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On Welfare Comparisons among Trade Policies

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Abstract

Welfare comparisons of two states with commodities trade and factor trade are made in a general many commodity, many factor and two country framework. As a corollary sufficient conditions for various trade policies such as commodities trade with factor trade, commodities trade without factor trade and autarky to be better than the others are derived.

I. Introduction

The purpose of this paper is to provide a sufficient condition to compare any two situations involving trade in both commodities and factors in a general many commodity and many factor and two country framework (Theorem 1). This is an extension of Ohyama [1972]'s formula where comparisons between two situations with trade only in commodities are made. Particularly as corollaries the sufficient conditions to compare three trade policies such as trade in both commodities and factors(f), trade only in commodities(c) and autarky(a) are provided. Furthermore Grossman [1984]'s condition for policy f to be better than policy c, and Bhagwati [1958] and Brecher and Diaz-Alejandro [1977]'s condition for immiserizing growth (policy c is better than policy f) are derived for 2×2 case.

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The welfare effects of capital mobility have been considered by many authors including Bhagwati [1958,1973], MacDougall [1960], Minabe [1974, 1981], Hamada [1974], Brecher and Choudhri [1982], Brecher and Feenstra [1983], Miyagiwa and Young [1986], Neary and Ruane [1988] and Schweinberger [1989]. Lately Wong [1991] considers the welfare comparisons of two situations involving trade in both commodities and factors allowing compensation among individuals. Our framework is more conventional than his in the sense that the social utility function is assumed. Also Grinols and Wong [1991] discuss the more general welfare comparisons of the two situations in economies without distortions as well as those with distortions such as economies of scale, imperfectly competitive markets, unemployment and domestic distortionary taxes.

In the next section welfare comparisons for two situations with trade in both commodities and factors are made in a general many commodity, many factor and two country framework following essentially the method adopted by Kemp [1969], Ohyama [1972] and Grossman [1984] but generalizing their results.

II. The Model[1]

Let:

$$e(p, u) = \min\{p \cdot c \mid U(c) \geq u\}$$

be the expenditure function of the home country, where $p > 0$ is its internal commodity price vector, c is the commodity consumption vector, $p \cdot c$ is their inner product, U is the home country's social utility function, which is strictly quasi-concave and strongly monotonic, *i.e.*, $c \leq c'$ and $c \neq c'$ imply that $U(c) < U(c')$. Let:

$$g(p, v) = \max\{p \cdot y \mid (y, v) \in Y\}$$

be the home country's revenue function, where y is its vector of commodity production, v is its vector of factor supplies and Y is its production set, which is convex and exhibits constant returns to scale. $g(p, v)$ is assumed to

1. Section II and in particular, Theorem 1 are entirely rewritten according to the suggestions of anonymous referee.

be twice differentiable. The shadow prices of the factors are then given by the vector $g_v(p, v)$ of partial derivatives of g with respect to factor supplies. If r is the internal price vector for factors, then under competitive choices by factor owners:

$$r = g_v(p, v).$$

Since the technology exhibits constant returns to scale, Euler's Theorem implies that:

$$g(p, v) = r \cdot v.$$

Let $x = c - y$ be the home country's excess demand vector whose positive (negative) elements correspond to imports (exports) . Capital letters denote variables associated with the foreign country. Thus, the home country implicitly levies tariff $p - P$ and taxes foreign factors at rates $R - r$. Superscripts f, c and a indicate variables associated with commodity trade plus factor movements, commodity trade with no factor trade and autarky. Thus $v - v^a$ is the vector of factor supplies originating from the foreign country. The foreign country practices free trade so that:

$$P^c x^c = 0 \tag{1}$$

and

$$P^f x^f - R^f(v^c - v^f) = 0 \tag{2}$$

Ohyama includes factors into tradable commodities so that factors are indistinguishable from commodities and hence are arguments of social utility function (*e.g.*, negative amounts of labor is regarded as leisure). However in this paper factors are distinguished from commodities in the sense that they are not included into arguments of social utility function and that their role in revenue revenue function is explicitly considered as in Eq. (7) below.

Ohyama showed that, given two situations (distinguished by superscripts 1 and 2), each of which can involve trade in commodities but no trade in factors (factors are distinguished from commodities as is explained above):

$$p^1(x^1 - x^2) \geq 0 \text{ implies } u^2 \leq u^1 \tag{3}$$

He inferred that:

$$p^c x^c \geq 0 \text{ implies } u^a \leq u^c \tag{4}$$

$$p^a x^c \geq 0 \text{ implies } u^c \leq u^a \tag{5}$$

Kemp also showed that, under the same assumption as Ohyama:[2]

$$p^1(c^1 - c^2) \geq 0 \text{ implies } u^2 \leq u^1,$$

which is immediate since $p^1 c^1 = e(p^1, u^1) \geq p^1 c^2 \geq e(p^1, u^2)$ holds by the assumptions and by definition of the expenditure function u.

In Theorem 1 below, (6) extends Ohyama's conclusion (3) to compare two situations (distinguished by superscripts 1 and 2), each of which can involve trade in both commodities and factors. (7) and (8) extend Ohyama's comparisons (4) and (5) of autarky and commodity trade to comparisons between autarky and a situation involving trade in both commodities and factors.

Theorem 1:

$$p^1(x^1 - x^2) + r^1(v^1 - v^2) \geq 0 \text{ implies } u^2 \leq u^1 \tag{6}$$

where $r^1 = g_v(p^1, v^1)$, *i.e.*, situation 2 yields lower welfare than situation 1 if the value of imports plus net payments for foreign factors is higher in situation 1 when commodities (factors) are valued at situation 1 internal prices (shadow prices). In particular:

$$p^a x^f + r^a(v^f - v^a) \leq 0 \text{ implies } u^f \leq u^a \tag{7}$$

$$p^f x^f + r^f(v^f - v^a) \geq 0 \text{ implies } u^a \leq u^f \tag{8}$$

i.e., trade in commodities and factors yields lower (higher) welfare than autarky if the value of imports plus net payments for foreign factors is negative (positive) when commodities and factors are valued at autarky prices (internal prices under trade).

Proof: Since the country's production set is convex, its revenue function g is concave in v so:

2. Kemp [1969] also includes factors into commodities so that factors are arguments of social utility function but factors are treated as traded as well as nontraded.

$$g^1(p^1, v^2) \leq g(p^1, v^1) + g_v(p^1, v^1)(v^2 - v^1) = g(p^1, v^1) + r^1(v^2 - v^1). \quad (9)$$

Therefore

$$\begin{aligned} e(p^1, u^2) &\leq p^1c^2 = p^1(y^2 + x^2) = p^1y^2 + p^1x^2 \leq g(p^1, v^2) + p^1x^2 \\ &\leq g(p^1, v^1) + r^1(v^2 - v^1) + p^1x^2 \qquad \text{by (9)} \\ &= p^1y^1 + r^1(v^2 - v^1) + p^1x^2 \\ &= p^1(c^1 - x^1) + r^1(v^2 - v^1) + p^1x^2 \\ &= e(p^1, u^1) - p^1x^1 + r^1(v^2 - v^1) + p^1x^2. \end{aligned}$$

It follows that

$$p^1(x^2 - x^1) + r^1(v^2 - v^1) \leq 0 \text{ implies } e(p^1, u^2) \leq e(p^1, u^1) \text{ and } u^2 \leq u^1.$$

This completes the proof of (6). (7) follows from (6) by setting $1 = a$ and $2 = f$, then noting that $p^a x^a = 0$. (8) follows from (6) by setting $1 = f$ and $2 = a$, then noting that $p^a x^a = 0$.

Grinols and Wong [1991] directly compute the welfare change $\Delta W = e(p^1, u^1) - e(p^1, u^2)$ and derived (in our notation)

$$\Delta W = S_c + S_p + p^1(x^1 - x^2) + r^1(v^1 - v^2)^{3/}$$

(their Eq. (5)) where $S_c = p^1c^2 - e(p^1, u^2) \geq 0$ being the consumption effect, and $S_p = p^1y^1 - r^1v^1 - (p^1y^2 - r^1v^2) = -(p^1y^2 - r^1v^2) \geq 0$ being the production effect. Hence it is shown that Theorem 1 can be also obtained employing their equation.

Note that Theorem 1 holds even when there is intervention in commodity or factor trade, or whether the home country is small or large.[4]

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3. This is obtained in the following;

$\Delta W = e(p^1, u^1) - e(p^1, u^2) = p^1c^1 - e(p^1, u^2) = p^1c^2 - e(p^1, u^2) + p^1c^1 - p^1c^2 = S_c + p^1(y^1 + x^1) - p^1(y^2 + x^2) = S_c + p^1y^1 - r^1v^1 - (p^1y^2 - r^1v^2) + r^1(v^1 - v^2) + p^1(x^1 - x^2) = S_c + S_p + r^1(v^1 - v^2) + p^1(x^1 - x^2)$

The consumption effect S_c and the production effect S_p are named by Grinols and Wong [1991].

4. Wong [1991] shows that (6) holds for a small country under free trade in both commodities and factors (Proposition 6) since he treats the case where compensation is allowed among individuals. However (6) holds in more general situations when the social utility function is assumed.

III. Application

A. *Grossman's Condition for Trade in Commodities to be Inferior to Trade in Commodities and Factors*

Setting $1 = f$ and $2 = c$, (6) becomes:

$$p^f(x^f - x^c) + r^f(v^f - v^c) \geq 0 \text{ implies } u^c \leq u^f$$

When factors are freely mobile $r^f = R^f$, so (1) and (2) yield Grossman [1984]'s Proposition 1:

$$(p^f - P^f)x^f + (P^c - p^f)x^c \geq 0 \text{ implies } u^c \leq u^f.$$

In addition, if free commodities trade, $p^f = P^f$, is allowed, then using (2) the above is simplified as:

$$p^f x^c \leq 0 \text{ implies } u^c \leq u^f. \tag{10}$$

(10) is a generalization of the gains from trade through the improvement in the terms of trade (in the case of no factor mobility) discussed by Kemp [1969], and Krueger and Sonnenschein [1967] to be the case of factor mobility.

B. *Bhagwati's Conditions for Immiserizing Growth for a Large Country which Imports Capital Freely*

Setting $1 = c$ and $2 = f$ and using (2), (6) becomes:

$$(P^f - p^c)x^f + (r^c - R^f)(v^c - v^f) + p^c x^c \geq 0 \text{ implies } u^f \leq u^c. \tag{11}$$

With no intervention in commodity or factor trade, $p^f = P^f$, $R^f = r^f$ and $P^c x^c = 0$ so (11) becomes:

$$(p^f - p^c)x^f + (r^c - r^f)(v^c - v^f) \geq 0 \text{ implies } u^f \leq u^c,$$

or by (2)

$$-p^c x^f + r^c(v^c - v^f) \geq 0 \text{ implies } u^f \leq u^c. \tag{12}$$

In the 2×2 Hecksher-Ohlin model, suppose that the exported good 2 is the numeraire and that capital is imported from abroad, so that $v^f > v^c$. Then the

hypothesis in (12) holds if the terms of trade deteriorate ($p_1^f > p_1^c$) and good 1 is capital intensive (so that $r^c < r^f$ by the Stolper-Samuelson Theorem). This yields Bhagwati [1958]'s conclusion that the arrival of capital from abroad reduces welfare in these circumstances.

C. Brecher and Diaz-Alejandro's Conditions for Immiserizing Growth for a Small Country with Import Protection

Suppose that foreign capital arrives in a small country without affecting factor or commodity prices so that $P^c = P^f$ and $r^c = R^f$. By (1), (11) becomes:

$$(p^c - P^c)(x^f - x^c) \leq 0 \text{ implies } u^f \leq u^c.$$

Thus, if the arrival of capital from abroad reduces imports which are subject to tariffs then welfare is reduced.

References

Bhagwati, J.N. [1958], "Immizerizing Growth: A Geometrical Note," *Review of Economic Studies* 25; pp. 201-5.

Bhagwati, J.N. [1973], "The Theory of Immiserizing Growth: Further Applications, in : Connolly, M.B. and A.K. Swoboda, eds., *International Trade and Money* (University of Toronto Press); pp. 45-54.

Brecher, A.R. and E.U. Choudhri, 1982, "Immizerizing Investment from Abroad: The Singer-Prebisch Thesis Reconsidered," *Quarterly Journal of Economics 92*; pp. 181-90.

Brecher, A.R. and C.F. Diaz-Alejandro [1977], "Tariffs, Foreign Capital and Immiserizing Growth," *Journal of International Economics* 7; pp. 317-22.

Brecher, A.R. and R.C. Feenstra [1983], "International Trade and Capital Mobility between Diversified Economies," *Journal of International Economics* 14; pp. 321-39.

Grinols, E.L. and K.L. Wong [1991], "An Exact Measure of Welfare Change," *Canadian Journal of Economics* 24; pp. 428-49.

Grossman, G.M. [1984], "The Gains from International Factor Movements," *Journal of International Economics* 17; pp. 73-83.

Hamada, K. [1975], "An Economic Analysis of Duty Free Zone," *Journal of International Economics* 4; pp. 225-41.

Kemp, M.C. [1969], The Pure Theory of International Trade and Investment, Chapter 12 (Prentice Hall) Englewood Cliffs, N.J.

Kreuger, A.N. and H. Sonnenschein [1967], "The Terms of Trade, the Gains from Trade and Price Divergence," *International Economic Review* 8; pp. 121-7.

MacDougall, G.D.A. [1960], "The Benefits and Costs of Private Investment from Abroad: A Theoretical Approach," *Economic Record* 36; pp. 13-35.

Minabe, N. [1974], "Capital and Technology Movements and Economic Welfare," *American Economic Review* 64; pp. 1088-100.

Minabe, N. [1981], "Tariffs, Capital Export and Immiserizing Growth," *Journal of International Economics* 11; pp. 117-21.

Miyagiwa, K.F. and L. Young [1986], "International Capital Mobility and Commercial Policy in an Economic Region," *Journal of International Economics* 20; pp. 329-41.

Neary, P. and F. Ruane [1988], "International Capital Mobility, Shadow Prices, and the Cost of Protection," *International Economic Review* 29; pp. 571-85.

Ohyama, M. [1972], "Trade and Welfare in General Equilibrium," *Keio Economic Studies* 9; pp. 37-73.

Schweinberger, A.G. [1989], "Foreign Capital Flows, Tariffs, and Welfare: A Global Analysis," *Canadian Journal of Economics* 22; pp. 310-27.

Wong, K.Y. [1991], "Welfare Comparisons of Trade Situations," *Journal of International Economics* 30; pp. 49-68.