{array}\right\}\left(\frac{\lambda}{1-\lambda}\right)\frac{L_2}{H_2}=w_2^h. \tag{19}$$

In Figure 4, we depict this relationship as the *AA* curve. The slope of the curve and its direction of shift are given by the following partial derivatives $\left|\partial w_2^h/\partial v_{23}\right|_{AA}<0$, $\left|\partial w_2^h/\partial t_2\right|_{AA}>0$, $\left|\partial w_2^h/\partial t_3\right|_{AA}<0$, $\left|\partial w_2^h/\partial v_{21}\right|_{AA}<0$.

To close, the model, we need a second relationship between w_2^h and v_{23}, by considering the wage equation in country 3

FIGURE 4
Illustration of Equilibrium 1



$$\left\{\left[1-z_{23}^{m}(v_{23},t_2)\right]\frac{\xi_2}{(1+t_2)}+\left[1-z_{23}^{x}(v_{23},t_3)\right]\xi_3(1+t_3)+\left[1-z_{23}^{m}(v_{23},t_2)\right]\xi_1\right\}\left(\frac{\lambda}{1-\lambda}\right)\frac{L_3}{H_3}=w_3^h. \tag{20}$$

Substituting this into $v_{23}=w_2^h/w_3^h$ yields a second relationship between w_2^h and v_{23}. In Figure 4, we depict this relationship as the *BB* curve. The slope of the curve and its direction of shift are given by the following partial derivatives $\left|\partial w_2^h/\partial v_{23}\right|_{BB}>0$, $\left|\partial w_2^h/\partial t_2\right|_{BB}<0$, $\left|\partial w_2^h/\partial t_3\right|_{BB}>0$. Figure 4 shows the equilibrium at the intersection of the *AA* and *BB* curves where w_2^h and v_{23} are simultaneously determined. Accordingly, a decrease in t_2 shifts down the *AA* curve and a decrease in t_3 shifts it up. Similarly, a decrease in t_2 shifts up the *BB* curve and a decrease in t_3 shifts it down.

Consider a decrease in t_2, as country 2 reduces the tariff, its import range expands implying a smaller set of goods for domestic production and thus a smaller demand for skilled labour. Thus, the skilled wage declines and so does the terms of trade. This is illustrated in Figure 4 as a movement from point E to point F. As the import range in country 2 expands, the demand for country 3 skilled labour increases and thus the wage of skilled labour increases, which worsens the terms of trade of country 2. The increase in country 3 labour cost leads country 2 to expand its export range, which raises country 2 skill demand and wage inequality. This is illustrated in Figure 4 by a movement from point F to point G. Whether the upward shift of the *BB* curve dominates the downward shift of the *AA* curve depends on the responsiveness of z_{23}^m to t_2 and the responsiveness of z_{23}^x to t_2. An increase in wage inequality is more likely to emerge if z_{23}^x is more responsiveness to t_2 than z_{23}^m.

Proposition 1: *Trade liberalisation between country 2 and country 3, due to a tariff reduction in country 2, may cause an increase in wage inequality in country 2.*

This implies that trade liberalisation between the South and the North, through a decline in the import tariffs imposed by the South, leads to an increase in the imports of the South from the North. This leads to a decline in demand for South products and skilled labour causing a decrease in the skill premium. This also causes an increase in the demand for the North products, an increase in the demand for skilled labour and in the skill premium in the North.

The increase in the cost of skilled labour in the North leads to an increase in the exports of the South to the North. This increases the demand for skilled labour and the skill premium in the South. The final effect on the skill premium in the South depends on the magnitude of these two effects. Under certain conditions, we can see the skill premium increasing in the North and in the South.

Next, consider trade liberalisation between country 2 and country 1. This reflects South–South trade openness. We obtain z_{21}^m as a function of v_{21} and t_2, such that $z_{21}^m = z_{21}^m(v_{21}, t_2)$ where $\left(\partial z_{21}^m/\partial v_{21}\right) > 0$ and $\left(\partial z_{21}^m/\partial t_2\right) < 0$. That is, an increase in the wage ratio between the two countries, by shifting comparative advantage towards country 1, widens the import range of country 2. An increase in country 2 tariffs, by shifting comparative advantage towards country 2, narrows the import range of country 2. Similarly, we obtain z_{21}^x as a function of v_{21} and t_1, such that $z_{21}^x = z_{21}^x(v_{21}, t_1)$ where $\left(\partial z_{21}^x/\partial v_{21}\right) > 0$ and $\left(\partial z_{21}^x/\partial t_1\right) > 0$. This says that the export range of country 2 decreases with both the wage ratio, and the tariff of country 1.

We derive an expression for country 2 share of world income, $\xi_2 = \xi_2(v_{23},v_{21},t_2,t_1)$ from equation (18), where $(\partial\xi_2/\partial v_{23}) < 0$, $(\partial\xi_2/\partial v_{21}) < 0$, $(\partial\xi_2/\partial t_2) > 0$, $(\partial\xi_2/\partial t_1) < 0$. These partial derivatives imply that an increase in v_{21}, by shifting comparative advantage towards country 1, widens country 2 import range and narrows its export range. This causes country 2 to run a trade deficit, which is restored in equilibrium by a decrease in its share of world income. Second, an increase in v_{23}, by shifting the comparative advantage to country 3, narrows the export range of country 2 to country 1. This causes country 2 to run a trade deficit which is restored in equilibrium by a decrease in its share of world income. Third, an increase in country 2 tariff narrows its import range implying a trade surplus. To restore trade balance, country 2 share of world income must rise in equilibrium. Fourth, an increase in country 1 tariff narrows country 2 export range implying a trade deficit. To restore trade balance, country 2 share of world income must fall in equilibrium. Substituting this into the skill premium in country 2 yields

$$\left\{\begin{array}{c}\left[z_{23}^m(v_{23},t_2) - z_{21}^m(v_{21},t_2)\right]\xi_2(v_{23},v_{21},t_2,t_1) + \left[z_{23}^x(v_{23},t_3) - z_{21}^m(v_{21},t_2)\right]\xi_3 \\ +\left[z_{23}^m(v_{23},t_2) - z_{21}^x(v_{21},t_1)\right]\xi_1\end{array}\right\}\left(\frac{\lambda}{1-\lambda}\right)\frac{L_2}{H_2} = w_2^h. \tag{21}$$

In Figure 5, we depict this relationship as the *CC* curve. The slope of the curve and its direction of shift are given by the following partial derivatives $\left|\partial w_2^h/\partial v_{23}\right|_{CC} < 0$, $\left|\partial w_2^h/\partial t_2\right|_{CC} > 0$, $\left|\partial w_2^h/\partial t_1\right|_{CC} < 0$, $\left|\partial w_2^h/\partial v_{21}\right|_{CC} < 0$.

To close, the model, we need a second relationship between w_2^h and v_{21}, by considering the wage equation in country 1

$$\left[z_{21}^m(v_{21},t_2)\frac{\xi_2}{(1+t_2)} + z_{21}^m(v_{21},t_2)\xi_3 + z_{21}^x(v_{21},t_1)\xi_1(1+t_1)\right]\left(\frac{\lambda}{1-\lambda}\right)\frac{L_1}{H_1} = w_1^h. \tag{22}$$

Substituting this into $v_{21} = w_2^h/w_1^h$ yields a second relationship between w_2^h and v_{21}. In Figure 5, we depict this relationship as the *DD* curve. The slope of the curve and its direction of shift are given by the following partial derivatives $\left|\partial w_2^h/\partial v_{21}\right|_{DD} > 0$, $\left|\partial w_2^h/\partial t_2\right|_{DD} < 0$, $\left|\partial w_2^h/\partial t_1\right|_{DD} > 0$.

Figure 5 shows the equilibrium at the intersection of the *CC* and *DD* curves where w_2^h and v_{21} are simultaneously determined. Accordingly, a decrease in t_2 shifts down the *CC* curve

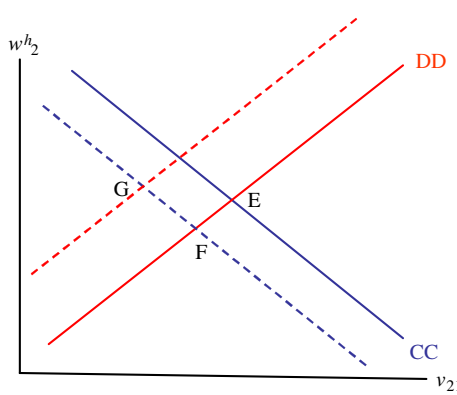
and a decrease in t_1 shifts it up. Similarly, a decrease in t_2 shifts up the *DD* curve and a decrease in t_1 shifts it down.

Consider a decrease in t_2, as country 2 reduces the tariff, its import range expands, implying a smaller set of goods for domestic production and thus a smaller demand for skilled labour. Thus, the skilled wage declines and so does the terms of trade. This is illustrated in Figure 5 by a movement from point E to point F. As the import range in country 2 expands, the demand for country 1 skilled labour increases and thus the wage of skilled labour increases, which worsens the terms of trade of country 2. The increase in country 1 labour cost leads country 2 to expand its export range, which raises country 2 skill demand and wage inequality. This is illustrated in Figure 5 by a movement from point F to point G. Whether the upward shift of the *DD* curve dominates the downward shift of the *CC* curve depends on the responsiveness of z_{21}^m to t_2 and the responsiveness of z_{21}^x to t_2. An increase in wage inequality is more likely to emerge if z_{21}^x is more responsiveness to t_2 than z_{21}^m.

Proposition 2: *Trade liberalisation between country 2 and country 1, due to a tariff reduction in country 2, may cause an increase in the wage inequality in country 2 and a decrease in wage inequality in country 1, if* z_{21}^x *is more responsive to* t_2 *than* z_{21}^m

Consider a decrease in t_2. The direct effect is that it reduces country 2 competitiveness against imports from country 1, and hence increases its import range. The indirect effect is to lower country 2 relative wage to country 1. This indirect effect enhances country 2 competitiveness at both the export and import margins, thus increasing its export range and decreasing its import range. Adding up the direct and the indirect effect, a decrease in t_2 expands country 2 export range but will have an ambiguous effect on its import range. An increase in wage inequality in country 2 is more likely to emerge if z_{21}^x is more responsive to t_2 than z_{21}^m. In this case, z_{21}^x decreases with trade liberalisation along with an increase in wage inequality in country 2. The effect on $z_{21}^m$is ambiguous, which implies it is possible that z_{21}^m decreases. This causes a decrease in wage inequality in country 1. If trade between country 1 and 2 is considered as South–South trade, then trade liberalisation between Southern countries can cause an increase in wage inequality in one and a decrease in wage inequality in the other.

FIGURE 5
Illustration of Equilibrium 2



4. CONCLUSION

The $2 \times 2 \times 2$ Heckscher–Ohlin model predicts that openness induces countries to export the good that intensively uses the relatively abundant factor of production and import the good that intensively uses the relatively scarce factor of production. As developed countries are considered skilled abundant, they export the good that intensively uses skilled workers. Thus, trade openness contributes to an increase in the relative price of the skilled-intensive good, to a rise in the relative demand for skilled workers and accordingly to an increase in the skill premium. The theory also predicts that as developing countries are unskilled abundant, they are expected to experience a decline in the relative price of their skilled-intensive good and consequently a decline in the skill premium. Empirical evidence, however, demonstrates that though some developing countries witnessed a declining skill premium, others experienced a widening wage gap after trade liberalisation.

This paper attempts to reconcile the empirical evidence with the theoretical predictions by introducing a model where the direction of trade can produce the observed patterns of skill premia in the South. The model developed in this paper is an extension of Xu (2003) to consider the aspect of South–South trade. In this context of endogenously determined non-traded goods, South–South trade expands the import range of the country that reduces the tariff. This increases the demand for and the cost of skilled workers in the other country. This increase in the cost of skilled workers also leads the country that reduces the tariff to expand its export range and reduce its import range. Therefore, the country that reduces the tariff experiences an increase in its export range, which leads to an increase in the skill premium. As the impact on the import range is ambiguous, it is possible that the other country experiences a decline in the skill premium.

The conclusions of the theoretical set-up has some policy implications. Developing countries that are liberalising trade has to consider the impact of this decision on the skill premium and that this impact will depend on whether they are liberalising trade with other developing countries or developed countries.

The proposition that trade openness between developing countries can cause some countries to experience a decrease in the skill premium, while others experience an increase in the skill premium can be tested empirically. This is left to future research.

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