North–South trade and income inequality

E. Kwan Choi *

Department of Economics, Iowa State University, Ames, IA 50010, United States

Abstract

This paper investigates the effects of North–South trade on international income inequality. While empirical studies suggest that trade liberalization encourages income convergence and reduces the per capita income gap between poor and rich countries, North–South trade is shown to increase the income gap between the two regions. On the other hand, trade liberalization by either region increases the welfare of both regions, and does not necessarily reduce the gap in "real income" or utility.
© 2006 Elsevier Inc. All rights reserved.

JEL classification: F1; F13
Keywords: North–South trade; Income inequality

1. Introduction

A month following a ministerial meeting in Doha, Qatar, China became an official member of the World Trade Organization (WTO) on December 11, 2001. China's WTO accession is likely to boost both the US–China and EU–China bilateral trade volumes. Both China and its trading partners are expected to benefit from China's expanding role in world trade. For instance, Ianchovichina, Martin, and Fukase (2000) report that China's share of world exports will rise from 3.7% in 1995 to over 6.3% in 2005. However, little attention has been paid to the impact of North–South trade on the income gaps between high-income countries and low-income less-developed countries (LDCs). Will such unprecedented trade liberalization reduce the income gap between LDCs and industrial nations of Europe and North America?

There are two schools of thought regarding the effect of trade liberalization on international income inequality. Some have asserted that trade will tend to cause greater income inequalities between countries (Myrdal, 1956; Prebisch, 1950; Singer, 1950). In contrast, Adam Smith envisioned a situation in which trade between a rich country and a poor country leads to income convergence (Elmslie, 1994). Recent empirical studies also suggest that trade promotes income convergence. Rassekh and Thompson (1998) argued that since trade tends to equalize factor prices, per capita income can differ between countries primarily because of differences in capital-to-labor ratios.[1] Choi (2001) investigated the impact of neighbor-immiserizing growth in a model of three trading blocs. Chao and Yu (1997) also

---

* Tel.: +1 515 294 5999; fax: +1 515 294 9913.
  E-mail address: kchoi@iastate.edu.

[1] Krueger (1968) suggested that when factor endowments are dissimilar between countries, trade will equalize factor prices and can perpetuate divergence of per capita incomes.

investigated the long run impacts of trade liberalization through relaxation of quantity restrictions. Chao, Chou, and Yu (2001) analyzed the effect of trade liberalization through export duty rebates.

The purpose of this paper is to investigate whether North–South trade will deepen or reduce international income inequality between the two trading blocs. Accordingly, this paper develops a two-country, two-good, two-factor general equilibrium model within the North–South framework, and analyzes the impacts of trade liberalization on the income gap between the two regions. The South is assumed to be abundant in labor and the North in capital. Two competing measures of national income are used to examine the effects of trade liberalization: national income and real income.

Section 2 develops the basic model. Section 3 investigates how trade liberalization affects the terms of trade and trade volumes, while Section 4 deals with the effects of trade liberalization on national incomes and welfare. Section 5 contains concluding remarks.

2. The basic model

We consider the impacts of North–South trade on international income inequality. In light of the increased importance of China's role in world trade, the world is assumed to consist of two trading blocs, the North (EU and North America) and the South (China).[2] We employ the following assumptions:

(1) The South consists of N identical workers who also are consumers.
(2) Two factors, capital K and labor N, are used to produce two goods, the exportable Z and the importable Y.
(3) The exportable Z is the numéraire, and the domestic price and the foreign price of the exportable are equal to unity.
(4) The South is abundant in labor, whereas the North is abundant in capital. Both regions have identical production technologies, and no factor intensity reversal occurs.
(5) Factors are fully employed and are mobile between sectors.
(6) Perfect competition prevails in product and factor markets.

It is important to note that factor price equalization is not assumed in this paper. However, since no factor intensity reversal occurs, each region exports the product that intensively uses its abundant factor.

Let Z and Y denote the domestic production of the exportable and the importable, respectively. Variables of the North are denoted by lowercase letters. As in the standard Heckscher–Ohlin model, the relationships between input and output are written as:

$$a_{KZ}Z + a_{KY}Y = K,$$
$$a_{NZ}Z + a_{NY}Y = N,$$

where a_{ij} is the input–output coefficient representing the amount of input i used to produce one unit of product j, $i=K$, N, and $j=Z$, Y. Production possibilities of the two regions are given by

$$Z = F(Y), \ z = f(y).$$

There is no uncertainty in the product prices, and producers are assumed to observe the world price P^* and the domestic prices P and p.

In the South, consumer preferences are represented by a monotone increasing and quasiconcave utility function, $U=U(C, X)$ where C and X denote domestic consumption of the exportable and the importable, respectively. Similarly, consumer preferences of the North are denoted by Budget constraints of consumers are:

$$C + PX = I,$$
$$c + px = i,$$

where P and p are the domestic prices of the Y good, and I and i denote—in terms of the numéraire—consumer income of the South and the North, respectively. The first-order conditions for optimal consumption are $U_C/U_X=1/P$ and $u_c/u_x=1/p$. Let $C=C(P, I)$ and $X=X(P, I)$ denote the demand for the importable and the exportable. We assume that both goods

---

are normal in all countries. That is, in the South, $\partial C/\partial I > 0$ and $\partial X/\partial I > 0$. Demands for the two goods, $c = c(p, i)$ and $x = x(p, i)$ of the North are similarly defined. The indirect utility function can be written as

$$V = U[C(P,I), X(P,I)],$$
$$v = u[c(p,i), x(p,i)].$$

Assume that the home government restricts trade by imposing a tariff $T = P - P^*$ on imports. In practice, export taxes are rarely used. Since the exportable good is used as a numéraire in our analysis, we invoke Lerner's symmetry theorem that the export tax and import tariff are equivalent in that they have identical effects on trade. Thus, we use the export tax t on export q for the North. Since the North imposes an export tax, the world price $P^* = p + t$, and the export price of Y in the North can deviate from its domestic price p. The import demand function of China is

$$Q(P,I) = X(P,I) - Y(P), \tag{1}$$

which implies $Q_I = X_I$, where subscripts denote partial derivatives. Similarly, the North's export supply function is:

$$q(p,i) = y(p) - x(p,i). \tag{2}$$

In the South, the government revenue from trade taxes is

$$G = TQ,$$

where T is a specific tariff. Following the convention, we assume that the tariff revenue is rebated to the consumer. Consumer income in China is written as

$$I = Z + PY + TQ.$$

Total revenue $Z + PY$ is distributed to factors, and is equal to factor income,

$$Z + PY = WL + RK.$$

Including the tariff revenue, the indirect utility functions can be written as

$$V(P,I) = V[P, Z + PY + TQ(P,I)],$$
$$v(p,i) = v[p, z + py + tq(p,i)]. \tag{3}$$

Let the domestic price of the importable in the South be

$$P = P^* + T,$$

where T is the specific tariff. Note that in (1) an increase in T changes consumer income, $I = Z + PY + TQ$, which in turn affects the South's import demand. Substituting consumer income into (1) gives

$$Q = X[P^* + T, Z + (P^* + T)Y + TQ(P,I)] - Y(P^* + T) \equiv Q(P^*, T), \tag{4}$$

where $Q(P^*, T)$ is now the reduced-form import demand function in terms of P^* and T, and it reduces to the usual import demand function $Q(P)$ in the absence of a tariff. Specific tariff rates, T and t, are assumed fixed.

Export taxes are rarely used in the real world. However, they are equivalent to export quotas, which are more often used. Export quotas used by OPEC during the 1970s and again recently, raised the price of oil dramatically. To facilitate our analysis, we invoke Lerner's symmetry theorem that export taxes and import tariffs are equivalent in that they have identical effects on trade. We assume that the North imposes an export tax $t = P^* - p$.[3] The domestic price of Y in the North is $p = P^* - t$. From $q(p, i) = y(p) - x[(p, z + py + tq)]$, we get

$$q = y(P^* - t) - x[P^* - t, z + (P^* - t)y + tq(p,i)] \equiv q(P^*, t). \tag{5}$$

---

[3] Suppose that the North imposes a tariff on its imports $(c - z)$. Recall that the price of the numéraire is unity. Balance of trade requires

$$(c - z) = p^*(y - x).$$

Let α be the ad valorem tariff that the North imposes on its imports of the numéraire. Then the North's tariff revenue from restricting imports is

$$\alpha(c - z) = \alpha P^*(y - x).$$

This shows that imposing an ad valorem tariff α on imports $(c - z)$ amounts to imposing an ad valorem tax α–or specific export tax $t = \alpha P^*$ per unit– on the North's export $(y - z)$, which yields tax revenue $\alpha P^*(y - x) = t(y - x)$.

The market clearing condition for the South's importable good is:

$$Q(P*, T) = q(P*, t),\qquad(6)$$

where $q(P*,t)$ is the North's export supply of Y.

3. North–South trade and the terms of trade

In this section, we investigate the effects of North–South trade liberalization on the terms of trade. We first examine how various parameters affect the South's reduced import demand function in (4). Differentiating (4) with respect to T, we get

$$\frac{\partial Q}{\partial T} = X_P - Y' + X_I\left(Y + Q + T\frac{\partial Q}{\partial T}\right),$$

where X_P is the slope of the Marshallian demand curve, and Y' is the slope of the supply curve.

Let $X_P^u \equiv X_P + XX_I$ (<0) be the slope of the South's compensated demand curve. Then

$$\frac{\partial Q}{\partial T} = \frac{X_P^U - Y'}{1 - TX_I} < 0.\qquad(7)$$

Intuitively, this implies that an import tariff shifts the import demand curve to the left. Differentiating (4) with respect to $P*$ gives

$$\frac{\partial Q}{\partial P*} = X_P - Y' + X_I\left(Y + T\frac{\partial Q}{\partial P*}\right) = \left(X_P^U - QX_I - Y'\right) + TX_I\frac{\partial Q}{\partial P*}.$$

Rearranging the terms, we get

$$\frac{\partial Q}{\partial P*} = \frac{X_P^U - QX_I - Y'}{1 - TX_I} < 0,\qquad(8)$$

since the importable is a normal good, the compensated demand curve X^U is negatively sloped, and the supply curve of Y is positively sloped.

Differentiating the North's reduced form import demand function (5) with respect to t gives

$$\frac{\partial q}{\partial t} = \left[x_p - x_i\left(-y + q + t\frac{\partial q}{\partial t}\right)\right] - y',$$

where $y'(p)$ is the slope of the North's supply curve of Y. Using the North's compensated demand curve, we get

$$\frac{\partial q}{\partial t} = \frac{x_p^u - y'}{1 + tx_i} < 0.\qquad(9)$$

That is, an export tax shifts the North's export supply schedule to the left. Differentiating (5) with respect to $p*$ gives

$$\frac{\partial q}{\partial P*} = y' - x_p - x_i\left(y + t\frac{\partial q}{\partial P*}\right) = \left(y' - x_P^u + qx_i\right) - tx_i\frac{\partial q}{\partial P*}.$$

Rearranging the terms, we get

$$\frac{\partial q}{\partial P*} = \frac{y' - x_P^u + qx_i}{1 + tx_i} > 0.\qquad(10)$$

How does the South's unilateral trade liberalization affect the terms of trade? For example, China's unilateral trade liberalization means a reduction in the tariff from the prohibitive rate T^0, at which China will not import any product from the North.[4] If the tariff rate is above the prohibitive rate China will be in autarky. Differentiating (6) with respect to T, holding all other tariffs constant, we get

$$\left(\frac{\partial Q}{\partial P^*} - \frac{\partial q}{\partial P^*}\right)\frac{\partial P^*}{\partial T} + \frac{\partial Q}{\partial T} = 0.$$

Rearranging the terms, we get

$$\frac{\partial P^*}{\partial T} = -\frac{\dfrac{\partial Q}{\partial T}}{\dfrac{\partial Q}{\partial P^*} - \dfrac{\partial q}{\partial P^*}} < 0. \tag{11}$$

Note that $Q(p^*, T) - q(p^*, t)$ measures the world's excess import demand for Y. While individual countries may impose tariffs, the world's excess import demand must be inversely related to its price p^*. Since $\partial Q/\partial T < 0$ by (7), it follows that $\partial p^*/\partial T < 0$.

Similarly, differentiating (6) with respect to t gives

$$\left(\frac{\partial Q}{\partial P^*} - \frac{\partial q}{\partial P^*}\right)\frac{\partial P^*}{\partial t} - \frac{\partial q}{\partial t} = 0.$$

Rearranging the terms, we get

$$\frac{\partial P^*}{\partial t} = \frac{\dfrac{\partial q}{\partial t}}{\dfrac{\partial Q}{\partial P^*} - \dfrac{\partial q}{\partial P^*}} > 0. \tag{12}$$

It follows that the South's terms of trade improve as its own tariff increases, but worsen as the North's tariff increases.

4. North–South trade liberalization and national income

Considerable empirical evidence exists showing that trade tends to reduce the income gaps between rich and poor countries. Two measures may be used to determine whether the gaps between these regions are shrinking as a result of trade liberalization: (1) national income and (2) consumer welfare. In a world of two factors, national income can be written as

$$\Phi = WN + RK, \tag{13}$$

where W and R are wage and capital rental, and N and K denote fixed supplies of labor and capital, respectively. Rassekh and Thompson (1998) and Slaughter (1997) focus their attention on per capita income,

$$\frac{\Phi}{N} = W + R\frac{K}{N}. \tag{14}$$

Countries may differ in capital endowment and population, as well as in factor prices. If trade equalizes factor prices, then differences in per capita income reflect the differences in capital abundance (K/N). According to the Stolper–Samuelson Theorem, a change in tariff or trade liberalization affects the output prices and factor prices in (13). For instance, an increase in T increases P, which in turn raises R, or the return to the factor intensively used in the Y industry, and decreases the South's wage rate, W. Since factors receive income from production activities, it is more convenient to work with an equivalent definition of national income. Specifically, the South's national income is:

$$\Theta = Z + PY = Z + (P^* + T)Y. \tag{15}$$

---

[4] The South's prohibitive tariff rate T^0 is not fixed, but depends on the export tax of the North. Conversely, the North's prohibitive export tax t^0 also depends on the tariff the South imposes.

Similarly, the national income of the North is:

$$\theta = z + py = z + (P^* - t)y. \tag{16}$$

One possible drawback of these concepts is that outputs are evaluated at domestic prices, which can be distorted by tariffs.

4.1. The effects of trade liberalization on the South

We now examine the effects of trade liberalization on the South's income. Differentiating (15) with respect to T, and noting $dZ + PdY = 0$ for maximization of producer revenue, we obtain

$$\frac{\partial \Theta}{\partial T} = Y\left(1 + \frac{\partial P^*}{\partial T}\right) > 0. \tag{17}$$

From (11), $\partial p^*/\partial T < 0$. Note that in the absence of the Metzler paradox, $\partial p^*/\partial T > 0$. The assumption that both traded goods are normal precludes this paradox. Thus, the South's unilateral trade liberalization reduces its national income.

How does the North's trade liberalization affect the South's national income? Note that t does not affect the South's income directly, but rather indirectly through the terms of trade. Also, we assume that there is no strategic behavior, i.e., $\partial T/\partial t = \partial t/\partial T = 0$. Differentiating (15) with respect to t, and noting (12), we get

$$\frac{\partial \Theta}{\partial t} = Y\frac{\partial P^*}{\partial t} > 0. \tag{18}$$

Thus, unilateral trade liberalization in the North raises the income of the South.

4.2. The effects of trade liberalization on the North

Next, consider the effects of trade liberalization on the North. Similar to the expression for the South, the North's national income is written as

$$\theta = z + py = z + (P^* - t)y. \tag{19}$$

Differentiating (19) with respect to t and noting that $dz + (p^* - t)dy = 0$ for maximization of national income, we obtain

$$\frac{\partial \theta}{\partial t} = y\left(\frac{\partial P^*}{\partial t} - 1\right) < 0. \tag{20}$$

Note that $\partial p^*/\partial t > 0$ by (12). However, if we use Lerner's symmetry theorem, an export tax is equivalent to an import tariff. A rise in tariff creates a wedge between the increased domestic price and the decreased foreign price, and the absence of the Metzler paradox ensures that this tariff wedge works normally. In a case similar to the Metzler paradox, an increase in export tax may raise the foreign price p^* so much that the domestic price $p = p^* - t$ actually may rise as well. However, since both goods are normal, this paradox does not occur, i.e., $dp/dt < 0$.[5] Barring a Metzler-like paradox for the export tax, we see that trade liberalization by the North increases its national income.

Note that the Southern tariff rate T does not affect the North's national income in (19) directly, but rather through a change in the terms of trade. Differentiating (19) with respect to T yields

$$\frac{\partial \theta}{\partial T} = y\frac{\partial P^*}{\partial T} < 0. \tag{21}$$

That is, a reduction the Southern tariff raises the North's national income.

---

[5] Recall that the export tax t is equivalent to an import tariff t imposed on the North's import of Z, whose relative price is $1/p$. Note that $d(1/p)/dt = -(dp/dt)/p^2 > 0$ in the absence of Metzler paradox, which is precluded because both goods are normal.

Comparing (17) and (21), we see that the South's unilateral trade liberalization reduces its own income but raises the North's income, thereby exacerbating the income divergence between the two regions. From (18) and (20), the North's unilateral trade liberalization also increases its own national income but lowers the South's national income, thereby widening the income gap between the two regions.

Proposition 1. *Assume that national income is measured by factor income in* (13). *Then bilateral trade liberalization widens the income gap between the two regions.*

National income statistics are readily available and hence provide a basis for international comparison of living standards. A drawback of using national income for this purpose is that it varies with the terms of trade. For instance, when the tariff is lowered from the prohibitive level, the South reaps gains from trade. However, (17) show that in the absence of the Metzler paradox, the South's national income continually declines as the tariff is reduced.

4.3. Real income convergence

We now consider another measure, consumer utility, to investigate whether trade liberalization increases or decreases welfare gaps. How does a tariff reduction affect the South's consumer income and welfare? Differentiating $I = Z + PY + TQ$ with respect to T gives

$$\frac{\partial I}{\partial T} = Y \frac{\partial P}{\partial T} + Q + T \frac{\partial Q}{\partial T} > 0, \tag{22}$$

which is generally indeterminate. When evaluated at $T=0$, this reduces to $\partial I / \partial T = Y(\partial P / \partial T) + Q > 0$. Note that tariff revenue is TQ, which is zero when $T=0$, and as T increases, TQ increases at first, reaches a maximum, and declines thereafter. Except when autarky is chosen for noneconomic reasons, the tariff rate should be below the point that maximizes tariff revenue, at which rate $Q + T(\partial Q / \partial T) > 0$. When evaluated at the prohibitive tariff T^0, $\partial I / \partial T = Y(\partial P / \partial T) + T(\partial Q / \partial T)$. Since there is no tariff revenue at T^0 initially, if the Metzler paradox does not occur, a decrease in tariff will reduce the domestic price of the importable ($\partial P / \partial T > 0$), and yield positive tariff revenue ($T(\partial Q / \partial T) < 0$). Thus, beyond the tariff that maximizes tariff revenue, $\partial I / \partial T$ is indeterminate.

Next, differentiating I with respect to t gives

$$\frac{\partial I}{\partial t} = \frac{\partial I}{\partial P^*} \frac{\partial P^*}{\partial t} \tag{23}$$

where

$$\frac{\partial I}{\partial P^*} = Y + T \frac{\partial Q}{\partial P^*},$$

which reduces to Y when the tariff is zero. Thus, an increase in the price of the importable raises consumer income. However, for a positive tariff, a rise in the price of the importable may not necessarily increase income.

Differentiating V in (3) with respect to T and using Roy's identity, we get

$$\frac{\partial V}{\partial T} = V_I \left(-X \frac{\partial P}{\partial T} + Y \frac{\partial P}{\partial T} + Q + T \frac{\partial Q}{\partial T} \right).$$

Recall that since both goods are normal, the Metzler paradox does not occur, and hence $\partial P / \partial T = \partial p^* / \partial T + 1 > 0$. Thus, we obtain

$$\frac{\partial V}{\partial T} = V_I \left(-Q \frac{\partial P}{\partial T} + Q + T \frac{\partial Q}{\partial T} \right) = V_I \left(-Q \frac{\partial P^*}{\partial T} + T \frac{\partial Q}{\partial T} \right). \tag{24}$$

When evaluated at the prohibitive tariff T^0, $Q=0$ and $\partial Q / \partial T < 0$, and hence $\partial V / \partial T < 0$ in (24). That is, China benefits from unilateral trade liberalization, i.e., from lowering its tariff from the prohibitive level. Starting from the free trade point ($T=0$), an increase in T raises utility at first, reaches a maximum at the so-called optimal tariff ($\partial V / \partial T = 0$), and declines thereafter ($\partial V / \partial T < 0$). Comparing (22) and (24), we see that in the absence of the price effect on consumption ($-X(\partial P / \partial T)$), the two equations will have the same sign. The utility criterion, rather

than the national income criterion, more accurately captures the change in welfare when bilateral trade liberalization affects the terms of trade.

No strategic behavior is assumed in tariff setting between governments. As the foreign export tax rate varies, the South's import tariff remains constant, i.e., $\partial P/\partial t = \partial p^*/\partial t$. Differentiating V in (3) with respect to t yields

$$\frac{\partial V}{\partial t} = V_I \left(-Q + T \frac{\partial Q}{\partial P^*} \right) \frac{\partial P^*}{\partial t} < 0. \tag{25}$$

Thus, unilateral trade liberalization by the North raises the South's welfare. Comparing (18) and (25), we see that trade liberalization by the North raises the South's welfare, but reduces its income. Thus, the two criteria yield conflicting signals.

Proposition 2. *From the autarky situation, the South's unilateral trade liberalization reduces its income but improves its welfare. However, beyond a certain point, the South may not benefit from further unilateral trade liberalization.*

How does the North's trade liberalization affect the South? The North's tariff affects the South's welfare only through the terms of trade changes. Differentiating (3) with respect to t gives

$$\frac{\partial V}{\partial t} = \frac{\partial V}{\partial P^*} \frac{\partial P^*}{\partial t} < 0, \tag{26}$$

since

$$\frac{\partial V}{\partial P^*} = V_I \left(-Q + T \frac{\partial Q}{\partial P^*} \right) < 0,$$

and by (12) $\partial p^*/\partial t < 0$). That is, the North's trade liberalization benefits the South.

Next, consider the effects of unilateral trade liberalization by the North. Differentiating $i = z + (p^* - t)y + tq$ with respect to T, and noting that in (11) $\partial p^*/\partial T < 0$, gives

$$\frac{\partial i}{\partial T} = \left(y + t \frac{\partial q}{\partial T} \right) \frac{\partial P^*}{\partial T} < 0. \tag{27}$$

That is, the per capita income of the North shrinks as the South reduces its tariff unilaterally.

Note that the North's own export tax affects the exports directly and also indirectly via a change in the terms of trade. That is, $dq/dt = \partial q/\partial t + (\partial q/\partial p^*)(\partial p^*/\partial t)$. Since the intent of an export tax is to reduce exports, we assume that dq/dt is negative. Differentiating $i = z + py + tq$ with respect to t gives

$$\frac{\partial i}{\partial t} = y \frac{\partial p}{\partial t} + q + t \frac{dq}{dt} > 0. \tag{28}$$

When evaluated at the prohibitive tariff rate t^0, $\partial i/\partial t = y(\partial p/\partial t) + t(dq/dt)$. Since there is no export tax revenue at t^0 initially, if a paradox does not occur, a decrease in tax will raise the domestic price of the exportable ($\partial p/\partial t < 0$), and yield positive tariff revenue ($t(\partial q/\partial t) < 0$), but it will be negligible initially because the change in export volume will be small. Thus, the North's per capita income increases initially in the neighborhood of autarky, i.e., $\partial i/\partial t > 0$.

Differentiating the North's indirect utility in (3) with respect to t gives

$$\frac{\partial v}{\partial t} = v_i \left(q \frac{\partial P^*}{\partial t} + t \frac{dq}{dt} \right). \tag{29}$$

At the prohibitive export tax t^0, $q = 0$, and hence $\partial v/\partial t < 0$. That is, the North also benefits initially from its unilateral trade liberalization. Differentiating v in (3) with respect to T gives

$$\frac{\partial v}{\partial T} = v_i \left((-x + y) \frac{\partial P^*}{\partial T} + t \frac{\partial q}{\partial P^*} \frac{\partial P^*}{\partial T} \right) = v_i \left(q + t \frac{\partial q}{\partial P^*} \right) \frac{\partial P^*}{\partial T} < 0, \tag{30}$$

Table 1
The effects of North–South trade liberalization on income and welfare

	North	South
Trade	$\dfrac{\partial Q}{\partial T} < 0$	$\dfrac{\partial q}{\partial t} < 0$
	$\dfrac{\partial Q}{\partial P^*} < 0$	$\dfrac{\partial q}{\partial P^*} > 0$
	$\dfrac{\partial P^*}{\partial T} < 0$	$\dfrac{\partial P^*}{\partial t} > 0$
National income	$\dfrac{\partial \Theta}{\partial T} > 0$	$\dfrac{\partial \theta}{\partial T} < 0$
	$\dfrac{\partial \Theta}{\partial t} > 0$	$\dfrac{\partial \theta}{\partial t} < 0$
Utility	$\dfrac{\partial V}{\partial T} < 0$	$\dfrac{\partial v}{\partial T} < 0$
	$\dfrac{\partial V}{\partial t} < 0$	$\dfrac{\partial v}{\partial t} < 0$

since the foreign export supply curve is positively sloped ($\partial q/\partial p^* > 0$), where $q = y - x$ is the foreign export supply of the Y good. Thus, the South's trade liberalization benefits the North.

Comparing (24) and (30), the South's trade liberalization benefits both regions. According to (26) and (29), the North's trade liberalization also benefits both regions. In either case, trade liberalization raises the welfare of both regions, rather than reducing the income gaps between the two regions.

Proposition 3. *Unilateral trade liberalization by either the North or the South not only improves its own welfare but also raises the welfare of the other region, and does not reduce real income (welfare) gaps between the two regions.*

5. Concluding remarks

This paper investigated the impacts of trade liberalization within the North–South framework. Comparative static results are summarized in Table 1. National income, measured by factor income $\Theta = WN + RK$, often is used for international comparison of living standards because it is readily available. However, this measure is easily manipulated by protectionist policies, because the terms of trade can be adjusted easily by tariffs or export taxes. At any rate, it is shown that unilateral trade liberalization by either trading bloc widens the income gap between the rich (North America and EU) and the poor regions (China).

In some ways, utility is a better measure for international comparison of "real" income gaps between countries. Unilateral trade liberalization by either the South or the North benefits both regions, and hence does not necessarily narrow the "real income" gap between the two regions. However, it often is argued that trade expansion between the two regions will tend to equalize factor prices. If trade causes factor prices to move toward equalization, then from (14), the income gap between the two regions depends entirely on the capital–labor ratios (K/N). If increased trade induces LDCs to accumulate more capital per person, then trade will generate income convergence. If not, expanding trade may perpetuate international income inequality as Krueger (1968) had argued earlier. The key to success or rising productivity for China and other newly industrializing countries may be found in capital accumulation afforded by their export-oriented policies. For instance, Owen (1999) found that countries with low human capital stocks tend to increase their accumulation of human capital with increased trade.

References

Chao, C. -C., Chou, W. L., & Yu, E. (2001). Export duty rebates and export performance: Theory and China's experience. *Journal of Comparative Economics*, *29*, 314–326.

Chao, C. -C., & Yu, E. S. H. (1997). Trade liberalization in oligopolistic competition with unemployment: A general equilibrium analysis. *Canadian Journal of Economics*, *30*, 479–496.

Choi, E. K. (2001). Neighbor-immiserizing growth: The Asian crisis. *Japanese Economic Review, 52*, 405–416.

Elmslie, B. T. (1994). The endogenous nature of technological progress and transfer in Adam Smith thought. *History of Political Economy, 26,* 649–664.

Ianchovichina, E., Martin, W., & Fukase, E. (2000). *Assessing the implications of merchandise trade liberalization in China's accession to WTO.* The World Bank Group publication.

Krueger, A. O. (1968). Factor endowments and per capita income differences among countries. *Economic Journal, 78*, 641–659.

Myrdal, G. (1956). Trade as a mechanism of international inequality. In G. Myrdal (Ed.), *Development and underdevelopment, National Bank of Egypt fiftieth anniversary commemoration lectures, Cairo* (pp. 47–51). (Reprinted in Gerald Meier (1995)).

Owen, A. (1999). International trade and the accumulation of human capital. *Southern Economic Journal, 66*, 61–81.

Prebisch, R. (1950). *The economic development of Latin America and its principal problems.* New York: United Nations.

Rassekh, F., & Thompson, H. (1998). Micro convergence and macro convergence: Factor price equalization and per capita income. *Pacific Economic Review, 3*, 3–11.

Singer, H. W. (1950). The distribution of gains between investing and borrowing countries. *American Economic Review, 40*, 473–485.

Slaughter, M. (1997). Per capita income convergence and the role of international trade. *American Economic Review, 87*, 194–199.