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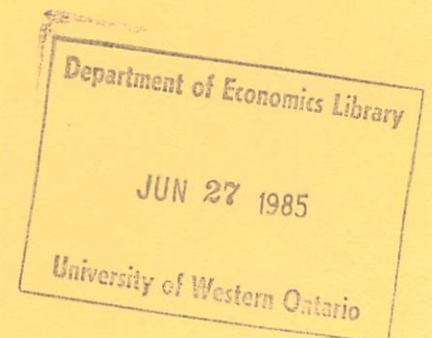
A NORTH-SOUTH MODEL OF

INTERNATIONAL JUSTICE

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This paper contains preliminary findings from research work
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A North-South Model of

International Justice

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1. INTRODUCTION

Rawls (1971) has proposed that gains from economic cooperation be shared in a way which maximizes the welfare of the worse-off participant. Mirrlees (1972), Sheshinski (1971) and Phelps (1973) have applied the so-called minimax criterion of economic justice to the problem of wage-income taxation in a closed economy.

In a seminal contribution, Findlay (1983) postulated that the Rawlsian criterion could be easily applied to the economic gains generated by international exchange of commodities. He argued that free trade is not, in general, "just" in that the gains from trade are not distributed with any regard to the relative welfare levels of participating countries. The North-South negotiations can be considered as an attempt to establish an international economic order which will ensure that the distribution of gains from trade is fair. Thus, it is natural to study how the minimax criterion of international distributive justice would modify the level and nature of existing commercial policies and institutions which determine the distribution of gains from trade between North and South.

When the minimax criterion is applied to countries instead of individuals, it implies an additional constraint to the distribution of the gains from trade. Since any country (as opposed to any individual) can survive without trade, in order to induce countries to cooperate the minimax criterion must guarantee the autarky welfare level for each country. Thus, in a North-South model it is possible that the North enjoys a higher welfare level than the South even if the latter gets all the gains from trade.

In this paper, a model of North-South trade is developed. Following Findlay and Wilson (1984), the North is endowed with the means to produce an intermediate product which can be termed "technology" and augments the

productive abilities of the factors employed in the production of the other good, which can be thought of as a composite consumer good. The South produces only the composite consumer good, but it can increase its production by importing "technology" services from the North. An alternative interpretation of the present model could suggest that the intermediate product represents bureaucracy or government, in the sense of Findlay and Wilson (1984), which is only produced in the North. The pattern of trade, then, is consistent with the North-South period of colonialism.

The major findings of the paper are that "just" trade occurs when the South receives all the gains from trade (or when the welfare levels of both regions are equalized). Free trade and the imposition of the optimal tariff by the South do not meet the minimax criterion. When the South chooses a combination of a tariff and a transfer from the North there are two possible results. If the transfer given to the South does not influence the labour endowment of the North, then free trade and a transfer are the optimal policies satisfying the minimax criterion. However, if the transfer is financed through wage-income taxation which reduces the aggregate labour supply of the North, then a transfer plus a tariff is the optimal policy maximizing the welfare of the South.

The remainder of the paper is as follows: Section 2 develops the technology of the two countries and characterizes the free trade equilibrium. Section 3 introduces the notion of international economic justice and determines how a more "just" allocation of the gains from trade might be made. The paper terminates with Section 4 which contains conclusions and suggestions for further research.

2. THE MODEL

There are two countries in the world, the North (N) and the South (S) whose supply sides are described below.

2.1 The North

The North produces two goods, an intermediate product (T) and a final consumption good (C). The intermediate good, which may be considered to be technical skills or government services, is produced from the services of labour and a sector-specific resource (K) according to a neoclassical production function exhibiting constant returns to scale,

$$T = Z(L_T, K). \tag{1}$$

Let the first and second partial derivatives of the Z function with respect to labour be designated Z' and Z'', respectively, where

$$Z' > 0$$

$$Z'' < 0.$$

Note that both factors are essential to produce positive output, hence

$$Z(0, K) = 0.$$

Manufacture of the consumption good requires inputs of labour services and the services of the fixed endowment of land (V_N),

$$C_N = Y_N(L_C, V_N),$$

where Y_N is a neoclassical production function exhibiting constant returns to scale and whose first and second partial derivatives with respect to labour are, respectively,

$$Y_N' > 0$$

$$Y_N'' < 0.$$

Output of C can, however, be augmented by the use of some T in its production process, such that

$$C_N = \lambda_N(T_N) \, Y_N(L_C, V_N) \tag{2}$$

where T_N is the quantity of T used in the production of C. Let the function

λ_N have the properties $\lambda_N(0) = 1$

$$\lambda_N' > 0$$

$$\lambda_N'' < 0$$

where λ_N' and λ_N'' are, respectively, the first and second derivatives of λ_N with respect to its argument.

Labour is initially considered to be in inelastic supply and freely mobile between the two sectors, such that

$$L_T + L_C = \bar{L}_N, \tag{3}$$

where $\bar{L}_N$ is the North's labour endowment.

Assuming identical tastes for all agents in the North, utility is maximized when consumption is maximized. For the autarkic economy, this is identical with maximum output of C, C_N^*. Substituting (1) and (3) into (2),

$$C_N = \lambda_N(Z(\bar{L}_N - L_C, K)) \ Y_N(L_C, V_N) \tag{4}$$

Differentiating with respect to the variable term, L_C, yields a first-order condition that the marginal product of labour in both activities be equal,

$$\lambda_N'(T) \ Z'(L_T, K) \ Y_N(L_C, V_N) = \lambda_N(T) \ Y_N'(L_C, V_N) \tag{5}$$

Suppose now that the North were able to trade some of its T in exchange for imports of C. Consider the maximum production of C_N given exports, T_X.

$$C_N = \lambda_N(Z(\bar{L}_N - L_C, K) - T_X) \ Y_N(L_C, V_N) \tag{6}$$

$$\frac{dC_N}{dT_X} = -\lambda_N' \ Y_N(L_C, V_N) < 0$$

$$\frac{d^2 C_N}{dT_X^2} = \lambda_N'' Y_N'' + \{\lambda_N'' Z' Y_N' + \lambda_N' Z' Y_N'' - \lambda_N' Z' Y_N' + \lambda_N'' Y_N''\} \frac{dL_C}{dT_X}$$

The first term of the last expression, capturing the direct effect, is negative while the second term is positive. Assuming the direct effect dominates, C_N is a concave function of T_X.

At given international terms of trade,

$$p = \frac{P_T}{P_C}, \tag{7}$$

the North's objective is to maximize

$$C = C_N + C_M \tag{8}$$

where C_N is determined by (6) and C_M are imports of the consumption good such that,

$$C_M = pT_X. \tag{9}$$

Thus, substituting (6) and (9) into (8),

$$C = \lambda_N(Z(L - L_C, K) - T_X) Y_N(L_C, V_N) + pT_X \tag{10}$$

Taking partial derivatives, setting them to zero, and solving yields

$$p = A(L_C, T_X) = B(L_C, T_X)$$

where

$$A(L_C, T_X) = \frac{\lambda_N Y_N'}{Z'}$$

and

$$B(L_C, T_X) = \lambda' Y_N$$

The equality between A and B is analogous to that in equation (5) and ensures the efficient allocation of labour between sectors. This is shown in Figure 1(a). The absolute value of the slope of the C_N function in

equation (6) with respect to T_X is B, hence the domestic marginal rate of transformation between C_N and T_X must, for efficiency, equal the foreign rate of transformation, p.

The North's trading equilibrium is illustrated in Figure 1(b). Curve $N(T_X)$ is the graph of equation (6) showing the maximum production of C_N given exports of T_X. Production takes place at F with exports of T equal to OG and imports of C equal to ED. Domestic production of the consumption good is OE, giving a total consumption of OD. The gains from trade for the North may be measured as the increased quantity of consumption good available, equal to C_N^*D. Given the convexity assumptions, as p, the relative price of T, increases, Northern production of T rises and its production of C diminishes while consumption of C rises. Thus the North's offer curve must, at all prices at which there is trade, have a positive slope. This is because there is no conflict between income and substitution effects—a rising p increases the North's income in terms of C, the only good that is consumed. Thus the North's offer curve has the normal shape with positive elasticity of imports with respect to exports. The slope of a northern trade indifference curve

$$(TIC_N) \text{ is } \lambda'Y_N_N, \text{ i.e. } \left. \frac{dC_M}{dT_X} \right|_{C_N} = \lambda'Y_N_N .$$

2.2 The South

The South produces only the consumption good (C) as it has none of the specific capital necessary for the production of T. The consumption good is produced using the services of Southern labour (L_S) and land (V_S) according to a neoclassical production function exhibiting constant returns to scale

$$C_S = Y_S(L_S, V_S) \tag{12}$$

If the South were able to acquire technology services (T_S) from the North, this would be used to augment production such that

$$C_S = \lambda_S(T_S)Y_S(L_S,V_S) \qquad (13)$$

where the function λ_S has the properties

$$\lambda_S(0) = 1, \; \lambda_S' > 0, \; \lambda_S'' < 0$$

where λ_S' and λ_S'' are, respectively, the first and second derivatives of λ_S with respect to its argument. This relationship between C_S and T_S is illustrated in Figure 2(a).

Suppose that the technology services were available from the North only through trade. Thus the South would export units of the consumption good (C_X) in exchange for imports of technology (T_M). At given international relative prices, p, the South maximizes its consumption,

$$C = \lambda_S(T_M)Y_S(L_S,V_S) - C_X \qquad (14)$$

where $\qquad C_X = pT_M.$ $\qquad\qquad (15)$

Substituting (15) into (14) yields

$$C = \lambda_S(T_M) \; Y_S(L_S,V_S) - pT_M \qquad (16)$$

The first-order condition for maximum consumption is

$$p = \lambda_S'Y_S \qquad (17)$$

Thus the domestic rate of transformation between C_S and T_M must equal the foreign rate of transformation, as is shown in Figure 2(b) where $S(T_M) = \lambda_S(T_M)Y_S(L_S,V_S)$. Note also that $\lambda_S'Y_S$ is the slope of a southern trade indifference curve (TIC_S),

i.e. $\left. \dfrac{dC_X}{dT_M} \right| = \lambda_S' \; Y_S > 0.$ Production takes place at D using OJ imported

technology. Of the OH domestic production FH is exported, leaving OF for domestic consumption. The gains from trade are therefore C_S^*F.

The free-trade offer curve of the South is

$$C_X = pT_M \qquad (18)$$

where $p = \lambda_S' Y_S$

and
$$\frac{dC_X}{dT_M} = (\lambda_S'' T_M + \lambda_S')Y_S \gtrless 0$$

2.3 Free-Trade Equilibrium

The quantities of consumption good and technology traded between the North and the South under free trade are illustrated in Figure 3(a). Curve OC_N represents the North's offer curve and OC_S is the South's offer curve which is the graph of equation (18). Combining equations (11) and (17) yields the free-trade condition that

$$p^{FT} = \frac{\lambda_N Y_N'}{Z'} = \lambda_N' Y_N = \lambda_S' Y_S \tag{19}$$

i.e. labour is allocated efficiently between activities in the North and the marginal productivities of technology are identical across nations. Moreover, equation (19) implies that at the free-trade equilibrium point the trade indifference curves (not shown in Figure 3(a)) are tangent to each other.

Figure 3(b) incorporates Figures 1(b) and 2(b). The trade triangle is DEF, EF consumption good being exported by the North in exchange for DE of technology. The gains from trade for North and South are $C_N^* D$ and $C_S^* F$ respectively. Notice that with free-trade the gains from trade are shared by both countries.

3. INTERNATIONAL JUSTICE

Consider a free-trade equilibrium where the per capita income of the South is considerably below that of the North. The North's per capita income will be higher even under assumptions of identical production functions, due

to its sole ownership of the factor K, essential in the production of T. According to a Rawlsian concept of social justice, the distribution of the gains from trade should be such as to maximize the minimum per-capita utility and therefore free trade is not "just" [see Findlay (1982) for conditions under which free trade may result in a just distribution].

The next two sections shall examine policies, potentially available to the South, that may yield a more just distribution between countries.

3.1 Tariff Policy

Denote the North's free-trade offer curve by $C_M = p(T_X)T_X$. Now

$$\frac{dp}{dT_X} \equiv p' > 0,$$ and so the South has monopoly power in trade. Suppose now that the South uses a tariff in an attempt to capture the gains from trade from a passive (i.e. not tariff-imposing) North. Thus the South maximizes its consumption,

$$C_S = \lambda_S(T_M) \ Y_S - C_X \tag{20}$$

such that $T_M = T_X$ and $C_X = C_M$. First-order conditions yield

$$\lambda_X' Y_S = p + p'T_M, \tag{21}$$

at the trading equilibrium, the slope of the southern TIC is equal to the slope of the northern offer curve. Figures 4(a) and 4(b) illustrate the consequences of this tariff policy. Consider Figure 4(a) first. Given the shape of North's offer curve, the South's imposition of the optimal tariff reduces the volume of trade in both commodities from Oc to Of for technology and from Ob to Oe for the consumption good. Thus, the terms of trade for the South improve from p^{FT} to p^{OT} and the welfare of the South increases.

World production is inefficient because marginal rates of transformation are not equalized internationally. Figure 4(b) illustrates the South's optimal tariff equilibrium using the production possibilities technique. Note that the North still achieves a higher consumption level than it would in autarky.

3.2 Rawlsian Trade and Transfers

Consider now the situation in which, in addition to a tariff, the South receives a transfer τ from the North.[1] The question then is what the optimal policy is (in terms of a combination of a tariff and a transfer) that maximizes the welfare of the South subject to the constraint that the welfare of the North is neither less than that of the South nor less than it was in autarky. Assume that the transfer τ, expressed in units of the consumption good is financed through taxation in the North. Two forms of taxation are considered.

Firstly, suppose that the tax is levied on the returns to capital K and land V_N, both of which are supplied inelastically. Thus the objective for the South is to maximize

$$C_S = \lambda_S(T_M)Y_S - p(T_M)T_M + \tau \tag{22}$$

such that

$$C_N = \lambda_N Y_N + p(T_M)T_M - \tau \geq C_N^* . \tag{23}$$

First-order conditions yield

$$\frac{\lambda_N Y_N'}{Z'} = \lambda_N' Y_N = \lambda_S' Y_S \tag{24}$$

$$C_N = C_N^*$$

which is the condition for free-trade and efficient technology allocation of equation (19). In other words, the optimal policy is free trade (thereby maximizing world output of the consumption good) combined with a transfer of the North's gains from trade to the South, $\tau_1 = C_N^{FT} - C_N^*$.

This redistribution is illustrated in Figures 5(a) and 5(b). In the offer-curve diagram of Figure 5(a) Oc of technology (the free-trade volume) is exported from North to South in exchange for Ob consumption good imports. However bh of this is transferred back leaving the North with effectively only Oh consumption good, making it indifferent between this exchange and no trade whatsoever—thus point g is on the North's autarkic trade indifference cuve, TIC_N^A, while the South is on TIC_S^R. Figure 5(b) shows the North trading FE technology services in exchange effectively for FH units of consumption good, which exactly compensates for the cost of production. The South uses its technology imports to increase production by C_S^*H which, after its exports net of the transfer, gives it a consumption gain of C_S^*F.

Secondly, suppose now that the transfer is financed through wage taxation in the North. Following a variation of Sheshinski (1972), suppose that the North is composed of identical individuals whose utility depends on leisure and consumption. Then under standard assumptions, wage-income taxation reduces the supply of labour. Thus the labour endowment of the North, L_N, will be a decreasing function of the transfer τ.

The Rawlsian transfer should, under these circumstances, be that transfer which, together with any tariff imposed by the South, leaves the North at the same level of utility as it enjoyed in autarky. For analytic ease, a less sophisticated transfer is considered here—that which maintains the North's pre-trade per-capita consumption level.[2] In this case the South again maximizes its consumption, by its choice of tariff and transfer (as in equation (22)), but subject now to the restriction that

$$C_N = \lambda_N(Z(L_N(\tau) - L_C, K) - T_M)Y_N(L_C, V_N) + p(T_M)T_M - \tau \geq C_N^* \qquad (25)$$

This yields the first-order condition:

$$\lambda'_S Y_S - \lambda'_N Y_N = (-\lambda'_N Y_N Z' \frac{dL_N}{d\tau})(p + p'T_M - \lambda'_S Y_S) \qquad (26)$$

Except in particular circumstances, noted below, the optimal tariff for the South is not zero. Were labour unresponsive to the taxation (i.e. $dL_N/d\tau = 0$) or were the South insufficiently large to have monopoly power in trade (i.e. $p' = 0$), then the first-order condition becomes the same as that for free-trade (equation (19)). In all other cases the optimum policy consists of a combination of a tariff plus transfer, the former being less than the optimal tariff examined in section 3.1 and the latter being less than that required when the labour endowment of the North is independent of the transfer.

To see this, assume the contrary, that is, the South follows a free-trade policy and so $\lambda'_S Y_S = \lambda'_N Y_N$. Then, equation (26) implies that $p + p'T_S = \lambda'_S Y_S = \lambda'_N Y_N$. This means that the slope of North's offer curve is equal to the slope of its trade indifference curve which implies that $p' = 0$. In other words, if $\frac{dL_N}{d\tau} < 0$, then only if the South does not have monopoly power in trade is the optimal policy free-trade plus a transfer. With symmetric reasoning we can exclude very easily the possibility that the South would impose the optimal tariff. Thus, we conclude that in general, when $\frac{dL_N}{d\tau} < 0$ both sides of equation (26) will be positive.

This implies that the optimal amount of technology services imported by the South would be less than the free trade level but greater than the level corresponding to the optimal tariff in section 3.1. Moreover, this means that the transfer τ_2 under this policy will be necessarily less than τ_1 the optimal transfer when $\dfrac{dL_N}{d\tau} = 0$. Notice also, that since the North enjoys the same level of consumption as in autarky in both situations, when $\dfrac{dL_N}{d\tau} < 0$ the world's production of the consumer good is not efficient.

Thus, the South achieves a lower welfare level than under the situation of $\dfrac{dL_N}{d\tau} = 0$. In terms of Figure 5(a), when the transfer τ is financed through wage-income taxation, the higher the transfer τ, the more the North's trade-indifference curves shift northwest.

4.   CONCLUSIONS

In a model of North-South trade, in which the North is the sole producer of an output-augmenting technology, it was demonstrated that free trade is not "just", in the sense that it does not meet the Rawlsian criterion with respect to distribution of the gains from trade.

Alternative trading schemes were then analyzed to determine whether they were more "just". It was shown that the imposition of the optimal tariff by the South increases its share of the gains from trade and it is "closer" to the Rawlsian goal than free trade, especially when the other commercial policy instruments are absent. However the North does still receive some of the benefits from trade and world production is diminished.

When, in addition to preferential terms of trade, a transfer from North to South is introduced which reduces the supply of labour in the North, then a combination of a tariff plus a transfer allows the South to receive all the gains from trade. Finally, when the transfer from North to South is financed in a lump-sum fashion, then free-trade and the appropriate transfer permit the South to obtain all the gains from trade without diminishing the world production. This policy satisfies the Rawlsian criterion and dominates all the previous ones in terms of maximizing the welfare of the South.

FOOTNOTES

[1] The choice of the transfer that the South receives clearly is made by the North and hence is not a direct policy instrument of the South. However it is assumed here that the North is motivated by a "sense of justice" to give the South whatever transfer it desires so long as the North fares no worse in its trading than it did in autarky. Thus the transfer becomes, indirectly, a policy instrument of the South.

[2] The utility of the North does, in fact, increase. The taxation induces more leisure while the consumption level is maintained. The "true" Rawlsian transfer cum tariff, such that the North's utility remains constant, must then be more severe than that determined here.

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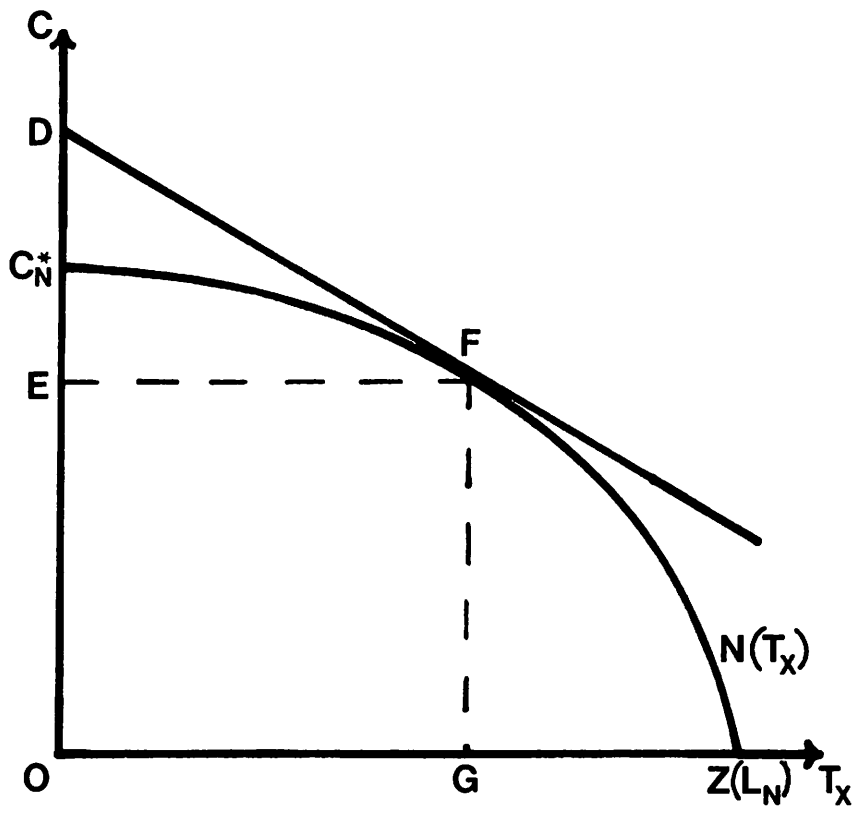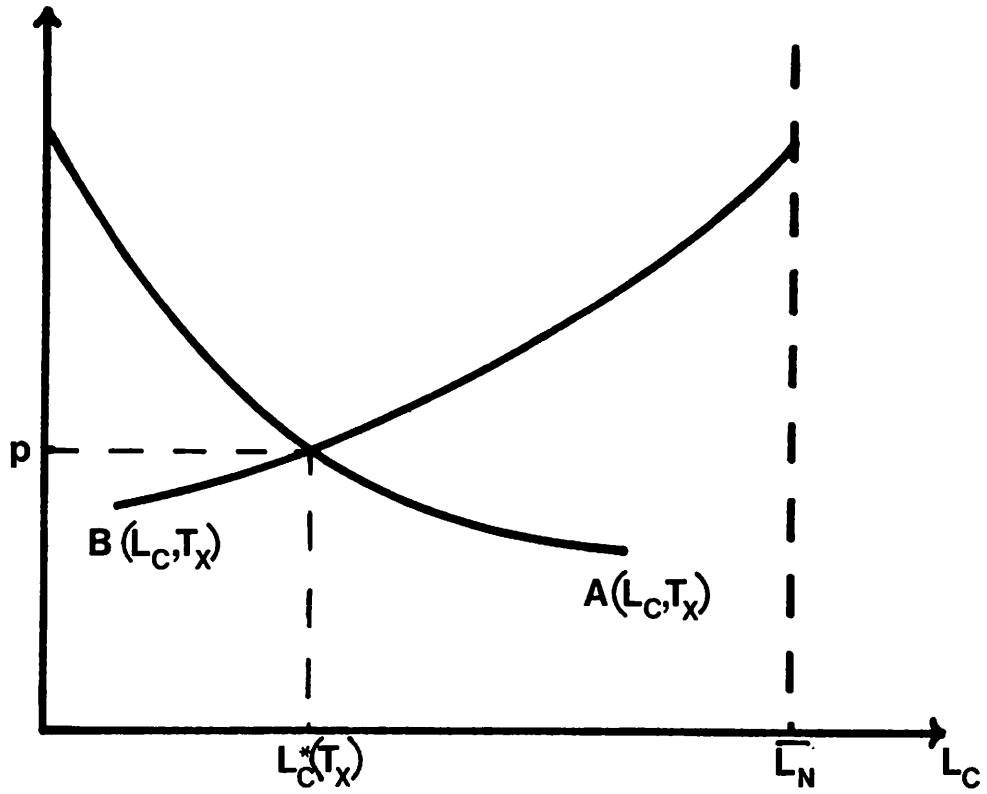Sheshinski, E. (1972), "The Optimal Linear Income Tax," <u>Review of Economic Studies</u>, July.
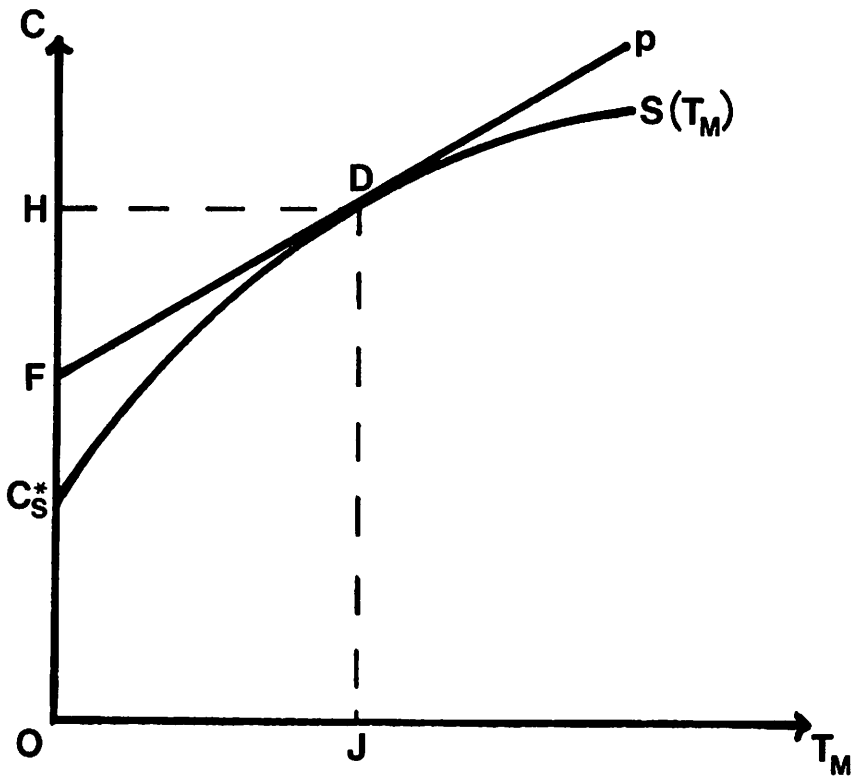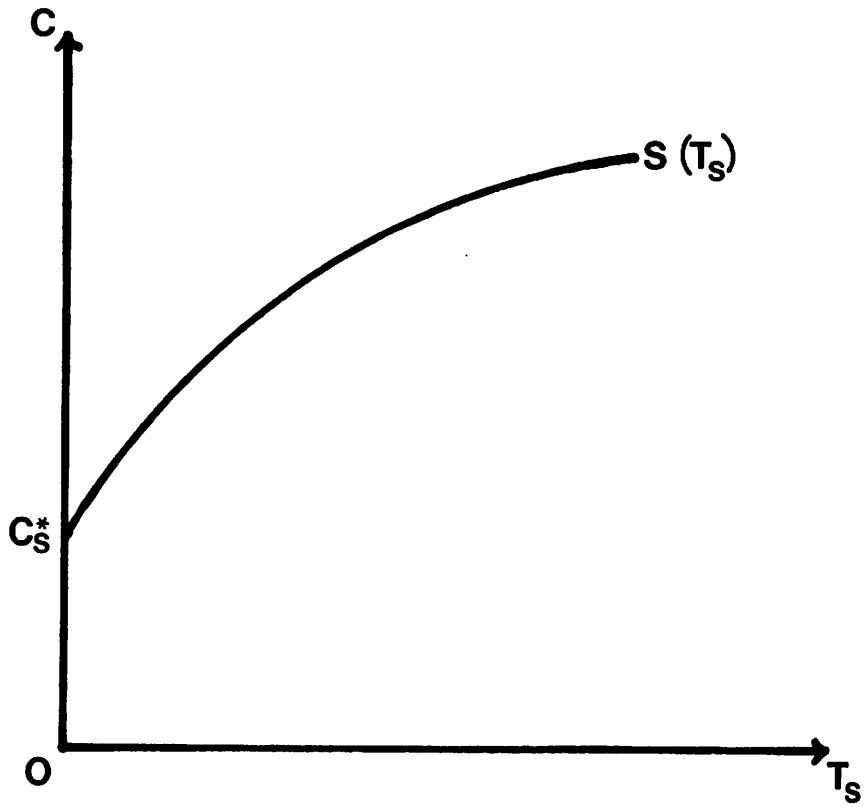
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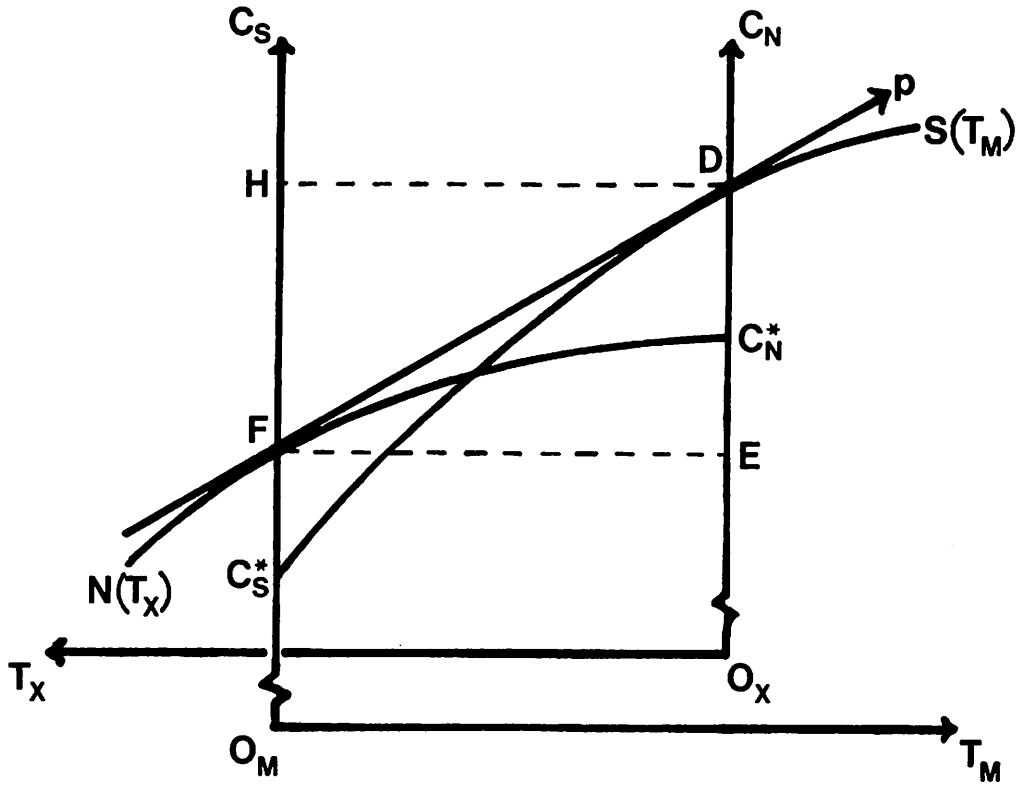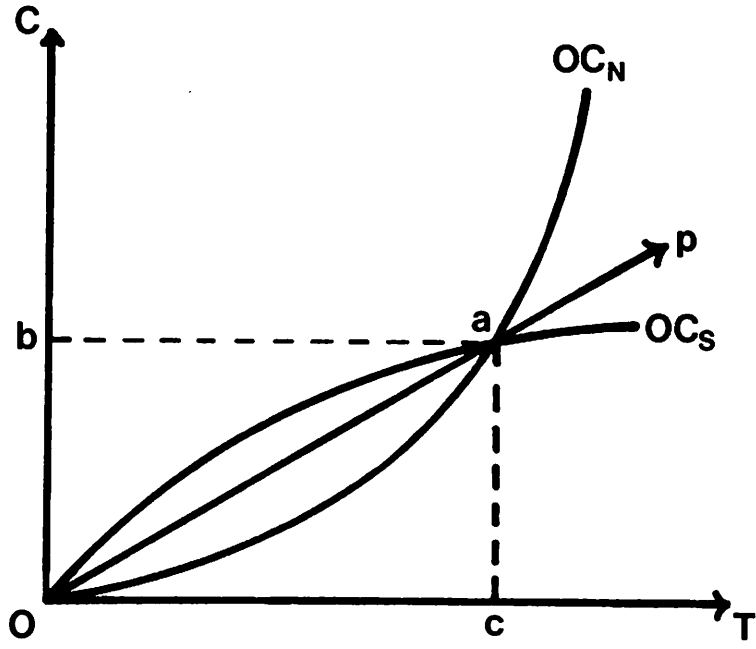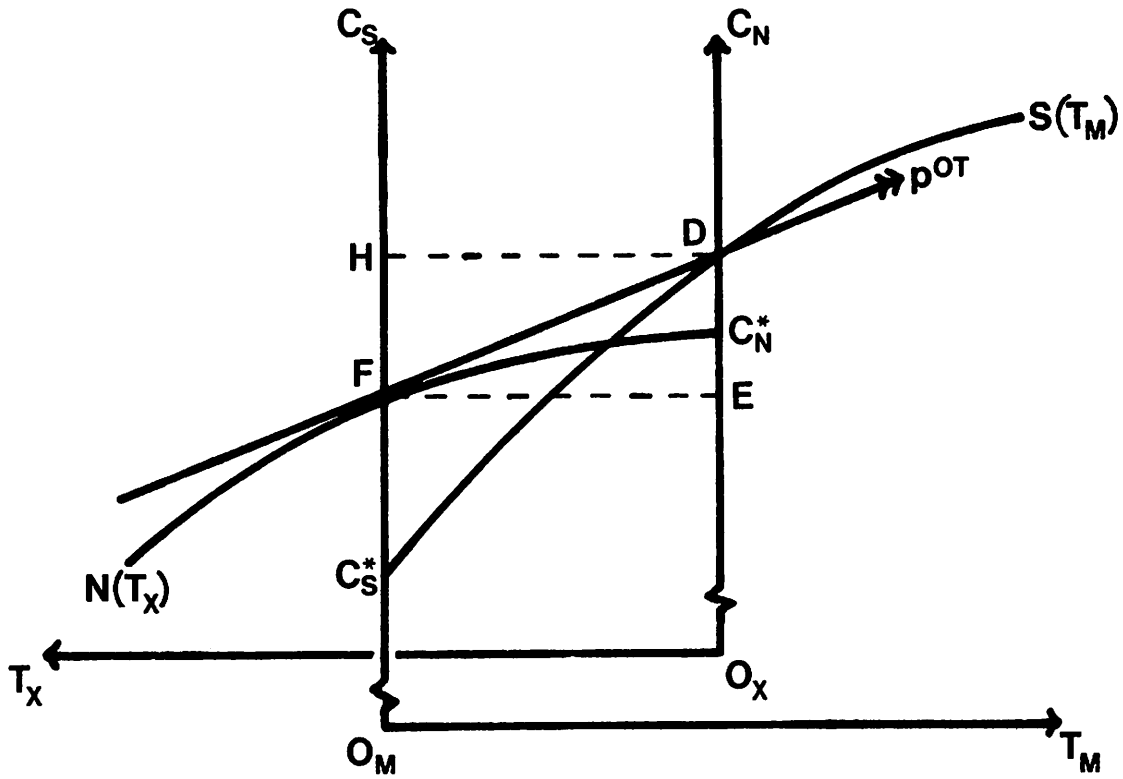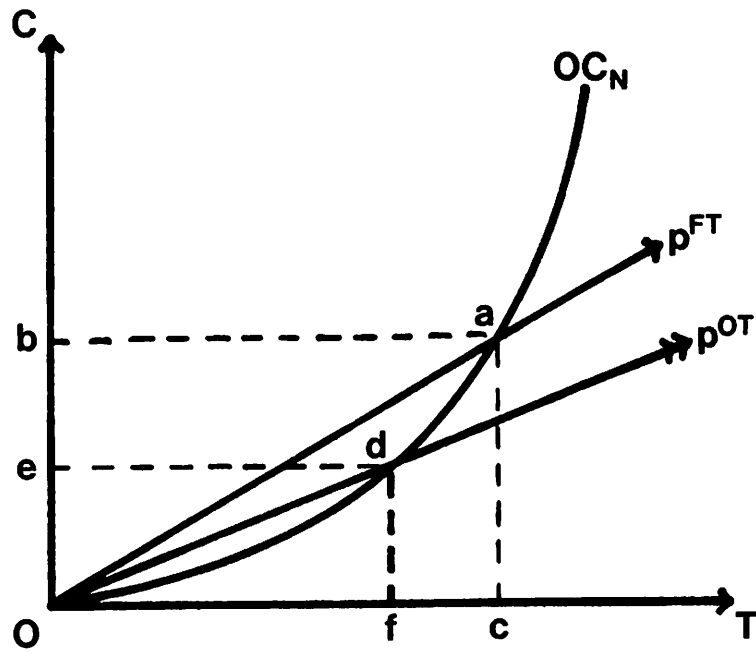

FIGURE 1(b)

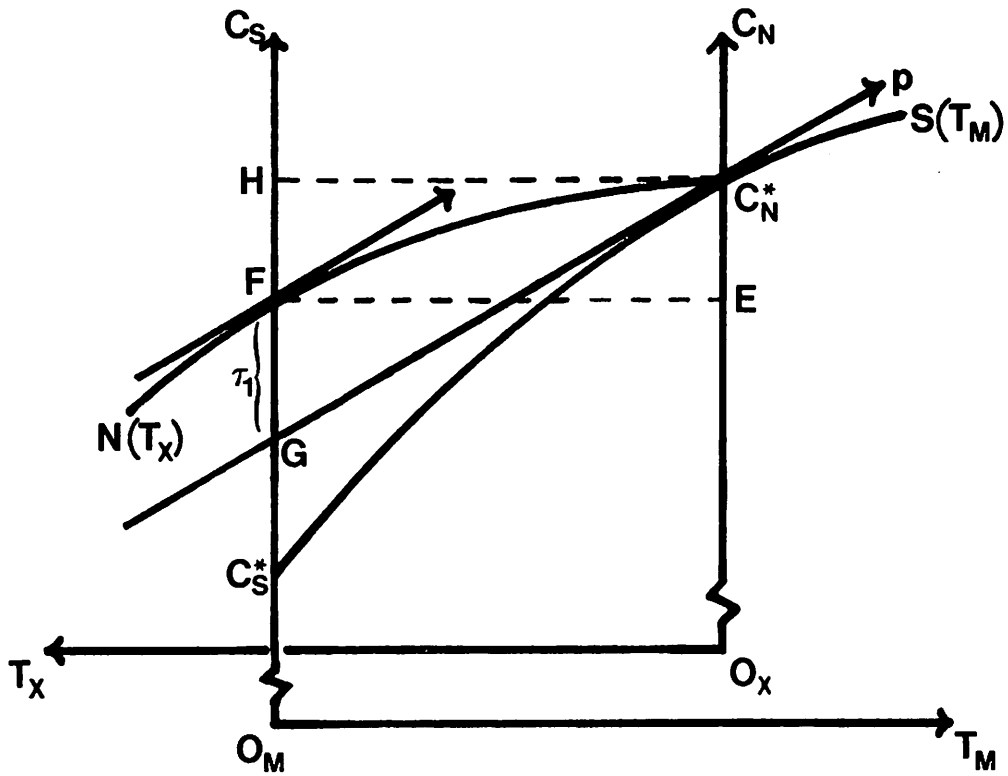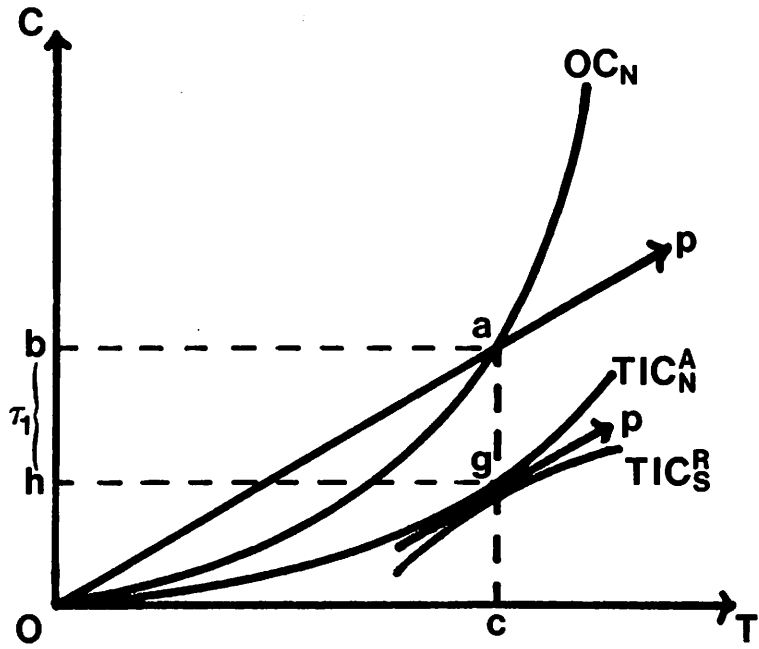FIGURE 2(a)

FIGURE 2(b)

FIGURE 3(a)

FIGURE 3(b)

FIGURE 4(a)

FIGURE 4(b)

FIGURE 5(a)

FIGURE 5(b)

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