The Problem of Deadweight Loss in the International Trade of Growing Capitalist Economies *

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I. Introduction

The purpose of this paper is to present a critical survey of the recent controversy about the welfare implication of international trade between two growing economies. This controversy appears to have both theoretical and policy significance by calling into question the principle of comparative advantage. The neo-Keynesians argue that trade between two economies in steady-state, but not satisfying the Golden Rule of Accumulation, can make either or both countries worse off (relative to welfare, measured in consumption per worker, in autarky), if the two countries have, before and after trade, unequal positive rates of profit and trade according to the capitalist rule (based on differences in autarkic relative market prices). The neo-classicists reject this argument on the grounds that it ignores the problem of transition between different steady-state paths and that it wrongly attributes to trade a deadweight loss actually caused by the implicit assumption of an imperfect international capital market.

II. The Neo-Keynesian Criticism of the Neo-Classical Theory of International Trade

Before attention is focused on the controversy about the welfare implications of trade in steady-state, we present a brief review of the neo-Keynesian criticism of the neo-classical trade theory. This criticism, stimulated by the famous Cambridge controversies in capital theory, is found in its most complete form in the writings of Metcalfe and Steedman (1972, 1973a, 1973b). We review this criticism because the question of deadweight loss in the steady-state Ricardian trade model is closely tied to it.

Metcalfe and Steedman (1972) put forward a fundamental objection to the Heckscher-Ohlin theorem. This objection is derived from a closed neo-classical, multi-technique, stationary-state model with two goods and two primary factors

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(land and labor), and with only circulating capital (goods in process) on the value of which a uniform positive rate of profit is earned. This objection which hinges on the assumption of a positive (as opposed to zero) profit rate has four components:

(a) "Perverse" switching; i.e., a higher rent-wage ratio may be linked with the use of more land-intensive techniques.
(b) The relative output of a commodity may be inversely related to its relative price.
(c) A more intensive demand for the land-intensive commodity may be linked with a lower relative price for that commodity and a lower rent-wage ratio.
(d) A greater relative supply of land may be linked with a higher relative price for the land-intensive commodity and a higher rent-wage ratio.

In short, the general validity of the Heckscher-Ohlin theorem (and indirectly the other neo-classical theorems such as the Stolper-Samuelson theorem and the factor price equalization theorem) is shown to be questionable by replacing the unrealistic zero profit assumption with the positive profit assumption. This result is of interest for our purposes since the question of deadweight loss from trade also hinges on the assumption of positive (as opposed to zero) profit rates in the Ricardian trade model.

Metcalfe and Steedman (1973a) develop the attack on the internal logic of the Heckscher-Ohlin theorem by emphasizing the heterogeneity of capital goods. The value of the total capital stock, expressed in terms of one of the two consumption goods, is assumed to be constant. Its physical composition, however, can change with changes in the structure of consumption goods' production. The rate of interest is the price of this aggregate value capital which is assumed to be immobile internationally. It should be noted that the heterogenous capital goods of Metcalfe and Steedman are intermediate inputs, assumed to be non-tradeable, which are completely used up in one production period.

Metcalfe and Steedman utilize a numerical example to show that under their assumptions the relation between the interest-wage ratio and the capital-labor ratios of the individual consumption goods and the relation between the interest-wage ratio and the relative price of the two consumption goods may not be monotonie. The general validity of both the price and the quantity versions of the Heckscher-Ohlin theorem and the Stolper-Samuelson theorem is called into question by the nonmonotonicity of the second relation. Metcalfe and Steedman find the neo-classical trade theory useless for not being able to predict the direction of trade and argue in favor of a neo-Ricardian trade theory that allows for tradeable intermediate inputs.

Metcalfe and Steedman (1973b) present an attack on the neo-classical factor price equalization theorem by making use of the dynamic nonsubstitution

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1 Metcalfe and Steedman (1972, p.155).
Theorem 2. The latter says that for each rate of interest there is a unique set of relative commodity prices independent of demand conditions. Therefore, if the autarkic steady-state rates of interest differ between two countries so will their autarkic steady-state relative commodity prices. Free trade will equalize relative commodity prices. Equalization of relative commodity prices, however, will not necessarily equalize the rates of interest and the real wages between the two countries even under incomplete specialization, if the technology set, assumed to be identical for the two countries, contains multiple techniques to produce each commodity. The reason is the nonmonotonicity of the relative commodity price sets function in the rate of interest which Metcalfe and Steedman demonstrate through a numerical example. They argue that the proof of the factor price equalization theorem by Samuelson is unacceptable since he assumes the monotonicity of the relative commodity price sets function in the rate of interest.

Samuelson (1975) in response to the criticisms of Metcalfe and Steedman concurs “with their warnings about the use of (such) aggregate capital magnitudes, which only work in certain Santa Claus cases (surrogate capital and worse),” and discusses at length the results of Metcalfe-Steedman (1972). Samuelson states

...that once we are in the Sraffa world of explicit time-phasing, we should recognize how many nonmonotonic relations may be introduced and how treacherous becomes unsophisticated intuition in making guesses and surmises.

Robinson and Sraffa are the sung heroes of this saga, and I sound my lyre in admiration for their Trojan deeds.

It should be noted in concluding this section that although the neo-Keynesian criticism of the neo-classical theory is based on the assumption of multiple techniques and on the possibility of reswitching, in the controversy about the deadweight loss from trade in the steady-state Ricardian model, the reswitching problem has been largely ignored. This has been done by either assuming a single technique for each commodity or assuming the exogenous rate of profit to be constant when multiple techniques are allowed.

III. The Gains from Trade in the Steady-State Ricardian Model

Metcalfe and Steedman, and Samuelson were first to investigate the implications of time-phasing (of labor) in the Ricardian trade model. These two initial investigations, which differ in their welfare conclusions, appear to have been done independently.

2 Mirrlees (1969) presents a proof of the theorem based on the assumptions of (a) Single primary input, (b) No joint products, (c) Constant returns to scale and (d) Steady-state.

3 Samuelson (1975, p. 352).

4 Samuelson (1975, p. 351).
Metcalfe and Steedman (1973c) set out to investigate the implications of time-phasing (with different production lags for different goods) for the Ricardian trade model, assuming:

(a) Two countries and two commodities.
(b) Complete specialization in trade.
(c) No intermediate inputs.
(d) Single technique (with constant returns to scale) for the production of each commodity in each country.
(e) Exogenous real wage for each country.
(f) Free trade.
(g) Perfect competition.
(h) Trade is carried out by capitalist firms on the basis of differences in the autarkic relative prices of the two countries.
(i) No trade in semi-finished commodities.
(j) The autarkic rates of profit (which can differ between the two countries) are positive.

Metcalfe and Steedman, taking the post-trade relative price, assumed to be between the autarkic relative prices, as given, reach the following conclusions:

(a) After trade the rate of profit in each country increases if the imported commodity enters into the real wage (a predetermined basket of the two commodities).
(b) The autarkic relative price in each country is determined jointly by technology (the labor coefficients and production lags) and the rate of profit (given the real wage rate).
(c) One (or both) of the two countries can be worse off in trade than in autarky by consuming a commodity bundle inside its (their) production possibility frontier(s).

Metcalfe and Steedman define comparative advantage in terms of relative unit labor requirements since in their assumed (zero growth) steady-state, the lags in production drop out of the picture and the linear labor constraint of each country becomes its production possibility frontier at any point in time. Trade, however, is carried out, by assumption, on the basis of differences in autarkic relative prices, which are not (necessarily) equal to the slopes of these production possibility frontiers. Thus, conclusion (c) obtains.

In the Appendix of Metcalfe and Steedman (1973c), intermediate inputs (with fixed coefficients), which are completely used up in one production period, are allowed. This introduces circulating capital into the Ricardian model. Conclusion (c) is asserted by Metcalfe and Steedman when such intermediate inputs are present. It is proven by Mainwaring (1974) and by Erdilek and Schive (1976).

Metcalfe and Steedman (undated) present an alternative and somewhat more sophisticated (capital theoretic) analysis that also leads basically to conclusion (c) above, assuming:
(a) A small country that takes the world terms of trade as given.
(b) Two final (consumption) commodities.
(c) Single primary factor of production (labor).
(d) Constant returns to scale in production which is vertically integrated for each commodity.
(e) Perfect competition.
(f) Free trade.
(g) Trade in final commodities only.
(h) Steady-state growth at the exogenous constant positive rate, \( g \).
(i) Exogenous constant positive profit rate, \( r \).

Metcalf and Steedman begin with the observation about a closed economy producing a single consumption commodity that if \( r > g \), then in general, consumption per worker, \( c \), is not maximized. (Maximum \( c \) obtains if \( r = g \), i.e., the Golden Rule prevails.) We show in Figure 1 that if an extra technique of production \( \beta \), in addition to the existing technique \( \alpha \), is made available to this economy, and technique \( \beta \) is in fact chosen at the ruling \( r \), then \( c \) may be lower than before the introduction of technique \( \beta \).
This implies that in a closed economy producing two consumption commodities, the introduction of an extra technique for one of the commodities, may lead to the shrinkage of the economy's per worker consumption possibility set (PWCPS). We can regard trade as the availability of an extra technique for one of the commodities, namely the imported commodity. Then the post-trade PWCPS may lie inside the autarkic PWCPS if the autarkic relative price and the steady-state domestic rate of transformation (in terms of per worker consumptions) are unequal. This inequality can obtain under time-phasing as shown in Metcalfe and Steedman (1973c).

The Metcalfe and Steedman conclusion that “when we compare two economies, with identical domestic production methods, profit rates and growth rates, one being autarkic and the other open to free-trade in consumption commodities, in general, we can make no a priori statement as to which economy will have the larger per worker consumption possibility set” is obtained through comparative dynamics which ignores the question of the transition between the pre-trade and post-trade steady-state paths. Metcalfe and Steedman state that their conclusion “is without prejudice as to the possible results of an analysis of the transition from autarky to free trade.” It is precisely this transition that Samuelson focuses on in his analyses of the problem of deadweight loss from trade.

Samuelson (1973) in its analysis of the question whether positive profit differentials between two countries vitiate the Pareto optimality of trade based on Ricardian comparative advantage, assumes
(a) Labor is the only factor of production.
(b) Clothing and food are the only consumption goods in the two countries “Asia” and “America”.
(c) The unit labor requirements are constant in both clothing and food production.
(d) The ratio of unit labor requirements (of clothing to food) is ½ in Asia and 2 in America.
(e) Although it has ten times the population of America, Asia can produce only about the same quantities of food and clothing as America.
(f) In both Asia and America, half of total income is spent on clothing and half on food.
(g) Trade is free and balanced; and, there is no borrowing between Asia and America.
(h) $r_2 > r_1 > 0$, where $r_1$ and $r_2$ are the exogenous constant profit rates in America and Asia, respectively.
(i) $dp/dr > 0$, where $p$ is the price of clothing in terms of food.
(j) Stationary-state equilibria.

5 Metcalfe and Steedman (undated, p. 4).
6 Ibid. As we will discuss later, the transition is analyzed in Metcalfe and Steedman (1974).
Samuelson finds that if the difference between $r_1$ and $r_2$ is large enough, "pervasive" specialization or trade reversal may obtain, i.e., America may specialize in clothing for which she has a comparative disadvantage at $r_1 = 0$, and Asia may specialize in food for which she has a comparative disadvantage at $r_2 = 0$. This reversal is caused by the fact that, with positive profit rates, the autarkic relative prices differ from the relative unit labor requirements. The trade reversal, in turn, makes both continents worse off (in terms of smaller consumptions of both commodities) relative to autarky (either with or without positive profits). Thus, there appears to be a deadweight loss from trade.

Samuelson argues, however, that there is no "deadweight loss in the strict sense of the term." His argument is based on the distinction between comparative dynamics, according to which there is a deadweight loss, and the analysis of the transition from the free-trade steady-state path to the autarkic steady-state path, according to which there is no deadweight loss. Samuelson's position is that in order to prove the Pareto superiority of the autarkic steady-state path to the free-trade steady-state path, and thus show the existence of a deadweight loss, one has to find a feasible transient non-steady-state path, from the autarkic path to the free-trade path, on which every American and every Asian is better off. Samuelson concludes that no such path exists unless international lending (from America to Asia) is allowed.

Samuelson (1975) expands upon Samuelson (1973) by contrasting, through numerical examples, the alternative cases in which the two countries have equal or unequal positive profit rates. A time-phased steady-state Ricardian system can lead to a "pervasive" specialization or trade reversal in either case. In the case with equal positive profit rates, there is no real deadweight loss, because the trade equilibrium, with less consumption of both commodities by the two countries than in the zero profit system, is Pareto optimal in the dynamic or intertemporal sense. Differently put, the trade equilibrium with equal positive profit rates and the trade equilibrium with zero profit rates are not Pareto comparable since the transition from the former to the latter entails the temporary sacrifice of some consumption.

In the case with unequal positive profit rates, however, there is a real deadweight loss because in the transition from the trade equilibrium with positive profit rates to the trade equilibrium with zero profit rates more of both commodities can be consumed by the two countries. Samuelson attributes this deadweight loss not to competitive capitalist trade but to the inequality of the profit rates which itself is caused by the absence of competitive international intertemporal lending.

In the Appendix of Samuelson (1975) traded intermediate inputs are allowed.
After noting that the nonsubstitution theorem no longer holds, Samuelson concludes:

All we need say in connection with "perverse" specialization-pattern reversals is this: with $r_1 = 0 = r_2$, there will be a geographical pattern of productions and the world will be on its production-possibility frontier. With positive $r$'s, the "exterior" patterns may not be competitively feasible and the world will then permently produce on a locus inside the concave frontier.

Samuelson (1976) restates the argument that in the Ricardian system, time-phasing with positive profit rates does not lead to inefficiency and both countries can gain from free trade if international capital movements are allowed to equalize their profit rates.

Samuelson, in his analyses of the deadweight loss problem, is concerned basically with the welfare differences between the zero profit and the positive profit competitive capitalist trade equilibria. His main conclusion is that with internationally equal positive profit rates, the zero profit and the positive profit steady-state trade equilibria are not Pareto comparable. He does not deal at length with the assertion first made by Metcalfe and Steedman (1973c) that in the time-phased Ricardian system with positive profit rates, competitive capitalist trade equilibria can be Pareto-inferior to competitive capitalist autarkic equilibria. It may be argued that this is the real question of dead-weight loss from trade due to the private profit motive. Samuelson disagrees:

One, but only one, problem one might consider is whether a balanced-trade equilibrium could be observed which involves less steady-state consumption of both goods than some observed competitive autarkic equilibrium. As I have stated the matter, the answer can be yes. But I do not agree that this is essentially germane to the real question of deadweight loss from the (private) profit motive.

Samuelson, taking the competitive capitalist trading regime as given, does not consider alternative trading regimes under which a country can have larger gains from trade. Mainwaring (1974) distinguishes between the capitalist and socialist trading rules which yield different steady-state trade equilibria if the Golden Rule does not hold.

Mainwaring (1974), inspired by the works of Metcalfe and Steedman, first presents the argument that in the time-phased Ricardian system with positive profit rates, capitalist free trade can make one or both countries worse off relative to autarky in terms of per worker consumption. Mainwaring's main point, adopted from Metcalfe and Steedman (undated) is "that the analysis of international trade can be viewed essentially as a particular problem of the choice of technique."

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9 Samuelson (1975, p. 331).
10 Samuelson (1975) admits that free trade by itself can equalize the profit rates under very restrictive assumptions.
11 In a letter, dated January 13, 1976, to this author.
Each country has to choose between two equilibria: $E^0$ (pre-trade) and $E^T$ (post-trade). This choice of technique is made in capitalist trade by comparing the feasible combinations of the real wage and the rate of profit. Mainwaring exploits the dual relationship between the per worker consumption and the rate of growth, in measuring the gains from trade.

Mainwaring's diagrammatic analysis is based on the following assumptions:

(a) Two countries and two commodities.
(b) Each commodity is produced by constant returns to scale techniques which require intermediate inputs as well as labor.
(c) Perfect competition with no taxes or distortions.
(d) One period production lag for both commodities.
(e) The real wage, $w$, (in terms of the second commodity) is paid at the end of the production period.
(f) No fixed capital.
(g) Trade is free and balanced.
(h) No international factor mobility.
(i) The post-trade commodity price ratio is exogenously given.
(j) Complete specialization is feasible for each country.
(k) Steady-state equilibria with exogenously given constant positive rates of growth, $g_1$ and $g_2$, and rates of profit, $r_1$ and $r_2$ for countries 1 and 2, respectively.

The choice of technique in each of the capitalist economies is among three wage-profit frontiers, the two complete specialization frontiers and the autarkic frontier. The one that yields the maximum wage for the given constant profit rate is chosen. Mainwaring considers two cases: (a) identical techniques in both countries and (b) different techniques in the two countries. For the case with identical techniques, the two countries are assumed to have different rates of profit. Since the relative commodity price is assumed to be strictly monotonic in the rate of profit, the direction of trade is determined by the difference between the two countries' rates of profit. In his analysis of the gains from trade, Mainwaring assumes identical constant consumption proportions for capitalists and workers. Only capitalists save with a constant saving rate, $s$. Thus, $g = sr$ in steady-State, with $0 \leq s \leq 1$ implying $0 \leq g \leq r$. For the identical techniques case, Mainwaring shows that total consumption per worker in one country can be less, and that capitalists' consumption per worker in both countries can be less with trade than without trade. The capitalist's gain from trade, in terms of capitalists' consumption per worker, varies with $s$, but not in the same direction for both countries.

In the case the techniques differ between the two countries, Mainwaring shows that the direction of trade again depends on $r_1$, and $r_2$ (which determine the autarkic relative prices) and that both countries can lose from trade by ending up with lower consumptions per worker than in autarky.
It should be noted that by assuming that \( r_1 \) and \( r_2 \) are exogenous and constant, Mainwaring avoids the problem of reswitching when multiple techniques for each commodity are allowed. The constancy of \( r_1 \) and \( r_2 \) after trade is based on the implicit assumption of no international lending.

In the final section of his paper Mainwaring contrasts the capitalist and socialist trading rules. The capitalist rule is to maximize \( w \), at the given \( r \), on the basis of the difference between the autarkic relative price and the post-trade relative price.

In the socialist economy, the planner, who is assumed to know all the available techniques, sets \( w \), as a monopsonist for labor whose supply is assumed to be perfectly inelastic to \( w \) and growing at the constant rate, \( n \). The planner has to (a) choose \( g \) so that \( g = n \) to get full employment and (b) maximize consumption per worker at that \( g \). He sets \( w \) so that \( r \geq g \) for sustained growth. If we assume that public consumption is zero, then \( s = 1 \). Therefore, \( r = g \) and \( c = w \), which means that the capitalist and socialist trading rules become identical. If, however, we assume that public consumption is positive, then \( s < 1 \). Therefore, \( r > g \) and \( c > w \), which means that the two rules are different, i.e., maximizing \( w \) at a given \( r \), the capitalist rule, is different from maximizing \( c \) at a given \( r \), the socialist rule. Hence, Mainwaring concludes, the socialist planner will not rely on differences in autarkic relative prices to determine the direction of trade. We show in the Appendix that this conclusion needs to be clarified by distinguishing when the Golden Rule does not hold, between capitalist and socialist autarkic relative prices, a distinction that Mainwaring fails to make. Mainwaring’s autarkic relative prices are the capitalist autarkic relative prices.

Mainwaring considers the two cases of identical and different techniques for two socialist economies, assuming that there is always a single technique for each commodity.

In the case with identical techniques, Mainwaring shows that the two socialist countries can have mutually gainful trade if their growth rates are different, although their autarkic relative prices are the same.

In other words, the two socialist countries whose rates of profit are equal can both benefit from trade if their rates of saving differ. On the other hand, if these two countries have different rates of profit, yielding different autarkic relative prices, but equal rates of growth then mutually gainful trade is impossible.

In the case with different techniques, Mainwaring argues that the two socialist countries can have mutually beneficial trade if their Golden Rule autarkic relative prices were to differ.

Mainwaring ends his paper with the observation that under decentralized socialism, the planner can set the rate of profit equal to the growth rate and then let the competitive state enterprises trade according to the capitalist rule. Then the consumption per worker will be at its maximum at the given rate of growth.
Erdilek and Schive (1976) generalize Mainwaring's two-commodities analysis to the n-commodities case. Erdilek and Schive note in their conclusion that the possibility of a deadweight loss from trade in a competitive capitalist world has been demonstrated under very restrictive assumptions. They then point out that this demonstration should be assigned far less policy significance than Mainwaring assigns to it.

In Erdilek and Schive (1976) as in Mainwaring (1974) the following are assumed:

(a) Steady-state growth with full employment at the given constant rate.
(b) Balanced trade, no international capital mobility, and a given constant profit rate.
(c) Per worker aggregate consumption is the only criterion for measuring the gains from trade.
(d) Fixed economy-wide proportions in consumption which remain constant after trade.
(e) Constant technology of production, with only one technique for each commodity.

All these assumptions are very restrictive. (a) allows for no change in the exogenous growth rate of the labor force (equal to the growth rate of the economy) and no structural change or economic development after trade\(^\text{13}\). (b) is unrealistic, especially in ruling out completely all financial transactions. (c) is based on the Golden Rule of Growth Theory. Although this Rule occupies a prominent place in the literature, its welfare significance has been seriously questioned and often rejected\(^\text{14}\). (d) ignores the problem of distribution between capitalists, who are assumed to do all the saving in the economy, and workers. Furthermore, it rules out substitution in consumption on the economy level, even on the basis of constant national taste after trade is introduced. (e) rules out the possibilities of reswitching and technological change.

In the model underlying the analyses of Erdilek and Schive, and of Mainwaring, there is no fixed capital, no heterogenous capital goods which last for more than one production period. In their model, the transition between the pre-trade and the post-trade steady-state paths is feasible in a single period. It involves a change in the structure of current production which is also the structure of circulating capital. Neither Erdilek and Schive nor Mainwaring recognize, however, that the transitional period consumption per worker is likely to differ from the equilibrium autarkic and post-trade consumptions per worker, as a result of the change in the structure of production. In the transitional period, the post-trade intermediate input requirements have to come out of the autarkic gross outputs.

\(^{13}\) An excellent discussion of the restrictive nature of steady-rate growth models can be found in \textit{Hahn} (1971).

\(^{14}\) For a more general criticism of the exclusive role per capita consumption plays in the construction of utility functions of growth theory, see \textit{Leijonhufvud} (1968, pp. 227–229).
Metcalfe and Steedman (1974) present the only neo-Keynesian analysis which deals with the problem of transition. It investigates in two different ways the gain from trade of capitalist economies that are in stationary state. First, it compares the national incomes or total net outputs (valued at the given international prices) of two separate economies which are identical except that one is in autarky and the other is in trade. Second, it compares the autarkic and post-trade national incomes (both valued at the given international prices) of a given economy which switches from autarky to trade. In this second comparison, the problem of transition is explicitly considered.

In this analysis, Metcalfe and Steedman assume:
(a) Two primary factors (labor and land) that have constant endowments and are paid post-factum.
(b) Two goods whose production requires intermediate inputs as well as primary factors.
(c) For good 1 there is a single process and for good 2 there are two alternative processes, all of which are subject to constant returns to scale.
(d) Perfect competition.
(e) Positive constant rate of profit (interest).
(f) Single period of production for both goods, at the end of which all intermediate inputs are completely used up (i.e., there is only circulating capital).
(g) Homothetic social utility function and positive social rate of time of preference.
(h) Free trade at the given international prices.
(i) Transition (i.e., changes in the structure of production and allocation of inputs) from autarky to trade can be completed in a single period of production.

Metcalfe and Steedman emphasize that a positive rate of profit affects a stationary state economy in the same way a factor market distortion affects it. Both drive a wedge between the domestic marginal rate of transformation (DMRT) and the switching price ratio (SPR). SPR is the unique commodity price ratio for which both available techniques are operated simultaneously. It should be noted that Samuelson likewise stresses the similarity of the effect of a positive rate of profit and the distortion created by an ad valorem turnover tax.

In comparing the equilibrium national incomes of two separate stationary economies with identical production possibility sets and tastes, one economy in autarky and the other in trade, Metcalfe and Steedman distinguish between the exchange and the specialization effects of trade on welfare. The exchange effect is positive, i.e., it provides a gain from trade, whether or not DMRT = SPR. The specialization effect, however, can be negative if DMRT \(\neq\) SPR. Thus, with a positive rate of profit, trade can lead to a specialization loss, which may then

outweigh the exchange gain, resulting in an overall loss. This conclusion is obtained without considering the transition from autarky to trade.

In their analysis of the transition, Metcalfe and Steedman take as their measure of the gain from trade, the difference between the present values of the net output streams of the autarkic and post-trade stationary states\(^{16}\). Both streams are valued at the given international prices and discounted at the same interest rate. Metcalfe and Steedman distinguish between two versions of this dynamic measure: the "steady-state" measure\(^{17}\)

\[
\Delta C = \frac{q(y_T - y_A)}{r}
\]

and the "inclusive" measure\(^{18}\)

\[
\Delta V = \Delta C + q(\bar{y} - y_A) = \frac{Z_T - Z_A}{r}
\]

where

\[
q = \text{the vector of international prices},
\]

\[
y_T = \text{the vector of net outputs in trade},
\]

\[
y_A = \text{the vector of net outputs in autarky},
\]

\[
r = \text{the rate of profit (assumed to be equal to the social rate of time preference)},
\]

\[
\bar{y} = \text{the vector of net outputs in transition},
\]

\[
Z_T = \text{total primary factor income (valued at the international prices) in trade},
\]

\[
Z_A = \text{total primary factor income (valued at the international prices) in autarky}.
\]

Ceteris paribus, the values of \(\Delta C\) and \(\Delta V\) change with the terms of trade, which is, by assumption, the foreign marginal rate of transformation (FMRT). If we assume SPR < DMRT, then depending on whether FMRT <, =, > DMRT, we will obtain \(\Delta C <, =, > 0\), but never \(\Delta V < 0\)\(^{19}\). Therefore, if the dynamic measure of the gain from trade includes the transitional net output, the switch from autarky to trade cannot yield a deadweight loss.

The above results of Metcalfe and Steedman are derived from a steady-state model with a zero growth rate and two primary factors, in which the welfare criterion is total net output valued at the given international prices. This model is different from the model of Metcalfe and Steedman (undated), Mainwaring (1974), and Erdilek and Schive (1976), with a positive growth rate and a single primary factor, in which the welfare criterion is physical consumption per worker. The

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\(^{16}\) Although they assume a social utility function, Metcalfe and Steedman do not use it. Instead, they rely on national income as their welfare criterion which, of course, presents an index number problem.

\(^{17}\) Metcalfe ans Steedman (1974, p. 592).

\(^{18}\) Metcalfe and Steedman (1974, p. 593).

\(^{19}\) Metcalfe and Steedman (1974, pp. 593–594).
crucial difference between the two models, however, is the use of different welfare criteria.

Suppose that in the Erdilek and Schive analysis we change the welfare criterion to the value of total net output (the sum of the values of sectoral consumptions, net exports and investments) per worker, at the given international prices. Then it can be easily shown that for the steady-state measure of the gain from trade which includes the value of the transitional net outputs, we get, following Metcalfe and Steedman (1974):

\[ \Delta V = \frac{w_T - w_A}{r} \]

where

\( w_T \) = the wage rate in trade,
\( w_A \) = the wage rate in autarky.

Since according to the capitalist trade rule exports and imports are chosen to maximize the wage rate, the switch from autarky to trade can not yield a deadweight loss. Therefore, if the Erdilek and Schive analysis adopts national income per worker, instead of physical consumption per worker, as its welfare criterion and also takes account of the transitional national income, then it shows the impossibility of a deadweight loss from trade. As in Metcalfe and Steedman (1974), the steady-state loss can not exceed the transitional gain.

This conclusion depends, however, on several restrictive assumptions. Metcalfe and Steedman state that they "...have not taken account of the possibility of 'perverse' switching of techniques or the foundation of more complex expectational responses." Mainwaring, after noting that when a country suffers a steady-state loss the autarkic value of its capital stock per worker is greater than the with-trade value, points out that the transitional gain can offset the steady-state loss only through disinvestment which becomes available for consumption. Consequently, he argues that if instead of circulating capital "we assume fixed capital which is specific to a particular process then the transition from a non-specialized economy to a specialized economy, rather than releasing goods for consumption might involve inavoidable 'junking' and, therefore, a transitional loss, to be added to any steady-state loss." Furthermore, he stresses the incongruity of the assumption that the rate of profit is equal to the rate of social time preference, with the Ricardian and neo-Keynesian approaches to distribution.

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21 In a letter, containing his comments on Erdilek and Schive (1976), dated July 15, 1976, to this author.
22 Ibid.
IV. Summary and Conclusions

This study has presented a critical survey of the recent controversy about the question of deadweight loss from trade between two Ricardian economies in steady-state growth. The neo-Keynesians, who have attacked the general (logical) validity of the Heckscher-Ohlin theorem and the related theorems of the neo-classical theory of international trade, have argued in favor of a neo-Ricardian trade theory which allows for tradeable intermediate inputs, production lags and positive profit rates. They have also argued that according to such a theory, capitalist trade can result in negative gains for one or both trading countries, thus putting forth a trade argument about the dynamic inefficiency of capitalism. The neo-Keynesians have made a distinction between the capitalist and socialist trading rules. They have proposed the socialist rule in order to render trade mutually beneficial to two trading countries.

The neo-classical rebuttal has rejected the adequacy of comparative dynamics on which the neo-Keynesian analysis has been based and emphasized the crucial importance of the transition from one steady-state equilibrium to another. It has also singled out the implicit neo-Keynesian assumption of an imperfect international capital market as the real culprit behind the deadweight loss from capitalist trade.

Our review of this controversy has reached the following conclusions:

(a) The neo-Keynesian argument about the negative trade gain has been based on very restrictive assumptions and it has ignored or neglected the problem of transition from autarky to trade. Despite the neo-classical emphasis on this problem, however, transitional analysis has not yet advanced beyond a rudimentary level.

(b) More adequate neo-Ricardian trade models based on less restrictive assumptions are required to obtain theoretical results that can have a serious bearing on trade policies. Besides the exclusive reliance on steady-state analysis or comparative dynamics, the assumption of exogenous growth rates and profit rates in steady-

22a This is the general neo-Keynesian argument. Professor Steedman emphasizes that "people must not use the 'gain' debate as a reason for neglecting the general argument" (in a letter dated July 6, 1976, to this author).

23 For another argument, based on the separation of investment and saving decisions, about the dynamic inefficiency of capitalism, see Lancaster (1973).

24 According to Professor Steedman, the neo-classical rebuttal over-emphasizes the problem of transition: "Is the transition from a hypothetical autarky to the trading world we know, really very interesting? In a general statement about the significance of trade, the comparison seems appropriate" (in a letter, dated July 6, 1976, to this author).

25 Professor Samuelson states that "as soon as one considers intertemporal efficiency, inclusive of transient dynamic paths, the whole problem becomes clear: at equal profit rates, there is no deadweight loss; under freedom to borrow and lend, there is no deadweight loss" (in a letter dated June 9, 1976, to this author).
state analysis has to be relaxed as a first step toward the formulation of a general neo-Ricardian trade theory.

(c) It is misleading to distinguish between the capitalist and socialist trading rules in terms of price and non-price based decisions. Instead, a distinction should be made between capitalist and socialist prices.

(d) In the analysis of the gains from trade, more attention should be paid to the choice of the welfare criterion and the sensitivity of the basic results to this choice should be investigated.

Appendix

Relative Prices in Capitalist and Socialist Trading

In this section, we distinguish between the capitalist and socialist trading rules in terms of their autarkic relative price vectors which differ from each other if the Golden Rule, i.e., \( r = g \), does not hold.

The List of Symbols Used:

- \( x \) = the vector of \( n \) sectoral gross output levels per worker
- \( g \) = the rate of steady-state growth
- \( A \) = the \( nxn \) matrix of intermediate input requirements
- \( e \) = the vector of \( n \) sectoral consumption proportions
- \( l \) = the vector of \( n \) sectoral labor input requirements
- \( r \) = the rate of profit
- \( w \) = the wage rate
- \( p \) = the vector of \( n \) sectoral exogenous world prices
- \( c \) = the aggregate consumption per worker
- \( t \) = the vector of \( n \) sectoral export levels per worker
- \( v \) = the shadow wage rate
- \( q \) = the vector of \( n \) sectoral shadow prices

1. Capitalist Trading

Capitalist trading between countries \( a \) and \( b \) can be modeled as a linear programming problem. The world prices at which the two countries trade are exogenously given. The capitalist trading rule is the maximization of the wage at the exogenous constant rate of profit. This maximization is subject to sectoral net supply and labor supply constraints in each of the two countries.
The joint optimization method is used to formulate the linear programming problem. This method makes possible an explicit treatment of the trading problem as a choice of technique. All the variables are expressed on a per worker basis.

From the national income identities for countries a and b, assuming balanced trade, we get

\[ w_a = c^a p'e^a + (g_a - r_a)p'A^a x^a \]
\[ w_b = c^b p'e^b + (g_b - r_b)p'A^b x^b \]

The objective function \( M = w_a + w_b \) is maximized subject to

\[ -[I - (1 + g_a)A^a]x^a + c^a e^a + t^a - t^b \leq 0 \quad (1) \]
\[ -[I - (1 + g_b)A^b]x^b + c^b e^b - t^a + t^b \leq 0 \quad (2) \]
\[ (l^a)' x^a \leq 1 \quad (3) \]
\[ (l^b)' x^b \leq 1 \quad (4) \]
\[ p't^a - p't^b \leq 0 \quad (5) \]
\[ -p't^a + p't^b \leq 0 \quad (6) \]

Constraints (1) and (2) are the sectoral net supply constraints in countries a and b, respectively. Constraints (3) and (4) are the labor supply constraints. Constraints (5) and (6) together imply \( p'(t^a - t^b) = 0 \), i.e., balanced trade. In the dual of this problem, the objective function \( m = v_a + v_b \) is minimized subject to:

\[ -(q^a)' [I - (1 + g_a)A^a] + v_a (l^a)' \geq (g_a - r_a)p'A^a \quad (1) \]
\[ -(q^b)' [I - (1 + g_b)A^b] + v_b (l^b)' \geq (g_b - r_b)p'A^b \quad (2) \]
\[ (q^a)' e^a \geq p'e^a \quad (3) \]
\[ (q^b)' e^b \geq p'e^b \quad (4) \]
\[ (q^a)' - (q^b)' \geq 0 \quad (5) \]
\[ -(q^a)' + (q^b)' \geq 0 \quad (6) \]

Constraints (1) and (2) are the non-positive profit constraints of perfect competition in countries a and b, respectively. Constraints (3) and (4) constrain the sectoral shadow prices from below on the basis of the given world prices. Put differently, they constrain the shadow price values of the unit consumption baskets from below on the basis of the world market values of the unit consumption baskets of countries a and b. Constraints (5) and (6) together imply the equalization of the sectoral shadow prices of countries a and b, \( q^a = q^b \).
If in the primal solution $c_a > 0$ and $c_b > 0$, then $p = q^a = q^b$. Furthermore, $w_a = v_a$ and $w_b = v_b$. Therefore, the dual constraints (1) and (2) can be written as
\[
p' \leq w_a (l^a)' [I - (1 + r_a)A^a]^{-1}
\]
\[
p' \leq w_b (l^b)' [I - (1 + r_b)A^b]^{-1}
\]

If a country produces in a given sector, then the corresponding constraint for that sector holds as an equality. If the constraint for a given sector holds as a strict inequality in a given country, then that country does not produce in that sector.

2. Socialist Trading

Socialist trading, like capitalist trading, between countries a and b can be modeled as a linear programming problem. The socialist trading rule is the maximization of the aggregate consumption per worker at the exogenous constant rate of growth subject to sectoral net supply and labor supply constraints in each country.

Again the joint optimization method is used to formulate the linear programming problem. This method provides an explicit treatment of the trading problem as a choice of technique. All the variables are expressed on a per worker basis. The objective function $M = k_a c_a + k_b c_b$ is maximized subject to:

\[
- [I - (1 + g_a)A^a] x^a + c_a e^a + t^a - t^b \leq 0
\]
\[
- [I - (1 + g_b)A^b] x^b + c_b e^b - t^a + t^b \leq 0
\]
\[
(l^a)' x^a \leq 1
\]
\[
(l^b)' x^b \leq 1
\]

In the objective function $k_a$ and $k_b$ are the weights on the per worker consumption of countries a and b, respectively. We assume $k_a + k_b = 1$.

If we vary $k_a/k_b$ between zero and infinity through parametric linear programming, then we will obtain the joint-consumption per worker frontier (JCPWF) for countries a and b, which shows the maximum consumption per worker (CPW) for one country for a given CPW of the other country.

Corresponding to any point $(c_a, c_b)$ on the JCPWF, there is a primal and a dual solution. For each $(c_a, c_b)$, we can thus compute the trade balance $p' (t^a - t^b) \geq 0$. We want $(c_a, c_b)$ for which $p' (t^a - t^b) = 0$. In this way we obtain the free balanced trade
solution of the socialist trading model. The dual of this problem has the objective function $m = w_a + w_b$ to be minimized subject to:

$$-(p^a)' [I - (1 + g_a)A^a] + w_a (l^a)' \geq 0$$  \hspace{1cm} (1)

$$-(p^b)' [I - (1 + g_b)A^b] + w_b (l^b)' \geq 0$$  \hspace{1cm} (2)

$$(p^a)' e^a \geq k_a$$  \hspace{1cm} (3)

$$(p^b)' e^b \geq k_b$$  \hspace{1cm} (4)

$$(p^a)' - (p^b)' \geq 0$$  \hspace{1cm} (5)

$$-(p^a)' + (p^b)' \geq 0$$  \hspace{1cm} (6)

Constraints (1) and (2) are the non-positive profit constraints of perfect competition. Constraints (3) and (4) constrain the sectoral shadow prices from below on the basis of the primal objective function weights. Put differently, these weights determine the price levels and thus the international competitiveness of the two countries. Constraints (5) and (6) together imply $p^a = p^b = p$.

Therefore, the dual constraints (1) and (2) can be written as:

$$p' \leq w_a (l^a)' [I - (1 + g_a)A^a]^{-1}$$  \hspace{1cm} (1')

$$p' \leq w_b (l^b)' [I - (1 + g_b)A^b]^{-1}$$  \hspace{1cm} (2')

When we compare the capitalist and socialist price constraints, we see that the latter replace $r$ with $g$ in the unit costs. If $r = g$, then the capitalist and socialist autarkic price vectors are identical. If $r > g$, however, then the capitalist and socialist autarkic price vectors are different. Therefore, the structures of capitalist and socialist trades are different.

Our distinction between the capitalist and socialist autarkic price vectors corresponds to the distinction made by von Weizsäcker between the concept of "price" and the optimal planning concept of rational "value"\(^{26}\). Von Weizsäcker notes that relative prices, and not values, indicate the marginal rates of transformation between two consumption goods in a single period trade-off, whereas the values indicate the steady-state trade-off between two consumption goods. These values are to be computed by weighting the labor inputs of a good by time dependent weights which take account of the growth of the system. Values and prices become identical for $r = g$. Von Weizsäcker points out, however, that in real-life planning, values can not replace prices, because the former are applicable to steady-state

\(^{26}\) Von Weizsäcker (1971, p. 25) It should be noted that von Weizsäcker's "value" concept is different from Marx's (Capital, Volume I) "value" concept. The latter is derived from equal markups (rates of surplus value) on direct labor inputs only in all sectors. For the distinction between these two value concepts see: Von Weizsäcker and Samuelson (1971) and Samuelson (1973a).
comparisons only and not to dynamic problems of transition between different steady-state paths, which require the usual prices\(^\text{27}\).

References

Metcalfe, J. S. and I. Steedman, Undated, “The Golden Rule and the Gain from Trade,” mimeographed paper received on request from Professor Steedman.

\(^{27}\) Von Weizsäcker (1971, p.26).
Zusammenfassung

Das Problem des Deadweight Loss im internationalen Handel wachsender kapitalistischer Wirtschaften


Das Hauptresultat der Studie ist, dass das neo-keynesianische Argument, welches auf sehr engen Annahmen beruht, nicht gültig ist, bis es durch eine Analyse des Übergangs von der Autarkie zum Handel unterstützt werden kann.

Résumé

Le problème de la perte sèche (Deadweight Loss) dans le commerce international des économies capitalistes en croissance

Cette étude présente un examen critique de la récente controverse soulevée par la question du gain négatif des échanges entre deux économies en état de croissance constante. Du fait qu'elle met en question le principe de l'avantage comparé, cette controverse entre néo-keynésiens et néoclassiques semble avoir une importance non seulement théorique mais aussi pratique en matière de politique économique. Il serait toutefois erroné de procéder à une différenciation entre les principes qui régissent les échanges (trading rules) des systèmes capitalistes et socialistes en partant des décisions se basant sur les prix et de celles qui n'en tiennent pas compte. En lieu et place, il conviendrait d'établir la distinction entre relativité des prix, tels qu'ils sont appliqués en régimes capitalistes et socialistes.

La principale conclusion fournie par cette étude réside dans le fait que l'argument néo-keynésien – lequel se base sur un éventail très étroit de suppositions – restera dépourvu de justesse aussi longtemps qu'il ne sera pas appuyé par une analyse de la transition de l'autarcie au commerce.

Abstract

The Problem of Deadweight Loss in the International Trade of Growing Capitalist Economies

This study is a critical survey of the recent controversy about the question of negative gain from trade between two economies in steady-state growth. This controversy between the neo-Keynesians and neo-classicists appears to have both theoretical and policy significance by calling into question the principle of comparative advantage. It is misleading, however to distinguish between the capitalist and socialist trading rules in terms of price and non-price based decisions. Instead, a distinction should be made between capitalist and socialist relative prices.

The main conclusion of the study is that the neo-Keynesian argument which is based on very restrictive assumptions lacks validity until it can be supported by an analysis of the transition from autarky to trade.