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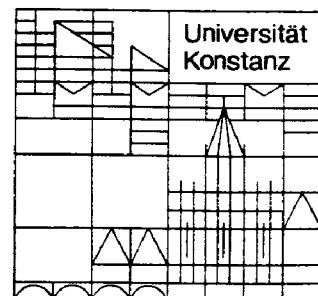
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Sonderforschungsbereich 178
„Internationalisierung der Wirtschaft“

Diskussionsbeiträge



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Fakultät für Wirtschafts-
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Andreas Haufler

**General Consumption Taxes
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**GENERAL CONSUMPTION TAXES AND
INTERNATIONAL TRADE:
A DUALITY APPROACH**

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General Consumption Taxes and International Trade: A Duality Approach

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Abstract

The paper analyzes the effects of general consumption taxes levied under alternative tax principles. It is shown that different national tax rates imposed under a general destination principle or a general origin principle create no relative price distortions and no redistributive effects in a simple international trade model. Under mixed tax principles, nationally diverging tax rates are no longer neutral, however.

Two such cases are studied: in the first setting, the destination principle applies to trade in intermediate goods while final consumer goods are taxed under the origin principle. In a second case (which has been termed a restricted origin principle) trade within an economic union is based on the origin principle while trade with third countries follows the destination principle. It is argued that the abolition of border controls in the European Community will inevitably lead to either the one or the other of these mixed principles for taxing international trade.

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1 Introduction

With the abolition of border controls in the European Community (EC) as part of the '1992' internal market program, interest in the issue of choosing a 'neutral tax principle' for intra-EC trade in goods has risen steeply. The term 'neutrality' is used somewhat vaguely both in political discussions and in the academic literature. In this paper, it is defined as the absence of (relative) price changes *and* redistributive effects¹. The issue is older than the Community itself and dates back to the Tinbergen-Report of 1953 which states that a general consumption tax levied under either the destination or the origin principle does not distort relative prices². More recent contributions have analyzed settings where neither the origin principle nor the destination principle is applied generally.

Grossman (1980) and Sinn (1990) discuss relative price effects when intermediate goods bear the tax rate of the destination country while final consumer goods are taxed in the country of origin. This analysis is directly relevant to the problem faced by the European Community since it applies equally to an international tax credit method (Vorsteuerabzug) and a deferred payment system.

Shibata (1967), Whalley (1979, 1981) and Berglas (1981) analyze the case of the so-called 'restricted origin principle' where trade within an economic union is taxed under the origin principle while trade with third countries follows the destination principle. If the subtraction method (Vorumsatzabzug) were introduced for intra-EC trade without a simultaneous change in GATT rules³ the restricted origin principle would be the relevant setting for international goods taxation from an EC-perspective.

While these contributions are closely related, they use different model frameworks and there is as yet no systematic survey of this literature⁴. This paper attempts to treat the issues mentioned above in a unified framework using duality theory. Fur-

¹In contrast, the term 'distortion' is restricted here to changes in relative prices. One example for confusions that have arisen from an ambiguous use of the terms 'distortion' and 'neutrality' is the argument between Whalley (1979, 1981) and Berglas (1981), p. 385.

²See Europäische Gemeinschaft für Kohle und Stahl (1953), p. 24.

³GATT rules are currently based on the destination principle for international trade. See GATT, Art. III, para. 1 and 2 and especially Annex 1 ad Art. XVI which states that the remission of domestic consumption taxes for export is not considered as a subsidy.

⁴An exception is the treatment in Sørensen (1989), pp. 39ff.

thermore, it extends the analysis by incorporating the effects of general consumption taxes on national welfare. This allows to clearly separate pure income redistributions from distortions in relative prices and it links the analysis to the literature on tax reform and optimal trade policy⁵. The explicit analysis of national welfare effects will also yield some further insights into the issue of tax competition which has so far been discussed primarily with respect to capital taxation. On the other hand, the framework chosen excludes the analysis of macroeconomic imbalances caused by general consumption taxes which are relegated to a brief comment in the concluding section⁶.

Section 2 of this paper outlines the model framework and provides a detailed discussion of the assumptions made. Section 3 restates the well-known neutrality propositions of both the general destination and the general origin principle in a duality notation. Section 4 analyzes the case when intermediate goods and final goods receive different tax treatments. Section 5 addresses the issue of the restricted origin principle in a three-country, three-good framework. Section 6 concludes with some comments on the choice of the (second-) best method of taxing international sales in the EC internal market.

2 The Model and its Assumptions

The framework for the analysis is a simple Heckscher-Ohlin type international trade model with an equal number of countries and (tradeable) goods. The production possibility set is strictly convex in each country and boundary solutions are excluded so that all countries produce all goods in a trade equilibrium⁷. Countries are denoted by superscript letters ($k = A, B, C$) while a subscript number ($i = 1, 2, 3$) indicates goods. There will be two countries and two goods in sections 3 and 4 and three goods and three countries in section 5. The additional symbols used follow standard duality notation⁸:

⁵See the survey by Dixit (1985) and Keen (1987, 1989) for an application to the European Community.

⁶These effects are emphasized in the survey article by Peffekoven (1983).

⁷The exclusion of boundary solutions implies that factor endowments in the trading countries are 'not too different' and lie within the diversification cone. Cf. Dixit and Norman (1980), p. 52.

⁸See e.g. Dixit and Norman (1980) or Keen (1989).

- p_i^k : producer price for good i in country k
- t^k : uniform tax rate in country k
- $q_i^k = p_i^k(1 + t^k)$: consumer price for good i in country k
- u^k : national utility in country k
- r^k : national product in country k
- e^k : national expenditure in country k
- T^k : total tax revenue in country k .

The derivatives of the expenditure and the revenue function are indicated by subscript letters:

- $r_{p_i}^k = x_i^k$: supply of good i in country k
- $e_{p_i}^k = c_i^k$: (compensated) demand for good i in country k .
- $e_{u^k}^k$: inverse of the marginal utility of income in country k

Finally,

- $m_i^k = c_i^k - x_i^k$: import demand for good i in country k

In the remainder of the paper, I will use the symbols x , c , m rather than the derivative expressions to characterize supply and demand functions.

The analysis abstracts from any obstacles to free trade other than general consumption taxes. Taxes are imposed ad valorem and with a uniform rate in each country. Tax rates will generally differ between countries, however, so that $t_1^A = t_2^A = t^A$ but $t^A \neq t^B$. The general consumption tax analyzed here can thus be thought of as a general retail sales tax or, for application in the European Community, as an idealized value added tax (VAT) with a comprehensive coverage of the tax base and a single rate⁹.

⁹This setting excludes non-neutralities that are due to a non-generality of the *tax itself* and arise also in a purely national setting. This simplification allows to concentrate on non-neutralities that are due to a non-generality of the *tax principle* for international trade and are thus of a genuinely international origin. For a discussion of distortions arising in international trade because of an incomplete coverage of the VAT, see Krugman and Feldstein (1989).

There is a single consumer in each country so that the issues of interindividual equity and inter-nation equity coincide¹⁰. On the production side, standard assumptions of competitive markets ensure that prices equal marginal cost. What concerns the government, the model assumes that in each country the revenue from the general consumption tax is redistributed to the single consumer as a lump-sum payment and public expenditures are abstracted from. Furthermore, it is assumed that the raising of the tax creates no excess burden in a domestic setting. Since a general consumption tax is analytically equivalent to a tax on all factor incomes, such a tax is distortive in a national setting if factor supplies respond to their real return. Following the standard assumptions of the Heckscher-Ohlin model, this potential source of inefficiency is excluded by assuming fixed factor supplies in each country¹¹.

A major simplification made in this paper is that changes in national incomes do not affect the determination of world relative prices¹². Technically, it is assumed that the partial derivative of the compensated demand function with respect to changes in utility is zero in each country, i.e. $\delta c_i^k / \delta u^k = 0$ for $k = A, B, C$ and $i = 1, 2, 3$. This assumption breaks up the full general equilibrium interdependency of the standard international trade model where national welfare and world relative prices are determined simultaneously¹³. Instead, the analysis here proceeds in two stages that build on one another: The first step is to determine relative prices in each country as a function of changes in tax rates alone. In the second stage, the effects of a tax change on national welfare are analyzed using the induced changes in relative prices as an intermediate result.

In the two-country, two-good case, trade equilibrium with general consumption taxes in both countries is fully described by a budget constraint for each country

¹⁰This follows the well-known tripartition of Musgrave and Musgrave (1989), 568f., where international taxation issues are classified into the two categories mentioned above and the issue of (international vs. national) efficiency.

¹¹The justification for these simplifying assumptions is the same as above: Only by excluding all domestic sources of inefficiency is it possible to isolate inefficiencies that arise in international trade *in addition to* possible domestic distortions. Of course, this subjects the analysis to the same second-best caveat that applies to most normative international trade results.

¹²There is clearly no justification for this assumption other than a pragmatic one: It simplifies the analysis greatly without sacrificing important additional insights that would be due to the repercussions that income changes have on relative price determination. See Keen (1989), p. 5 for the same assumption.

¹³See e.g. Dixit and Norman (1980), p. 81.

and the market-clearing condition for good 1. Market clearing for good 2 is implicit by Walras law. In the duality notation introduced above

$$e^A(q_1^A, q_2^A, u^A) = r^A(p_1^A, p_2^A) + T^A \quad (1)$$

$$e^B(q_1^B, q_2^B, u^B) = r^B(p_1^B, p_2^B) + T^B \quad (2)$$

$$x_1^A \left(\frac{p_1^A}{p_2^A} \right) + x_1^B \left(\frac{p_1^B}{p_2^B} \right) = c_1^A \left(\frac{q_1^A}{q_2^A} \right) + c_1^B \left(\frac{q_1^B}{q_2^B} \right) \quad (3)$$

The equilibrium described by (1)–(3) represents a Pareto optimum iff

$$\frac{q_1^A}{q_2^A} = \frac{p_1^A}{p_2^A} = \frac{p_1^B}{p_2^B} = \frac{q_1^B}{q_2^B} \quad (4)$$

so that the domestic rate of substitution equals the domestic rate of transformation which in turn equals the foreign rate of transformation (and substitution). It will be seen that condition (4) is fulfilled if a given tax principle is applied generally in international trade.

3 The Neutrality of General Tax Principles

This section restates the well-known neutrality propositions about the general destination and the general origin principle for the case of two goods and two countries¹⁴.

Relative producer prices in countries A and B are given by p_1^A/p_2^A and p_1^B/p_2^B respectively. Relative consumer prices in A and B are

$$\frac{q_1^k}{q_2^k} = \frac{p_1^k(1+t^k)}{p_2^k(1+t^k)} = \frac{p_1^k}{p_2^k} \quad (5)$$

Relative consumer prices thus equal relative producer prices in each country. This result follows directly from the general nature of the consumption tax and is independent from the tax principle applied.

¹⁴The neutrality of the destination and the origin principle was first mentioned in Europäische Gemeinschaft für Kohle und Stahl (Tinbergen Report, 1953), p. 24. The result is restated in Shibata (1967), pp. 198ff. and is proved more formally by Whalley (1979), pp. 216ff.

3.1 Relative Price Effects

General Destination Principle: It remains to consider the link between relative prices in the two countries. This link is established by a consumer arbitrage condition which in turn depends on the underlying tax principle. Under the destination principle, consumers in country k have to pay the tax rate t^k , no matter where the good originates¹⁵. Consumer arbitrage is based on absolute rather than relative prices so that it is necessary to introduce the exchange rate s explicitly:

$$s \left[\frac{\text{units of A's currency}}{\text{units of B's currency}} \right] : \text{exchange rate between countries A and B}$$

Consumers in country A are indifferent between buying at home and abroad if

$$p_1^A(1 + t^A) = s p_1^B(1 + t^A) \quad (6)$$

$$p_2^A(1 + t^A) = s p_2^B(1 + t^A) \quad (7)$$

Dividing (6) by (7) yields

$$\frac{p_1^A}{p_2^A} = \frac{p_1^B}{p_2^B}.$$

This shows that general consumption taxes under a generally applied destination principle do not distort relative prices. Note that the same arbitrage conditions as in (6)–(7) can be set up for consumers in country B who face a tax rate t^B and an exchange rate of $1/s$. The destination principle is compatible with differences in *absolute* consumer prices because the enforcement of border tax adjustments hinders consumers in the high-tax country to take advantage of the low tax rates abroad.

General Origin Principle: Under the origin principle, there are no adjustments at the border so that consumer arbitrage is based on tax-inclusive prices. The arbitrage conditions for consumers in country A and B are now

$$p_1^A(1 + t^A) = s p_1^B(1 + t^B) \quad (8)$$

$$p_2^A(1 + t^A) = s p_2^B(1 + t^B) \quad (9)$$

¹⁵In current Community practice, the destination principle is enforced through border tax adjustments that apply equally to all imported goods including direct consumer purchases. At present, the latter are legally subject to border tax adjustments if their value exceeds ECU 350.

Dividing (8) by (9) yields again

$$\frac{p_1^A}{p_2^A} = \frac{p_1^B}{p_2^B}$$

so that the general origin principle is non-distortive as well. Implicit in equations (8)–(9) is an adjustment of the exchange rate relative to the no-tax situation if tax rates differ between countries. This exchange rate adjustment is given by

$$s = \frac{1 + t^A}{1 + t^B} \quad (10)$$

Equation (10) can be interpreted as follows: If the tax rate in country A is higher than the tax rate in country B, the exchange rate will rise, implying a devaluation of country A's currency. This is the so-called exchange rate argument that is needed to establish the neutrality of the general origin principle. The model used here focuses on relative prices and assumes an instantaneous adjustment of the exchange rate so that trade balance effects cannot occur.

3.2 Welfare Effects

General Destination Principle: The analysis is performed for country A but it applies equally to country B. Prices for good 2 are normalized in each country¹⁶

$$p_2^A \equiv p_2^B \equiv 1 \quad (11)$$

Tax revenue under the general destination principle is given by

$$T_{DP}^A = t^A(p_1^A c_1^A + c_2^A) \quad (12)$$

Equation (1) is modified by substituting in for consumer prices and using (12)

$$e^A[p_1^A(1 + t^A), (1 + t^A), u^A] = r^A(p_1^A, 1) + t^A(p_1^A c_1^A + c_2^A). \quad (13)$$

Totally differentiating (13) and using the derivative properties and notations stated in section 2 yields

$$e_{u^A}^A du^A = -m_1^A dp_1^A + t^A(p_1^A dc_1^A + dc_2^A) \quad (14)$$

¹⁶The normalization implies that in the no-tax situation the exchange rate must be equal to one since under free trade the law of one price must hold for this good.

The term $e_{u^A}^A$ in this equation is the inverse of the marginal utility of income¹⁷ and I will assume

$$e_{u^k}^k \equiv 1 \text{ for } k = A, B, C$$

in this paper for notational simplicity and without altering any of the results.

The first term on the RHS of (14) is a terms-of-trade effect which states that if country A is a net exporter of good 1, it will gain from a rise in the relative price of this good. We know, however, from the preceding analysis that $dp_1^A = 0$ so that this term equals zero under the general destination principle. Furthermore, from the first-order condition of consumer utility maximization in country A

$$p_1^A dc_1^A + dc_2^A = 0 \quad (15)$$

so that the general destination principle does not redistribute real income (or welfare) between countries.

General Origin Principle: Under the origin principle, the tax imposed is effectively a tax on production and tax revenue is given by

$$T_{OP}^A = t^A(p_1^A x_1^A + x_2^A). \quad (16)$$

Equation (1) thus changes to

$$e^A[p_1^A(1 + t^A), (1 + t^A), u^A] = r^A(p_1^A, 1) + t^A(p_1^A x_1^A + x_2^A). \quad (17)$$

Totally differentiating yields

$$du^A = -m_1^A(1 + t^A)dp_1^A + t^A(p_1^A dx_1^A + dx_2^A) + (p_1^A x_1^A + x_2^A - p_1^A c_1^A - c_2^A)dt^A \quad (18)$$

The first two terms of (18) drop out in the absence of relative price changes and by the first-order condition of producer profit maximization

$$p_1^A dx_1^A + dx_2^A = 0. \quad (19)$$

The additional term here is $(p_1^A x_1^A + x_2^A - p_1^A c_1^A - c_2^A)$ which is just the budget constraint under free trade. We thus get

$$du^A = 0.$$

¹⁷See Dixit and Norman (1980), pp. 60f. for a derivation.

Since trade is balanced in this model, it is irrelevant whether the tax base is domestic consumption or domestic production.

It is stated here without proof that all the neutrality results obtained in this section carry over to the case of three and more goods (and countries).

4 Trade in Intermediate Goods

Having discussed the general destination principle and the general origin principle in the previous section, the natural question to ask is what happens if the destination principle applies to trade in one good while the origin principle is relevant for trade in the other. This is exactly the problem that the European Community faces in its attempt to do away with border controls as an integral part of the internal market program. The abolition of border controls will imply that elements of the origin principle enter the taxation of intra-European trade. This is true under both alternatives to the current border controls that have been seriously considered by policy-makers, namely an international tax credit system on the one hand¹⁸ and a variant of the deferred payment system on the other¹⁹. To discuss this issue, it is assumed that trade in good 2 (the numeraire good) remains to be based on the destination principle. Good 2 can be termed an 'intermediate good' with this term applying to all goods that are purchased by a VAT-registered trader²⁰. On the other hand, good 1 can be called a 'final consumer good' and represents all those transactions that can only effectively be taxed in the country of origin once border controls are abolished²¹.

¹⁸This method was first proposed in European Community-Commission (1985), para 172 and has been termed a 'common market principle' (Gemeinsamer-Markt-Prinzip) by Biehl (1969).

¹⁹It is clear by now that the deferred payment system will be applied in the European Community as a 'transitional' solution at the beginning of 1993. It shall be replaced by the international tax credit method no later than in 1997. See Europäische Gemeinschaften - Kommission (1990), pp. 1ff. Cf. Haufler (1990), pp. 131ff. for a systematic comparison of the alternative solutions.

²⁰I prefer the term 'intermediate good' to the term 'investment good' used by Sinn (1990) because the classification depends not on the nature of the good but on the identity of the buyer. The export of a fully processed good for pure resale in the country of destination will be taxed under the destination principle if the trader is VAT-registered.

²¹The most recent draft directive from the EC Commission attempts to reduce the scope of the origin principle in the internal market by setting up special rules that subject mail order firms, VAT-exempt banks and government agencies and the purchase of new cars to the tax rate of the

4.1 Relative Price Effects

Arbitrage for good 1 is based on the origin principle and equation (8) is repeated here for convenience

$$p_1^A(1 + t^A) = s p_1^B(1 + t^B).$$

Arbitrage for good 2 is based on the destination principle. The normalization (11) is substituted in equation (7) to yield

$$(1 + t^A) = s(1 + t^B).$$

Since trade in the numeraire good is based on the destination principle, the exchange rate will remain unchanged from the no-tax situation. This implies that for trade in good 1, there is no compensation for tax differentials. Dividing the two arbitrage conditions by each other and solving for p_1^B yields

$$p_1^B = p_1^A \frac{(1 + t^A)}{(1 + t^B)}. \quad (20)$$

Equation (20) shows that differential tax rates create a wedge between relative producer prices in the two countries when a mixed tax principle is applied. To study the effects of this tax wedge more closely, equation (3) is rewritten as

$$x_1^A [p_1^A] + x_1^B \left[p_1^A \frac{(1 + t^A)}{(1 + t^B)} \right] = c_1^A [p_1^A] + c_1^B \left[p_1^A \frac{(1 + t^A)}{(1 + t^B)} \right]. \quad (21)$$

The total differential of (20) is given for later reference:

$$dp_1^B = d \left[p_1^A \frac{(1 + t^A)}{(1 + t^B)} \right] = \frac{(1 + t^A)}{(1 + t^B)} dp_1^A + \frac{p_1^A}{(1 + t^B)} dt^A - p_1^A \frac{(1 + t^A)}{(1 + t^B)^2} dt^B. \quad (22)$$

The total differential of (21) is given by

$$\left[-\frac{\delta m_1^A}{\delta p_1^A} - \frac{(1 + t^A)}{(1 + t^B)} \frac{\delta m_1^B}{\delta p_1^B} \right] dp_1^A + \left[\frac{-p_1^A}{(1 + t^B)} \frac{\delta m_1^B}{\delta p_1^B} \right] dt^A + \left[\frac{p_1^A(1 + t^A)}{(1 + t^B)^2} \frac{\delta m_1^B}{\delta p_1^B} \right] dt^B = 0. \quad (23)$$

destination country; cf. Europäische Gemeinschaften - Kommission (1990), pp. 9-11. It is clear, however, that at the very least direct consumer purchases abroad ('cross-border shopping') will be taxed in the country of origin as of 1993 so that the basic problem of a mixed tax principle remains.

Import demand for good 1 in each country is a negative function this country's domestic price for good 1:

$$\frac{\delta m_1^k}{\delta p_1^k} < 0 \text{ for } k = 1, 2. \quad (24)$$

This allows to determine the sign of the coefficient of dp_1^A in (23)

$$N \equiv \left[-\frac{\delta m_1^A}{\delta p_1^A} - \frac{(1+t^A)}{(1+t^B)} \frac{\delta m_1^B}{\delta p_1^B} \right] > 0 \quad (25)$$

Implicit differentiation yields

$$\frac{dp_1^A}{dt^A} = \frac{1}{N} \frac{p_1^A}{(1+t^B)} \frac{\delta m_1^B}{\delta p_1^B} < 0 \quad (26)$$

$$\frac{dp_1^A}{dt^B} = -\frac{1}{N} \frac{p_1^A(1+t^A)}{(1+t^B)^2} \frac{\delta m_1^B}{\delta p_1^B} > 0. \quad (27)$$

To get the price response in country B induced by a change in country A's tax rate, setting $dt^B = 0$ in equation (22), dividing both sides by dt^A and substituting (26) in this expression yields

$$\frac{dp_1^B}{dt^A} = -\frac{1}{N} \frac{p_1^A}{(1+t^B)} \frac{\delta m_1^A}{\delta p_1^A} > 0. \quad (28)$$

Likewise, for a change in t^B

$$\frac{dp_1^B}{dt^B} = \frac{1}{N} \frac{p_1^A(1+t^A)}{(1+t^B)^2} \frac{\delta m_1^A}{\delta p_1^A} < 0. \quad (29)$$

The results are thus symmetric: An increase in t^A lowers the relative price of good 1 in country A and raises it in country B. The same holds, mutatis mutandis, for an increase in t^B . The more elastic import demand in country B responds to a change in p_1^B the more of the adjustment to an increase in t^A will fall on the price of good 1 in country A.

Intuitively, an increase in t^A acts similar to a specific tax on good 1 *from the viewpoint of country B* because only consumers of good 1 in country B end up paying the increased tax while consumers of good 2 are sheltered from the tax rise through the application of the destination principle²². As a consequence, consumers in B will

²²It does not matter for this purpose whether exports leave country A free of tax (destination principle) or whether they are taxed in country A but VAT-registered traders in country B can claim an international tax credit in their home country. In both cases, country B's buyers of good 2 effectively pay their domestic tax rate t^B .

substitute away from good 1. Other things being equal, world demand for good 1 falls, putting downward pressure on its relative price in country A.

For the special case that tax rates are equal in the initial position, these results can be interpreted as follows: Since production decisions are known to be efficient under equal tax rates, a rise in t^A (which lowers p_1^A) leads to country A producing less of good 1 and more of good 2 than is warranted by its comparative advantage while country B 'overspecializes' in the production of good 1²³.

4.2 Welfare Effects

Country A now taxes the value of domestic production of good 1 and domestic consumption of good 2 so that

$$T_{MP}^A = t^A(p_1^A x_1^A + c_2^A) \quad (30)$$

Comparing (30) with the tax revenue under either the general origin or the general destination principle given in (12) and (16) shows that country A's tax revenue rises under the mixed tax principle if it is a net exporter of good 1 and it falls otherwise²⁴. There is thus a redistributive effect between countries A and B under a mixed tax principle.

To see how the magnitude of this effect changes with variations in t^A , the budget constraint for country A is set up

$$e^A[p_1^A(1+t^A), (1+t^A), u^A] = r^A(p_1^A, 1) + t^A(p_1^A x_1^A + c_2^A). \quad (31)$$

Totally differentiating and rearranging terms yields for county A

$$du^A = -m_1^A[(1+t^A)dp_1^A + p_1^A dt^A] + t^A(p_1^A dx_1^A + dc_2^A). \quad (32)$$

Substituting (20), (22) and $-m_1^A = m_1^B$ in the analogous expression for country B yields

$$du^B = m_1^A[(1+t^A)dp_1^A + p_1^A dt^A] + t^B(p_1^B dx_1^B + dc_2^B). \quad (33)$$

Comparing (32) with (33), it is obvious that the first terms in each equation represent a purely redistributive effect between the two countries (terms-of-trade effect) while

²³This is the result obtained by Sinn (1990), pp. 494ff.

²⁴Note that this effect cannot be eliminated by some sort of clearing mechanism because the clearing can only be based on trade in intermediate goods, for which records exist.

the second terms represent changes in tax revenues that do not add up to zero. The two effects are analyzed in turn.

Terms-of-Trade Effects: The analysis can be restricted to country A since we know that any gain for country A is mirrored by an equal loss for country B. The terms-of-trade term in (32) is isolated and restated here:

$$du_{TOT}^A = -m_1^A[(1 + t^A)dp_1^A + p_1^A dt^A]. \quad (34)$$

Dividing both sides by dt^A and using (26) yields

$$\frac{du_{TOT}^A}{dt^A} = -m_1^A \left[(1 + t^A) \frac{dp_1^A}{dt^A} + p_1^A \right] = -m_1^A \left[-p_1^A \frac{1}{N} \frac{\delta m_1^A}{\delta p_1^A} \right]. \quad (35)$$

so that

$$\text{sign} \left(\frac{du_{TOT}^A}{dt^A} \right) = -\text{sign}(m_1^A) \quad (36)$$

In order to interpret this result, suppose that country A is an exporter of good 1 (so that $m_1^A < 0$). Note that the bracketed term in (34) is just the total differential of $p_1^A(1 + t^A)$, i.e. of country A's price for the export good 1 (which leaves the country tax-inclusive since the origin principle applies). By the arbitrage condition $p_1^A(1 + t^A) = p_1^B(1 + t^B)$ this term must rise for an increase in t^A because of (28), leading to a terms-of-trade gain for country A.

The same result can be obtained from the following line of thought: By raising its tax rate, country A imposes a higher tax on the production of its export good 1 and a higher tax on the consumption of its import good 2²⁵. It is firmly established in the literature that a production tax on the exportable and a consumption tax on the importable both tend to improve a country's terms of trade.²⁶

²⁵Remember that the tax on good 1 is effectively a production tax while the tax on good 2 is a consumption tax.

²⁶Two results from the international trade literature are relevant here: First, an import tariff is known to be analytically equivalent to a consumption tax *and* a production subsidy for the import-competing good. See Dixit (1985), p. 342 for the general point that of the three trade policy instruments of production, consumption and trade taxes only two are independent. Second, Lerner's (1936) symmetry theorem states that an import tariff is analytically equivalent to an export tax. Combining these two results, the terms-of-trade effect discussed here can be shown to be analytically equivalent to an export tax levied on good 1 (or an import tariff levied on good 2). Cf. also Friedlaender and Vandendorpe (1968), pp. 1060ff. for a discussion of the terms-of-trade effects of specific consumption and production taxes.

Tax Revenue Effects: The second term in (32) is isolated and restated here:

$$du_{TR}^A = t^A(p_1^A dx_1^A + dc_2^A) \quad (37)$$

Dividing this term by dt^A and using (15) yields

$$\frac{du_{TR}^A}{dt^A} = -t^A p_1^A \frac{\delta m_1^A}{\delta p_1^A} \frac{dp_1^A}{dt^A} < 0. \quad (38)$$

Likewise, the effect of a change in t^A on tax revenue in country B is given by

$$\frac{du_{TR}^B}{dt^A} = -t^B p_1^B \frac{\delta m_1^B}{\delta p_1^B} \frac{dp_1^B}{dt^A} > 0. \quad (39)$$

Equation (38) states that country A loses tax revenue from a rise in its tax rate no matter which good it exports. The rise in t^A lowers the relative price of good 1 in country A. This increases country A's import demand for good 1 (or it reduces its export supply of that good). Since good 1 is the final consumer good, this result states that the rise in t^A induces consumers in country A to buy more of good 1 abroad (cross-border-shopping). This activity tends to erode country A's tax base because good 1 is taxed in the country of origin.

The results obtained so far can be summed up in the following table:

Table 1: Effects of a Change $dt^A > 0$ on Welfare in Country A

	terms-of-trade effect	tax revenue effect	total effect
$m_1^A < 0$	positive	negative	?
$m_1^A > 0$	negative	negative	negative

If country A is an exporter of good 1, it faces the trade-off of improving the domestic terms of trade at the expense of national tax revenue that is familiar from the optimal tariff literature. If country A is an importer of good 1, a rise in its tax rate unambiguously lowers the national welfare.

World Welfare: The rise in country A's import demand for good 1 induced by an increase in t^A must be matched by an equal fall in country B's import demand for that good. This can be shown through multiplying (26) by $\delta m_1^A / \delta p_1^A$ and (28) by $\delta m_1^B / \delta p_1^B$:

$$\frac{\delta m_1^B}{\delta p_1^B} \frac{dp_1^B}{dt^A} = -\frac{\delta m_1^A}{\delta p_1^A} \frac{dp_1^A}{dt^A}$$

Using this relationship, equations (38)–(39) can be added up to yield²⁷

$$\frac{du^{A+B}}{dt^A} = \frac{\delta m_1^A}{\delta p_1^A} \frac{dp_1^A}{dt^A} \frac{p_1^A}{(1+t^B)} (t^B - t^A) \quad (40)$$

so that

$$\text{sign} \left(\frac{du^{A+B}}{dt^A} \right) = -\text{sign}(t^A - t^B) \quad (41)$$

Equation (41) can be interpreted as follows: If $t^A > t^B$ initially, an increase in t^A represents a widening of the tax wedge and lowers world welfare while with $t^A < t^B$ in the initial situation the increase in t^A implies a convergence of tax rates that raises world welfare. This is an example of a general result in the tax reform literature which states that if there is only one distortion (which is here given by the *difference* in tax rates), any reduction in this distortion will improve world welfare²⁸.

4.3 The Small Country Case and Tax Competition

If country A is small relative to the rest of the world, it cannot alter the world price for its export good which is assumed to be good 1. Since good 1 leaves the country gross of tax, the producer price in country A must fall by the full amount of the tax. This can be demonstrated by setting the elasticity of world (i.e., country B) import demand with respect to p_1^B equal to minus infinity in equation (26). By a limit argument

$$\frac{dp_1^A}{dt^A} = -\frac{p_1^A}{(1+t^A)}. \quad (42)$$

Substituting (42) in (35) yields

$$\frac{du_{TOT}^A}{dt^A} = 0. \quad (43)$$

²⁷Strictly speaking, it is incorrect to add up welfare changes for the consumers in A and B because it is generally acknowledged that utility cannot be measured cardinally. The usual solution to this problem is to introduce a hypothetical lump-sum transfer that just compensates all countries except one for the national welfare effects that accompany the policy change. The effect on world welfare is then given by the change in the last country's welfare alone. Cf. Keen (1987), p. 110 for the explicit modelling of a hypothetical transfer and Hatta and Fukushima (1979), p. 506f. for the notion of compensation in the n-country case. The derivation of equation (40) should be interpreted as implicitly following such a procedure.

²⁸See Dixit (1985), pp. 344f.

In the absence of terms-of-trade effects, country A definitely loses tax revenue and thus reduces national welfare by raising its tax rate. Vice versa, this identifies an incentive for a small open economy to lower the domestic tax rate in order to attract cross-border shopping and increase the domestic tax base. If country B is small as well²⁹, the situation is symmetric and the model suggests a process of downward tax competition. This has no further implications in the model used here because the only purpose for raising taxes is to redistribute the revenue to the domestic consumer as a lump-sum payment. In contrast, if the tax were used to finance a local public good, a government that maximizes the welfare of its domestic consumer would face a trade-off between supplying the efficient level of the public good and increasing the domestic tax base. It is known from the literature on capital taxation that in a non-cooperative Nash equilibrium, the outcome will be an underprovision of the public good in each country³⁰. This result clearly carries over to the present analysis.

5 The Restricted Origin Principle

In the previous section, it was concluded that differential tax rates distort relative prices and redistribute income between countries if it is impossible to tax final consumer purchases according to the destination principle. Recalling from section 3 the neutrality of a general origin principle, one is led to conclude that intermediate goods should be taxed under the origin principle as well. This could be achieved for the case of VAT by applying the subtraction method (Vorumsatzabzug) to international sales. Indeed, this has been proposed by several authors and panels notably in West

²⁹There are two possible frameworks for such a case: Countries A and B can either be two of a large number of (identical) countries or both A and B are small relative to the rest of the world. See Zodrow and Mieszkowski (1986) for the first setting and Razin and Sadka (1990) for the second. Note, however, that in a setting with more than two countries, bilateral trade is not balanced in general and this may lead to additional effects. This point will be discussed in the following section.

³⁰See e.g. Zodrow and Mieszkowski (1986) who model identical local governments that use a tax on (mobile) capital to finance a local public good. Zodrow and Mieszkowski argue that local governments acting in isolation fear the outflow of capital to neighboring communities and thus an erosion of the domestic tax base in response to a local tax. This effect leads all governments to set their tax rates lower than they would otherwise prefer. In equilibrium, tax rates are equal (and there is no incentive for capital to move) but tax revenue in each country is insufficient to finance the desired level of the public good.

Germany³¹.

One problem with this solution is that the destination principle is currently applied globally rather than being restricted to the European Community only. While it is possible to suggest a worldwide switch to the origin principle³², there are no signs for such a move in practice. Therefore, the analysis has to incorporate the constraint that the destination principle must be maintained for trade with third countries. The case of the so-called restricted origin principle requires a three-country framework where countries A and B form an economic union and apply the origin principle for their mutual trade while trade between each of these countries and the third country C follows the destination principle. The trade structure is predetermined with country A exporting good 1 (and importing the other two goods), country B exporting good 2 and country C exporting good 3. It is assumed that the direction of trade does not change following the introduction of taxes.

5.1 Relative Price Effects

Arbitrage Conditions: Consumer arbitrage conditions for good 3 are based on the destination principle so that producer prices for good 3 will be equalized across countries. Good 3 is therefore chosen to be the numeraire good and its price is set equal to one in each country³³

$$p_3^A = p_3^B = p_3^C \equiv 1. \quad (44)$$

There are thus two relative producer prices p_1, p_2 in each country which equal relative consumer prices in this country by (5). Relative prices are linked across countries by consumer arbitrage conditions which are based on the origin principle for trade between countries A and B and the destination principle for all trade involving country C. Choosing relative prices in country A as the point of reference, this yields the results summarized in Table 2:

³¹Prominent among the proposals in favor of the subtraction method is the report of the Council of Scientific Advisers to the West German Ministry of Economics; see Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1986), para. 15. Cf. also Siebert (1989), pp. 9ff. and Sinn (1990), pp. 496f.

³²See Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1986), para. 15

³³This implies that all bilateral exchange rates are set equal to one.

Table 2: Relative Producer and Consumer Prices in Countries A,B,C

	country A	country B	country C
p_1^k	p_1^A	$p_1^A(1+t^A)/(1+t^B)$	p_1^A
p_2^k	p_2^A	$p_2^A(1+t^A)/(1+t^B)$	$p_2^A(1+t^A)(1+t^B)$

Table 2 shows that the introduction of taxes under the restricted origin principle will not distort relative prices when tax rates in A and B are equal and income effects are abstracted from³⁴.

Relative Price Effects of a Tax Change: Assuming as before that income effects play no role in the determination of relative prices, the market clearing conditions for the non-numeraire goods are given by

$$\begin{aligned} m_1^A(p_1^A, p_2^A) + m_1^B(p_1^B, p_2^B) + m_1^C(p_1^C, p_2^C) &= 0 \\ m_2^A(p_1^A, p_2^A) + m_2^B(p_1^B, p_2^B) + m_2^C(p_1^C, p_2^C) &= 0. \end{aligned} \quad (45)$$

In order to produce unambiguous results, equal supply and demand responses in all countries to a change in the *domestic* relative price are assumed³⁵:

$$\begin{aligned} \frac{\delta c_i}{\delta p_j} &= \frac{\delta c_i^k}{\delta p_j^k} \text{ for all } k = A, B, C; i = 1, 2, 3; j = 1, 2 \\ \frac{\delta x_i}{\delta p_j} &= \frac{\delta x_i^k}{\delta p_j^k} \text{ for all } k = A, B, C; i = 1, 2, 3; j = 1, 2 \end{aligned}$$

so that

$$\frac{\delta m_i}{\delta p_j} = \frac{\delta m_i^k}{\delta p_j^k} \text{ for all } k = A, B, C; i = 1, 2, 3; j = 1, 2. \quad (46)$$

The total differential of equation set (45) is now given by

$$\begin{aligned} \frac{\delta m_1}{\delta p_1} (dp_1^A + dp_1^B + dp_1^C) + \frac{\delta m_1}{\delta p_2} (dp_2^A + dp_2^B + dp_2^C) &= 0 \\ \frac{\delta m_2}{\delta p_1} (dp_1^A + dp_1^B + dp_1^C) + \frac{\delta m_2}{\delta p_2} (dp_2^A + dp_2^B + dp_2^C) &= 0 \end{aligned} \quad (47)$$

³⁴This is proposition (1) in Berglas (1981), p. 378. Note that there is no need for country C's tax rate to be equal to the tax rates within the union since country C applies a general destination principle for its trade. It is known from section 3 that general tax principles create no relative price effects even when tax rates differ between countries.

³⁵This assumption is necessary for determining the direction of relative price changes whenever the analysis is extended to more than two goods. Cf. e.g. Keen (1989), p. 10, proposition 4 (ii). Keen's analysis suggests that an alternative way of getting unambiguous results is to set all cross-price effects equal to zero.

It is assumed that t^B remains unchanged so that (22) simplifies to

$$dp_j^k = d \left[p_j^A \frac{(1+t^A)}{(1+t^B)} \right] = \frac{(1+t^A)}{(1+t^B)} dp_j^A + \frac{p_j^A}{(1+t^B)} dt^A \text{ for } k = B, C; j = 1, 2 \quad (48)$$

Defining

$$\begin{aligned} N_1 &\equiv 2(1+t^B) + (1+t^A) \\ N_2 &\equiv (1+t^B) + 2(1+t^A) \end{aligned} \quad (49)$$

and substituting the results from Table 2 and equation (48) in (47) allows to express all changes in terms of country A's relative prices:

$$\begin{aligned} \frac{\delta m_1}{\delta p_1} N_1 dp_1^A + \frac{\delta m_1}{\delta p_2} N_2 dp_2^A &= - \left[p_1^A \frac{\delta m_1}{\delta p_1} + 2p_2^A \frac{\delta m_1}{\delta p_2} \right] dt^A \\ \frac{\delta m_2}{\delta p_1} N_1 dp_1^A + \frac{\delta m_2}{\delta p_2} N_2 dp_2^A &= - \left[p_1^A \frac{\delta m_2}{\delta p_1} + 2p_2^A \frac{\delta m_2}{\delta p_2} \right] dt^A \end{aligned} \quad (50)$$

Applying Cramer's rule to equation system (50) yields the effects of a change in t^A on relative prices in country A³⁶

$$\frac{dp_1^A}{dt^A} = \frac{-p_1^A}{N_1} < 0 \quad (51)$$

$$\frac{dp_2^A}{dt^A} = \frac{-2p_2^A}{N_2} < 0 \quad (52)$$

To obtain the effects of a change in t^A on relative prices in country B, equation (48) is divided by dt^A and (51) and (52) respectively are substituted in to yield

$$\frac{dp_1^B}{dt^A} = \frac{2p_1^A}{N_1} > 0 \quad (53)$$

$$\frac{dp_2^B}{dt^A} = \frac{p_2^A}{N_2} > 0. \quad (54)$$

Finally, relative price changes in country C are given by

$$\begin{aligned} \frac{dp_1^C}{dt^A} &= \frac{dp_1^A}{dt^A} \\ \frac{dp_2^C}{dt^A} &= \frac{dp_2^B}{dt^A} \end{aligned}$$

³⁶The matrix of coefficients in system (50) is negative (semi-) definite by standard properties of the expenditure and the national product functions. See Dixit and Norman (1980), p. 130.

The results are summed up in Table 3.

Table 3: Relative Price Effects of a Change in t^A

	country A	country B	country C
dp_1^k/dt^A	$-p_1^A/N_1$	$2p_1^A/N_1$	$-p_1^A/N_1$
dp_2^k/dt^A	$-2p_2^A/N_2$	p_2^A/N_2	p_2^A/N_2

Trade Flows: Changes in trade flows can be inferred from Table 3. Since the import demand response to relative price changes is the same in each country by (46), changes in import demand are (negatively) proportional to changes in relative prices. Taking good 1 as an example, a rise in country A's general tax rate acts like a specific tax on good 1 *from the viewpoint of country B* so that country B will substitute away from importing good 1. This fall in world demand for good 1 lowers its net-of-tax price which is relevant for country C's import decision as well as for the production decision in country A. In equilibrium, the fall in country A's export supply (or the rise in its import demand) just matches the net change in foreign import demand. Analogous reasoning applies to goods 2 and 3.

Assuming a situation of *bilaterally* balanced trade *before* the tax change, the rise in t^A will drive country A's bilateral balance with country B into deficit and its bilateral balance with country C into surplus. This is matched by a trade deficit of country B vis-a-vis country C so that each country's trade will still be *multilaterally* balanced after the tax change.

5.2 Welfare Effects

The budget constraint in each country is given by (1), (2) and is repeated here for the three-country-case:

$$e^k(q_1^k, q_2^k, q_3^k, u^k) = r^k(p_1^k, p_2^k) + T^k \text{ for } k = A, B, C \quad (55)$$

Tax revenue in each country is specified as follows: Countries A and B tax their domestic consumption of good 3 (destination principle), the domestic production of their import good in trade with the other union country (origin principle) and domestic consumption plus the exports to the other union country of their export

good. Country C taxes the domestic consumption of all goods. This yields

$$\begin{aligned} T_{ROP}^A &= t^A(p_1^A c_1^A + p_1^A m_1^B + p_2^A x_2^A + c_3^A) \\ T_{ROP}^B &= t^B(p_1^B x_1^B + p_2^B c_2^B + p_2^B m_2^A + c_3^B) \\ T_{ROP}^C &= t^C(p_1^C c_1^C + p_2^C c_2^C + c_3^C). \end{aligned} \quad (56)$$

Comparing T^A in equation set (56) to $t^A(p_1^A c_1^A + p_2^A c_2^A + c_3^A)$, its value under the general destination principle shows that tax revenue is equal iff

$$p_1^A m_1^B = p_2^A m_2^A$$

which is the condition for *bilaterally* balanced trade (valued in country A's prices) between countries A and B³⁷.

Substituting (56) in (55) and totally differentiating yields

$$\begin{aligned} du^A &= (-m_1^A + t^A m_1^B) dp_1^A - (1 + t^A) m_2^A dp_2^A + (p_1^A m_1^B - p_2^A m_2^A) dt^A + \\ &\quad t^A (p_1^A dc_1^A + p_2^A dx_2^A + dc_3^A + p_1^A dm_1^B) \end{aligned} \quad (57)$$

$$\begin{aligned} du^B &= -(1 + t^B) m_1^B dp_1^B + (-m_2^B + t^B m_2^A) dp_2^B + \\ &\quad t^B (p_1^B dx_1^B + p_2^B dc_2^B + dc_3^B + p_2^B dm_2^A) \end{aligned} \quad (58)$$

$$\begin{aligned} du^C &= -m_1^C dp_1^C - m_2^C dp_2^C + \\ &\quad t^C (p_1^C dc_1^C + p_2^C dc_2^C + dc_3^C) \end{aligned} \quad (59)$$

Total welfare effects in each country can be separated into terms-of-trade effects (given in the first line of each equation) and tax revenue effects. These two effects are analyzed in turn.

Terms-of-Trade Effects: To see more clearly the nature of the terms-of-trade effects involved, the first line in (57) is rewritten by substituting $-m_1^A = m_1^B + m_1^C$ and rearranging terms:

$$du_{TOT}^A = m_1^B [(1 + t^A) dp_1^A + p_1^A dt^A] + m_1^C dp_1^A - m_2^A [(1 + t^A) dp_2^A + p_2^A dt^A] \quad (60)$$

Equation (60) comes close to the standard definition of a country's terms-of-trade. Noting that the squared bracket in the first term is the total differential of $p_1^A(1 + t^A)$, the first term is the weighted change in the price of good 1 exported to country B

³⁷This is proposition (2) in Berglas (1981), p. 378.

(which includes country A's tax). The second term is the weighted change in the price of good 1 exported to country C (which is net of tax). The third term is the weighted change in the price of good 2 imported from country B which is given by $p_2^A(1+t^A) = p_2^B(1+t^B)$ under the origin principle.

Dividing (57)–(59) by dt^A , substituting $-m_2^B = m_2^A + m_2^C$ and introducing (51)–(52) yields

$$\frac{du_{TOT}^A}{dt^A} = \frac{p_1^A[2(1+t^B)m_1^B - m_1^C]}{N_1} - \frac{p_2^A m_2^A(1+t^B)}{N_2} \quad (61)$$

$$\frac{du_{TOT}^B}{dt^A} = \frac{-2p_1^A(1+t^B)m_1^B}{N_1} + \frac{p_2^A[m_2^A(1+t^B) + m_2^C]}{N_2} \quad (62)$$

$$\frac{du_{TOT}^C}{dt^A} = \frac{p_1^A m_1^C}{N_1} - \frac{p_2^A m_2^C}{N_2} \quad (63)$$

Equation set (61)–(63) demonstrates that the terms-of-trade effects are mixed for each country. As an example, country A gains on its exports to country B (because the tax-inclusive price of good 1 rises) but incurs a terms-of-trade loss on the exports to country C and a further loss due to the rise in the price of its import good 2. It can be directly inferred from (61)–(63) that these effects are mirrored in the other countries so that aggregate terms-of-trade effects sum to zero.

Tax Revenue Effects: The second step is to isolate the effects of a change in country A's tax rate on tax revenue in each country. Observe first that there are no changes in country C's tax revenue since

$$p_1^k dc_1^k + p_2^k dc_2^k + dc_3^k = 0 \quad (64)$$

by the extension of (15) to the case of three goods³⁸.

Dividing the second lines in (57)–(58) by dt^A and rearranging yields as an intermediate result

$$\begin{aligned} \frac{du_{TR}^A}{dt^A} &= t^A \left[p_1^A \frac{dc_1^A}{dp_1^A} + p_2^A \frac{dx_2^A}{dp_1^A} + \frac{dc_3^A}{dp_1^A} \right] \frac{dp_1^A}{dt^A} + t^A p_1^A \left[\frac{dc_1^B}{dp_1^B} - \frac{dx_1^B}{dp_1^B} \right] \frac{dp_1^B}{dt^A} \\ \frac{du_{TR}^B}{dt^A} &= t^B \left[p_1^B \frac{dx_1^B}{dp_1^B} + p_2^B \frac{dc_2^B}{dp_1^B} + \frac{dc_3^B}{dp_1^B} \right] \frac{dp_1^B}{dt^A} + t^B p_2^B \left[\frac{dc_2^A}{dp_1^A} - \frac{dx_2^A}{dp_1^A} \right] \frac{dp_1^A}{dt^A} \end{aligned}$$

³⁸For this reason and because it does not enter the determination of relative prices, country C's tax rate can be set equal to zero throughout the analysis without altering any of the results.

Equations (51) and (53) are substituted in and the assumption of equal demand and supply responses (46) is used. Changes in quantities consumed and produced are linked by the first-order conditions of the consumer and the producer maximization problem in the three-good case which are given by (64) and

$$p_1^k dx_1^k + p_2^k dx_2^k + dx_3^k = 0. \quad (65)$$

This yields

$$\frac{du_{TR}^A}{dt^A} = \frac{-t^A p_1^A}{N_1} \left[-p_1^A \frac{dm_1}{dp_1} + \frac{dm_3}{dp_1} \right] < 0 \quad (66)$$

$$\frac{du_{TR}^B}{dt^A} = \frac{t^B p_1^A}{N_1} \left[-p_1^B \frac{dm_1}{dp_1} + \frac{dm_3}{dp_1} \right] > 0 \quad (67)$$

In the notation of equation (66), the rise in t^A reduces country A's tax base for two reasons: First, interpreting $\delta m_1/\delta p_1 < 0$ as the change in country B's import demand due to the rise in p_1^B induced by the tax hike, it is seen that origin-based exports to country B are reduced. Second, the term $\delta m_3/\delta p_1 > 0$ is interpreted as country A's own import demand response to the tax-induced fall in p_1^A . Destination-based imports of good 3 fall, leading to a further loss in tax revenue.

The effects of a change in t^A on country A's tax base are thus unambiguously negative. Given the mixed terms-of-trade effects, there is an incentive for each of the union countries to *cut* the domestic tax rate. As in the previous section, there is the possibility of a downward tax competition between the member states of the union with country C's tax revenue remaining unaffected. This result is in contrast to the strategic use of excise taxes where tax rates are *increased* in order to improve the domestic terms of trade³⁹.

World Welfare: Aggregating equations (66)–(67) and rearranging yields⁴⁰

$$\frac{du^{A+B}}{dt^A} = \frac{p_1^A}{N_1} \left[\frac{p_1^A}{(1+t^B)} \frac{dm_1}{dp_1} (t^A - t^B) - \frac{dm_3}{dp_1} (t^A - t^B) \right] \quad (68)$$

so that

$$\frac{du^{A+B}}{dt^A} = -\text{sign}(t^A - t^B) \quad (69)$$

³⁹This type of strategic tax-setting underlies Keen's (1987, 1989) analysis of welfare-enhancing 'harmonizing' tax reforms.

⁴⁰Cf. footnote 27.

This result is identical to the one obtained in equation (41) of the previous section.

The analysis of the restricted origin principle has thus shown that without a harmonization of tax rates within the union, the subtraction method for intra-EC sales leads to non-neutralities in a worldwide setting that are very similar to those identified in the discussion of intermediate goods. The split here is not between different *goods* being taxed under different tax principles but between different *countries* applying different systems of international taxation.

6 Summary: A Second-Best Tax Principle for the European Community

The analysis of this paper has demonstrated that there is no first-best solution to the problem of finding a 'neutral' tax principle for the European Community after the abolition of border controls.

The advantage of the origin principle (administered through the subtraction method for intra-EC trade between registered traders) is that it treats intermediate and final goods alike so that no distortions arise in a framework where final consumer goods can only be taxed in the country of origin. There are, however, a number of problems associated with the introduction of the subtraction method in the European Community. Given that a worldwide switch to the origin principle is not to be expected in the near future, it has been shown that non-neutralities arise in a worldwide setting when nationally diverging tax rates are imposed under a restricted origin principle.

Two other drawbacks of the subtraction method shall only briefly be mentioned here. First, a general switch to the origin principle is likely to cause short-run adjustment problems in high-tax countries when exchange rates do not react systematically to the change in the tax principle⁴¹. This highly visible short-run effect is likely to

⁴¹Throughout this paper, an immediate exchange rate adjustment based on purchasing power parities has been assumed. This is not a realistic assumption for the short run, however. See e.g. the survey by Frenkel (1981) who concludes that in the 1970's, movements in exchange rates were largely independent from movements in national price levels. Frenkel's explanation for this finding is (pp. 161ff.) that exchange rates are best regarded as asset prices which respond very quickly to new information while goods prices are far less sensitive to such 'news'.

create vigorous opposition from exporters in high-tax countries⁴².

Second, a purely administrative but presumably important argument in policy debates is that the tax credit method is currently used for national transactions in all member countries. The application of the subtraction method for international sales would introduce a break in the chain of value-added taxation that is bound to create a number of practical problems. If these problems prove to be insurmountable, the tax laws of all member countries would have to be changed in order to install the subtraction method as the general system of value-added taxation in the European Community.

Weighing these arguments against each other, it seems rather safe to conclude that the introduction of the subtraction method poses more new problems than it solves old ones. This implies that the non-neutralities associated with a different tax treatment for intermediate goods on the one hand and final consumer goods on the other cannot be avoided unless national tax rates are equalized.

There are, however, two different ways to bring this equalization about: The first route is an ex-ante harmonization by agreement of member states, the second is a decentralized adjustment of national tax rates in response to the working of market forces. The model identifies one danger inherent in the market solution: There is an incentive for each country to lower its tax rate in order to attract cross-border shopping and increase the domestic tax base. If countries are let alone in deciding about their appropriate tax rate, the outcome may be one where tax rates are harmonized but *the level* of value added taxation in the European Community is too low to supply the efficient level of public goods and services. It is important to keep in mind, however, that the framework used here abstracts from inefficiencies in the government sector as well as from heterogeneous preferences in the trading countries. It would therefore be inappropriate to call for an ex-ante harmonization of tax rates in the European Community on the basis of this simplified model alone.

⁴²See Berglas (1981), p. 386. Berglas considers the protest of exporters from high-tax countries to be economically unfounded but his own analysis is exclusively long run.

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