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This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the author.

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by

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I. Introduction

Contemporary analysis of the gains from international trade probably started from Samuelson's classic paper (Samuelson, 1939) but the rigorous proof of the gains from trade was delayed until Samuelson (1962) and Kemp (1962). Bhagwati (1968), Grandmont and McFadden (1972), Kemp and Wan (1972) and Ohyama (1972), among others, have made various contributions to the theory. In light of possible losers and gainers in moving from autarky to trade, the basic idea of the proofs, which relies on the Compensation Principle, requires some kind of hypothetical compensation from the gainers to the losers. Samuelson (1950, pp. 19 - 20) argued that "the only consistent and ethics-free definition of an increase in potential real income of a group is that based upon a uniform shift of the utility-possibility function for the group." His analysis was a serious blow to the criteria proposed by Kaldor (1939), Hicks (1940) and Scitovsky (1941). That the Samuelson criterion is widely accepted at least in the present context is due not only to his convincing argument but also to the fact that the trade utility possibility frontier is indeed uniformly outside the autarky one.

Samuelson (1962) did not talk much about the compensation scheme but warned that such scheme may not be feasible.[1] This gap was filled by Kemp and Wan (1972) and Dixit and Norman (1980). The latter made use of the dual approach and derived a simple feasible lump-sum income transfer system in which every individual can be made better-off under trade than at autarky. More recently, Dixit and Norman (1980) and Diewert, Turunen and Woodland (1984) derived systems of consumption and production taxes under which trade is made

beneficial to every individual.

On the other hand, people began to extend the analysis from comparing autarky with trade to comparing two trade positions. Kemp (1962) was the first to show rigorously the welfare implications of a change in the terms of trade, and was followed by the contributions of Krueger and Sonnenschein (1967), Kemp and Wan (1972) and Ohyama (1972). At the same time, people showed asymmetric emphasis on goods trade and factor mobility. Thus, Brecher and Diaz-Alejandro (1977), Brecher and Choudhri (1982) and Wong (1984b) analyzed the welfare effects of factor movements when trade prevails; Bhagwati and Tironi (1978), Bhagwati and Brecher (1980) and Brecher and Bhagwati (1981) analyzed the implications of the presence of fixed amounts of factors in the economy; and Wong (1983), Wong (1984a) and Grossman (1984) derived more general conditions for a welfare improvement due to factor movements. Although in the Arrow-Debreu type general equilibrium model, as far as the equilibrium is concerned, commodities and factors are treated symmetrically, in the real world, there are reasons for treating differently the movements of goods and the movements of factors. For example, the adjustments of the international commodity markets are more rapid while factors are more sluggish to flow across countries.

However, how can we say one trade position is better than the other? This is a fundamental question we have to answer before any meaningful welfare comparison, without interpersonal comparison, can be made. This paper reviews and defines in a simple way different criteria of welfare comparison. It then examines how they can be applied to compare two trade positions. It shows that in many cases, in contrast to the comparison between autarky and trade, the Samuelson is too restrictive to give any conclusion. The Kaldor criterion,

which was under heavy criticism of people like Scitovsky and Samuelson, is here suggested as a sensible and relevant criterion for comparing the present trade situation with a past equilibrium point. This is the main idea of this paper. The paper then, based on the Kaldor criterion, derive general conditions for beneficial movements of goods and factors.

The paper is organized as follows. Section II develops the framework, introduces notations and reviews the Kaldor, Hicks, Scitovsky and Samuelson criteria. It also extends the lump-sum income transfer system introduced in Dixit and Norman (1980). Section III will revisit the index problem and show that an increase in the real national income implies that the final situation is preferable to the initial equilibrium point - a welfare improvement by the Kaldor criterion. This result is applied in Section IV to derive the welfare implications of more trade in goods and factors. Section V shows that the Samuelson criterion is too restrictive in many cases to give any conclusion and argues that the Kaldor criterion could be a practical and reasonable one of welfare comparison. The last section concludes.

II. The Model

Consider a competitive economy in which there are I commodities, J primary factors, H consumers and N firms. Denote the non-negative vectors of domestic commodities and factors prices as $p = (p_1,.....,p_I)$ and $w = (w_1,.....,w_J)$, respectively. Individual h supplies the J-vector factor services, v_h, receives a lump-sum transfer, b_h, from the government and consumes the I-vector consumption good, x_h. He faces a consumption set which is closed, convex, and

bounded below in the non-negative orthant of the I-dimensional commodity space and his preferences can be represented by the utility function, $u_h = u_h(x_h, v_h)$, which is quasi-concave, homothetic and continuous. He is given fixed endowments of commodities and factor services but for simplicity, they are neglected. He maximizes his utility subject to his budget constraint, $p.x_h - w.v_h \leq b_h$, where "." denotes the inner product of two vectors. Alternatively, his consumption decision can be represented by the expenditure function, $e_h(p,w,u_h) = \min \{p.x_h - w.v_h \mid u_h(x_h,v_h) \leq u\}$ which is concave, linear homogeneous jointly in p and w, and continuous.[2] With non-satiation, $b_h = \sum_{h=1}^{H} e_h(p,w,u_h) = p.x_h - w.v_h$. The non-negative I-vector of aggregate consumption is given as $x = \sum_{h=1}^{H} x_h$ and the non-negative J-vector of aggregate factor supply as $v = \sum_{h=1}^{H} v_h$. Firm n employs factor services, v_n, to produce the non-negative vector of output, y_n, in such a way to maximize the profit, $p.y_n - w.v_n$. The production possibility set of each firm is closed and convex with the possibilities of inaction and free disposal. No transport costs, external economies and diseconomies are assumed. The non-negative I-vector of aggregate output is denoted as $y = \sum_{n=1}^{N} y_n$. With full employment of factors and in the absence of international factor movement, $v = \sum_{n=1}^{N} v_n$. With constant returns to scale, $p.y - w.v = 0$.

The role of the government is to vary the taxes or subsidies on tradable goods and factors and to redistribute income among individuals by setting the H-vector of lump-sum transfer $b = (b_1,.....,b_H)$. The elements of b may be positive (representing net transfer to the individual), negative (representing net transfer from the individual), or zero. It is assumed that income redistirbution can be made timelessly and costlessly. No domestic consumption or production taxes and subsidies are assumed, however.[3] In the absence of

international borrowing or transfer, the income redistribution plan is said to be feasible if the net transfer, $b_T = \sum_{h=1}^{H} b_h$ is not greater than the net tax revenue on traded goods and factors, d. The government does not produce or consume any good; so in equilibrium, $b_T = d$.

In order to concentrate the analysis below on the economy, we follow the terminology of Ohyama (1972) and define "foreign environment" as a catchall term representing the state of technologies, preferences, commodity and factor endowments, and government policies in the rest of the world. If the economy is too small to have significant influence on the world prices of commodities and factors by varying its own level of trade, the foreign environment can be represented by the set of prevailing world prices of tradable commodities and factors. To facilitate our analysis, let us define the following terms which are important in the concepts of welfare comparison introduced below.

Definition 1 (Economic Situation): An economic situation (or simply situation) s is a specification of the followings.

(i) the set of consumers;

(ii) the set of producers;

(iii) the government's taxes and subsidies on tradable goods and factors; and

(iv) the foreign environment.

In order to limit our analysis, we assume that the sets of consumers (with their preferences and endowments) and producers (with their production possibility sets) are given and invariant in different situations.

Definition 2 (Distribution): A distribution b is the H-vector lump-sum transfer, $b = (b_1, \ldots\ldots, b_H)$.

Assumption 1: Given any distribution in any situation, there exists a unique (competitive) equilibrium of the world.

Definition 3 (Equilibrium Point): An equilibrium point (or simply point), E(s; b), is the set of tuples of equilibrium vectors (p, w, x, y, v,.....)

The conditions for the existence and uniqueness of the equilibrium point can be provided by standard arguments. (See, for example, Arrow and Hahn, 1971, Chapter 5 and Grandmont and McFadden, 1972).

We now explain how, without interpersonal comparison, two situations can be compared from the welfare point of the economy. Label the situations as the initial one, s, and the final one, S, and distinguish the variables in these two situations by lower-case and upper-case letters, respectively.[4] Suppose that the equilibrium point of the economy moves from E(s;b) to E(S;B), what can we say about the change in the welfare of the economy? It is obvious that, in general, these two points cannot be directly compared because the movement usually creates losers and gainers.[5] We adopt the Compensation Principle under which income is hypothetically redistributed among individuals to see whether there exists a way of making every individual better-off, or at least not worse-off, in one situation than in another. Depending on whether only the income distribution in the initial situation, or that in the final situation, or both, are made, we have the following criteria of welfare comparison.

Definition 4 (Point-to-Situation Comparison - The Kaldor Criterion): Situation S is said to be preferable to the equilibrium point E(s;b) if there exists an income distribution B is S such that $u_h(X_h,V_h) \geq u_h(x_h,v_h)$ for all h.

Definition 5 (Situation-to-Point Comparison - The Hicks Criterion): The

equilibrium point E(S;B) is said to be preferable to situation s if there exists an income distribution b in s such that $u_h(X_h,V_h) \geq u_h(x_h,v_h)$ for all h.

The above two criteria assume that only the distribution in one of the situation is varied, the difference between them being that the Kaldor crtierion assumes the correctness of the status quo ante (Kaldor, 1939) while the Hicks criterion assumes the correctness of the status quo post (Hicks, 1940). Scitovsky (1941) showed that using either of these criteria could lead to the Scitovsky Paradox and argued for the double test: situation S is preferable to situation s if both the Kaldor and the Hicks criteria are satisfied. However, the assumption of the correctness of the status quo ante and/or status quo post was heavily cirticized by Samuelson (1950) because, he argued, the comparison should "depend upon the totality of all possible positions in each situation." (p. 11) His criterion can be stated as follows.

Definition 6 (Situation-to-Situation Comparison - The Samuelson Criterion): Situation S is said to be preferable to situation s if
(C1) for any given b in situation s, there exists some B in situation S such that $u_h(X_h,V_h) \geq u_h(x_h,v_h)$ for all h; or
(C2) for any given B in situation S, there exists some b in situation s such that $u_h(X_h,V_h) \geq u_h(x_h,v_h)$ for all h.

The Samuelson criterion can be stated in terms of either condition (C1) or (C2). As shown in the following proposition, these two conditions are equivalent.

Proposition 1: Conditions (C1) and (C2) are equivalent.

Proof: It suffices to show that (C1) implies (C2) as the converse can be shown

in a similar way. Suppose that (C1) holds but that (C2) does not. Then choose a distribution B^1 in situation S so that we cannot find a distribution in s such that $\tilde{u}_h \geq u_h(x_h,v_h)$ for all h, where $\tilde{u}_h = u_h(X_h^1, V_h^1)$ is the utility level of individual h at $E(S;B^1)$. Suppose that the government freezes the volume of trade in goods and factors and domestic prices, P^1 and W^1, at $E(S;B^1)$. The net tax revenue, D^1, if any, is then fixed. Then consider the following distribution b^1 in s: $b_h^1 = e_h(P^1,W^1,\tilde{u}_h) = P^1.x_h^1 - W^1.v_h^1$. Then $b_T^1 = \sum_{h=1}^{H} b_h^1 = P^1.x^1 - W^1.v^1$. Firms make optimal decisions to maximize their profits. Since under no distribution in s can we have $\tilde{u}_h \geq u_h(x_h,v_h)$ for all h, then $b^1 < D^1$. Thus the government has enough of resources to make every individual better-off than at $E(S;B^1)$. So choose b^2 such that $u_h(x_h^2,v_h^2) > \tilde{u}_h$ for all h. Because of (C1), there exists a distribution B^2 in situation S such that $u_h(X_h^2,V_h^2) \geq u_h(x_h^2,v_h^2)$ for all h. Combining the above results, we have $u_h(X_h^2,V_h^2) > u_h(X_h^1,V_h^1)$, showing that $E(S;B^1)$ is not at Pareto Optimal. However, this violates the First Fundamental Theorem of Welfare Economics. So (C2) must be true.

Q.E.D.

In the utility space, (C1) or (C2) means that situation S is preferable to situation s if the utility possiblity frontier (UPF) in situation S is uniformly beyond the utility possibility frontier in situation s.

III. Real National Income and Welfare

This section discusses some practical methods of applying the above criteria to compare two different situations. Perhaps the easiest, most commonly used and statistically possible way is to examine the change in the real national income of the economy. Formally, the real national income of the economy is said to rise in moving from situation s to situation S if

(1) $P.X - W.V > P.x - W.v,$

that is, if the value of the consumed goods and factor services, evaluated at prices in situation S, is higher in situation S than in situation s. A more general version of (1) is $P.X - W.V \geq P.x - W.v$. The information about the welfare of the economy we can get from (1) is given in the following two propositions.

Proposition 2: If (1) holds, then there exists a reallocation of the consumption bundle (x,v) at E(s;b) such that every individual is worse-off, or at least not better-off, than at E(S;B).

Proof: See Hicks (1940), Samuelson (1950) and Kennedy (1954).

Note that Proposition 2 refers to a reallocation of a fixed bundle of goods and factor services. However, (1) does not imply that E(S;B) is preferable to situation s because there may be an income distribution in situation s, which gives rise to a different bundle (x',v'), such that every individual is made better-off than at E(S;B). A counter example will be given in Section V. In this sense, Proposition 2 is not regarded as useful in determining whether there is a welfare improvement. Turning around, we cannot

show that we can reallocate the fixed bundle (X,V) at E(S;B) to make every individual better-off than at E(s;b) (Samuelson, 1950). However, given (1), we can show, that there exists an income distribution in situation S under which, with possibly a new bundle (X',V'), every individual can be made better-off than at E(s;b). In other words, (1) implies a welfare improvement by the Kaldor criterion.

Proposition 3: If (1) holds, then situation S is preferable to the equilibrium point E(s;b).

Proof: Let the government freeze the volume of trade, the level of factor movement and domestic prices, P and W, at E(S;B). The net taxes on trading goods and moving factors, $D = P.X - W.V$, if any, will then be fixed. The government then sets up the following transfer system in situation S: $B' = (B'_1,.....,B'_H)$, $B'_h = e_h(P,W,\tilde{u}_h) = P.X'_h - W.V'_h$, where $\tilde{u}_h = u_h(x_h,v_h) = u_h(X'_h,V'_h)$ is the utility level of individual h at E(s;b). In other words, each individual is given a transfer, which may be positive, negative, or zero, in order to remain at his utility level at E(s;b). We need to show that the sum of the transfers is not greater than D. Because of the definition of the minimum expenditure function, $P.X'_h - W.V'_h \leq P.x_h - W.v_h$. Thus $B'_T = \sum_{h=1}^{H} B'_h = P.X' - W.V' \leq P.x - W.v < P.X - W.V = D$, the last inequality being due to (1). So the government has resources to make every individual better-off, or not worse-off, than at E(s;b).

Q.E.D.

The usefulness of these two propositions is that they do not depend on the size of the economy. Can we, then, go one step further and argue that given (1), situation S is preferable to situation s? In other words, can we argue that (1) implies that the UPF in S is uniformly beyond the UPF in s? The

answer is, in general, we cannot, unless (1) holds for any distribution in situation s in the way stated in the following proposition.

Proposition 4: If for any distribution b in situation s, there exists a distribution B in situation S such that (1) holds, then situation S is preferable to situation s.

Proof: It follows condition (C1) and Proposition 3.

Q.E.D.

We can now make use of the above results to prove a classic proposition, "restricted trade is better than no trade." Although the proposition is well-known, we will provide a slightly different proof. Let us denote the autarky situation as s and the trade situation as S and define the following notations:

$m = x - y$ ($M = X - Y$) is the I-vector of net import (negative for export) of goods;

k (K) is the J-vector of net factor inflow (negative for outflow);

q (Q) is the I-vector of international commodity prices;

r (R) is the J-vector of international factor prices;

$t = p - q$ ($T = P - Q$) is the I-vector of specific taxes (negative for subsidies) on imported goods; and

$z = w - r$ ($Z = W - R$) is the J-vector of specific taxes (negative for subsidies) on inflowing foreign factors.

Since the economy is at autarky in situation s, $m = 0_I$ and $k = 0_J$ where 0_I (0_J) is the I-(J-)vector of zeros. The net taxes under trade, if any, is equal to $T.M + Z.K$. We first make the following two assumptions:

Assumption 2: Trade in goods and factors of the economy is always balanced.

Assumption 3: Restrictions on trade, if any, are such that $T.M + Z.K \geq 0$.

Assumption 2 implies that $Q.M + R.K = 0$. Trade restricted in the way given in Assumption 3 is called trade under self-financing tariffs by Ohyama (1972) or natural trade by Deardorff (1982). We can now state and prove the following proposition.

Proposition 5: Restricted trade is preferable to no trade.

Proof: For any autarky point $E(s;b)$ and any trade point $E(S;B)$, we have:

$$(2) \quad P.X - W.V = P.Y - W.V + P.M$$

$$(3) \quad = P.Y - W.K - W.V + T.M + Z.K$$

$$(4) \quad \geq P.y - W.v + T.M + Z.K$$

$$(5) \quad = P.x - W.v + T.M + Z.K$$

$$(6) \quad \geq P.x - W.v$$

Conditions (2) and (3) are due to the definitions of the terms; (4) is due to profit maximization, $P.Y - W.K - W.V \geq P.y - W.k - W.v$ and $k = 0_J$. Condition (5) is due to the autarky condition, $x = y$, and (6) due to Assumption 3. Note that conditions (2) to (6) holds for any distribution in the autarky situation. Thus by Propositions 3 and 4, restricted trade is better than no trade.[6]

Q.E.D.

Under free trade, since $T = 0_I$ and $S = 0_J$, so Assumption 3 holds and we immediately have the following corollary.

Corollary: Free trade is better than no trade.

IV. More Trade and Welfare

This section analyzes some cases in which an economy moves from one trade situation to another and how the welfare of the economy is affected in the movement. The analysis, based on condition (1) and Proposition 3, will derive conditions under which the final situation is preferable to the initial equilibrium points. The difficulty of deriving sufficient conditions for a welfare improvement by the Samuelson criterion will be shown in the coming section.

Define situations s and S as the initial and final situations. Taxes and subsidies on trading goods and moving factors are allowed as long as Assumption 3 is not violated.[7] Conditions (2) to (6) can be slightly modified as follows by taking into consideration the fact that k may not be zero and that $x = y + m$.

$$\begin{aligned} P.X - W.V &= P.Y - W.V - W.K + P.M + W.K \\ &\geq P.y - W.v - W.k + P.M + W.K \\ &= P.x - W.v + P.(M-m) + W.(K-k). \end{aligned} \tag{7}$$

Condition (7) immediately gives the following proposition.[8]

Proposition 6: If the following condition holds,

$$P.(M-m) + W.(K-k) > 0, \tag{8}$$

then the final situation is preferable to the initial equilibrium point.

Proof: It follows Proposition 3 and condition (7).

Q.E.D.

Proposition 6 means that if, when evaluated at final prices, the value of net import of goods and inflow of foreign factors rises, then there is an improvement in the welfare by the Kaldor criterion. One implication of the proposition is that "more trade in the sense of (8) is better than less trade." However, in applying the proposition, one caution is that (8) should include the prices and quantities of all moving goods and factors. The proposition can be applied in several special cases. For example, suppose, as in Wong (1984b) and Brecher and Diaz-Alejandro (1977), that there is an increase in the amount of foreign factors in the domestic economy. Then $K \geq k$, and (8) is reduced to $P.(M-m) > 0$. Thus there is a welfare improvement by the Kaldor criterion if, at the final prices, the net value of the import of goods is increased.[9] Another interesting application of the above proposition is the case when there are fixed amounts of foreign factors in the economy, as analyzed in Bhagwati and Tironi (1978), Bhagwati and Brecher (1980), Brecher and Brecher and Bhagwati (1981), and Wong (1984b). In these cases, $K = k$ and condition (8) is equivalent to $P.(M-m) > 0$.

Another sufficient condition for welfare improvement, which comes directly from (7), is an improvement in the terms of trade, as shown in the following proposition.

Proposition 7: If there is an improvement in the terms of trade in the sense that

$$(9) \qquad P.m + W.k < 0,$$

then there is an improvement in the welfare of the economy by the Kaldor criterion.

Proof: It can be shown that, given the balanced of trade assumption, P.M + W.K = T.M + S.K, which, by Assumption 3, is non-negative. Thus the proposition follows Proposition 3 and (7).

Q.E.D.

Note again that condition (9) includes all moving goods and factors. Special forms of (9) appear in the literature as the sufficient condition for a welfare improvement of an economy. For example, when there are pure exchanges of goods, it can be reduced to

(10) $P.m < 0,$

that is, an improvement in the commodity terms of trade. When there is only movement of factors but autarky in trade, as considered in Wong (1983, 1984a),[10] the correct condition for welfare improvement should be an improvement in the factor terms of trade as follows.

(11) $W.k < 0.$

There are certain cases in which either (10) or (11) can be used even though there are goods trade and factors flow. As (9) is expressed in terms of the final prices and initial quantities of moving goods and factors, so in the cases in which the changes in prices are due to the movements of additional goods and/or factors which are absent in the initial situation, then the elements in m and/or k corresponding to these goods and factors are necessarily zero. For example, Brecher and Choudhri (1982) used the terms-of-trade condition given in (10) to determine the welfare effect of capital transference from developed to less developed countries. As shown in (9), it is correct as long as the analysis refers to no capital flow in the initial situation. On the other hand, to determine the welfare effects of introducing free trade when

free capital mobility is prevailing, as did in Bhagwati and Brecher (1985), the correct terms-of-trade condition should include the quantities of capital moved and goods repatriated in the initial condition.[11]

V. The Samuelson Criterion or the Kaldor Criterion?

The two propositions stated in the above section derive sufficient conditions under which the final situation is preferable to the initial point, i.e., there is an improvement in welfare by the Kaldor criterion. The propositions come from Proposition 3 and condition (7). Thus a welfare improvement by the Kaldor criterion is the most conditons (8) and (9) can give. Except in certain cases, (8) or (9) is <u>not</u> a sufficient condition for a welfare improvement by the Samuelson criterion, a point which is often overlooked in the literature. The difficulty of applying the Samuelson criterion in the present context, as indicated in Proposition 4, is that welfare improvement by the criterion requires that (1) hold for any distribution in the initial situation. However, the validity of (9) between two observed points does in no way imply that it also holds for any distribution in the two situations. An example is given below.

Consider a small economy under free trade but no movement of factors. For simplicity, assume only two goods, 1 and 2, and fixed factor services. So the production possibilities of the economy can be represented by the frontier TT in Figure 1. Let the initial international commodity prices be represented by the price line AB, the production point be at Q and the consumption point be at C. Since under the initial income distribution, the aggregate consumption of

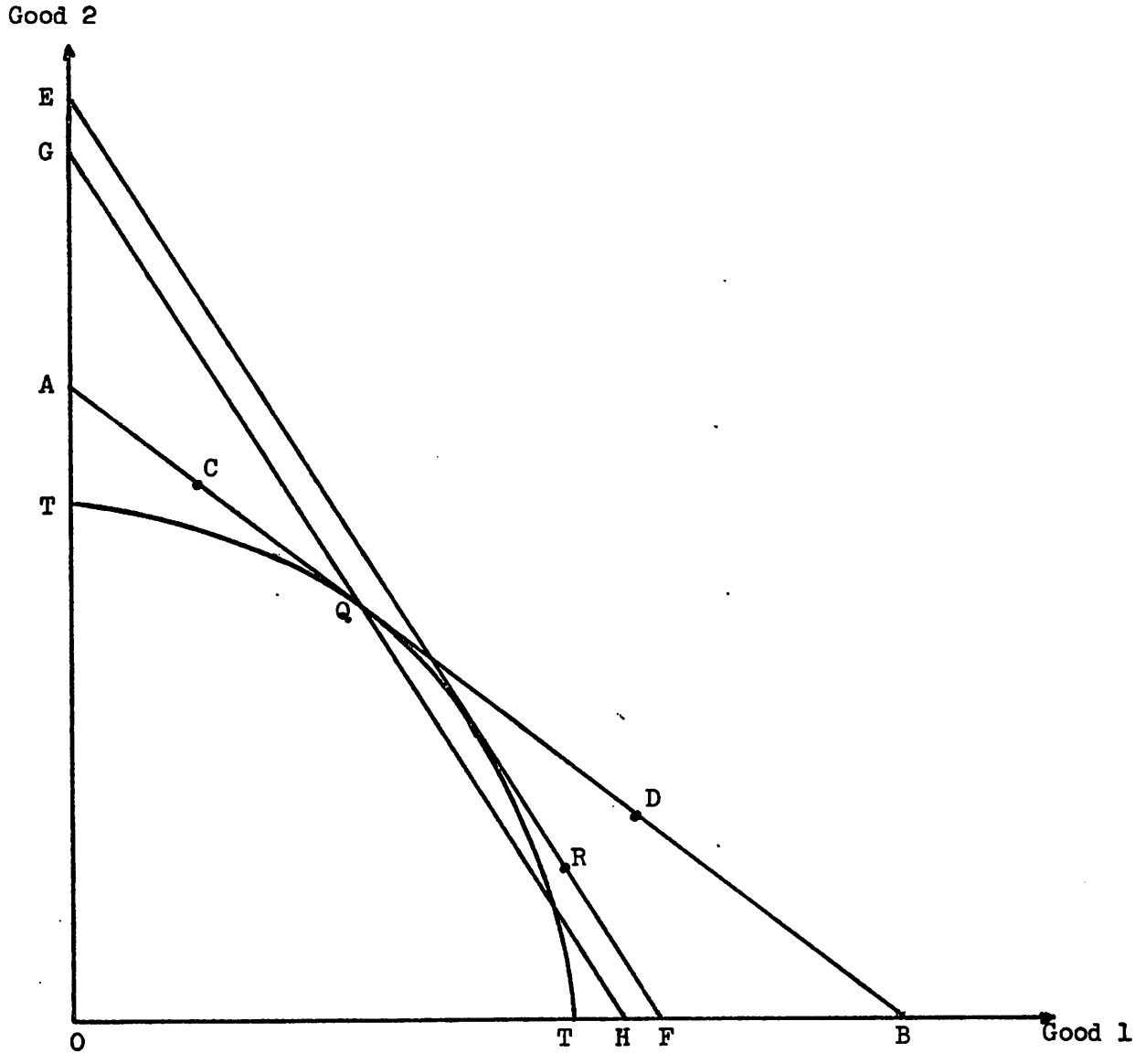

Figure 1

good 1 (2) is less (greater) than the aggregate production, the economy exports (imports) good 1 (2). Suppose that there is an autonomous increase in the relative price of good 1 and that the price line becomes EF or GH, as shown. Then we can easily show that the price change stands for an improvement in the terms of trade as (9) (with $k = 0$) or (10) holds. Proposition 6 tells us that given the initial consumption point C, we can find a consumption point on EF at which every individual can be made better-off.

However, if the distribution in the initial situation can be varied, as required under the Samuelson criterion, then in general no conclusion about welfare change can be made. It is because in the initial situation, there may exist a distribution with which the consumption point of the economy will shift to point D in Figure 1. To see this point, assume that there are two individuals in the economy. Individual 1's preferences are biased toward good 1 and 2's preferences toward good 2. If the government shifts income from individual 2 to individual 1, the economy's demand for good 1 will rise and that for good 2 will fall. Then in Figure 1, the consumption point will shift from C to D. With the consumption point at D, (9) or (10) no longer holds and no conclusion can be made.

The above result is not surprising if we note that the budget set of the economy in the initial situation is OAB while that in the final situation is OEF; neither of them is the subset of the other. This case is in contrast to the comparison between autarky and trade. In the latter case, the autarky consumption possibility set is a subset of the trade consumption possibility set.

Kemp (1962) was probably the first one to be awared of this difficulty. He explicitly stated that (9) or (10) is not just an observed fact but also a restriction: it holds for any distribution in the initial situation.[12] In terms of Figure 1, the restriction means that the initial budget set is restricted to OAQH less the line segment QH, which is obviously a subset of the final budget set. With this as a restriction, it is not difficult to show that there is an improvement of welfare by the Samuelson criterion. However, he did not give any justification for making this restriction and we have no reason to believe that this is the general case.

Later papers concerning similar problems were less explicit about this point. For example, Krueger and Sonnenschein (1967) and Kemp and Wan (1972) had not made it clear whether the terms-of-trade-improvement condition is also a restriction and thus it is not sure whether they were comparing the final situation with the initial situation (by the Samuelson criterion) or with the initial point (by the Kaldor criterion). Ohyama (1972), though correctly stated the Samuelson criterion, did not seem to be aware of the above difficulty.

To be fair, this paper is not denying the results of the above papers but to point out the inconclusiveness of applying the Samuelson criterion in the present context and to search for a practically feasible criterion of welfare improvement. It is noted that the Compensation Principle requires hypothetical income redistribution but the redistribution is usually not carried out. It is further noted that many problems are due to the movement of the economy from one trade point to another with the former one happened in the past. For example, this appears to be the type of problems analyzed in Krueger and Sonnennschein (1967) which indexed the situations by time periods. If this is

the case, then redistributing income in the past situation is an irrelevant question and no matter what the actual distribution was has to be taken as given. In other words, the meaningful welfare comparison is then to compare the present situation, in which income redistribution is possible, with the observed past equilibrium point. In other words, we need to apply the Kaldor criterion to see whether in the present situation, there exists a hypothetical distribution with which every individual can be made better-off than they actually were.

Lastly, referring back to a point in Section IV, the present example can be used to show that an increase in the real national income in terms of (1) does not imply that the final equilibrium point is preferable to the initial situation, i.e., a welfare improvement by the Hicks criterion. Suppose that the final consumption is such that it can be represented by point R in Figure 1, then there is an improvement in the terms of trade by (9) or (10), and thus an increase in the real national income. However, in this case, it is also true that $p.x - w.v > p.X - w.V$ which implies, by Proposition 3, that the initial situation is preferable to the final equilibrium point.

VI. Concluding Remarks

This paper revisited the Compensation Principle and investigated how it can be applied to compare two trade positions. Different criteria of welfare comparison were reexamined. Using the lump-sum income transfer system introduced in Dixit and Norman (1980), new results were obtained. A relevant question is what one can say about the welfare of a group of individuals if it

is observed that the real national income rises as given by (1). It has been proved in the literature that it implies that one can reallocate the given initial bundle of goods and services to make everyone worse-off, or at least not better-off, than at the final point and that one may not be able to reallocate the given final bundle to make everyone better-off than at the initial point. However, if income redistribution instead of reallocation of a fixed bundle of goods and services is performed, more opportunities of welfare improvement may exist and the results are significantly different. For example, given the national income condition (1), then we cannot show that the final equilibrium point is preferable to the initial situation but we can show that the final situation is preferable to the initial equilibrium point. The latter result, which means a welfare improvement by the Kaldor criterion, is a useful one when two trade positions are to be compared. There are two reasons. First, the Samuelson criterion, which in theory is superior to the Kaldor criterion, is too restrictive. In many cases, as shown in the example in Section V, none of the consumption possibility sets in the two trade positions is a subset of the other one. Second, if one of the two trade positions was in the past, then redistribution in that situation is irrelevant and we have to take the actual distribution in that situation as given. Then the Kaldor criterion, which assumes the correctness of status quo ante, is the meaningful one.

Based on the above results, the paper derived some sufficient conditions for welfare improvement by the Kaldor criterion when there is an increase in trade or when there is an improvement in the terms of trade. The criterion will find many other applications.

FOOTNOTES

1. Samuelson (1962) did talk something about the compensation scheme. But he seemed to be looking at the reallocation of a fixed amount of goods obtained under trade instead of redistribution of income in the trade situation. See his Figure 6 in which he referred to the feasibility locus "vg" corresponding to a fixed amount of goods instead of the frontier "ef". If income redistribution is allowed, then a feasible compensation scheme always exists, as shown below.
2. For the properties of the expenditure function, see Dixit and Norman (1980, Chapter 2).
3. For excellant expositions of the welfare effects of domestic consumption and production taxes and subsidies, see Bhagwati (1968) and Ohyama (1972).
4. The paper assumes that the economy moves from one situation to another due to, say, a change in the government policy or a change in the foreign environment. Calling them initial and final situations would not be appropriate if the government is considering two policy alternatives which could lead to two new different situations.
5. The movement from E(s;b) to E(S;B) is said to be a Pareto Improvement if $u_h(X_h,V_h) \geq u_h(x_h,v_h)$ for all h with a strict inequality for at least one individual.
6. Kemp and Wan (1972) noted that Kemp (1962, 1969) provided an 'almost proof' of the proposition by 'showing that no free trade equilibrium could be improved by returning to autarky,' and jumping to the conclusion that 'the free trade utility possibility frontier must pass above or through every possible autarkic equilibrium point.' Kemp and Wan then provided a complete

proof of the proposition. This paper (Propositions 4 and 5) offers an alternative way to fill the gap Kemp jumped over.

7. It is sometimes held that if there is a divergence between domestic and international prices, the absence of inferior consumption goods is needed for 'normal' results concerning the welfare effects of the terms of trade. This point, however, is not required as long as the economy is able to pick the optimal point along a given international price line. For details, see Kemp (1969, pp. 268-270).

8. For different forms of (7) and their implications, see Ohyama (1972) and Grossman (1984).

9. Wong (1984b) derived the optimal tariff policy when there exists foreign capital in the domestic economy. It showed that, for welfare improvement, a tariff (subsidy) should be imposed on the labor- (capital-) intensive importable good. As a result, additional inflow of foreign capital will be beneficial as it leads to more import. In Brecher and Diaz-Alejandro (1977), the importable is capital-intensive. Thus more foreign investment is immizerizing. However, capital inflow will sooner or later reverse the patterns of trade. So when the economy imports the other good which is labor-intensive, more capital inflow is beneficial.

10. Wong (1983, 1984a) also considered factor movements in the presence of goods trade.

11. For example, if foreign capital flows in and if only good 1 is repatriated, the terms-of-trade condition becomes $-P_1^W a + r^W k < 0$, where P_1^W and r^W are the price of good 1 and rental rate, respectively, under free trade and capital mobility, and a and k are the amounts of good 1 repatriated and foreign capital moved, respectively, under free capital mobility but autarky in

trade. Wong (1983) showed that in the 2x2 framework, the above condition can be expressed in terms of r^W and r, where r is the rental rate under free capital mobility but autarky in trade. Thus choosing good 1 as the numeraire, there is an improvement in the terms of trade and thus the national welfare if r is less than r which is less than the autarky rental rate.

12. See Kemp (1962), Section 4, especially Figure 3(b).

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