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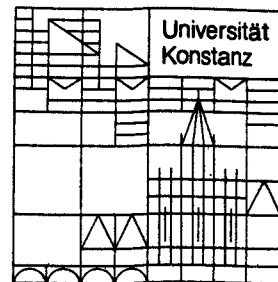
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Andreas Haufler

**Unilateral Tax Reform**  
**under the Restricted Origin Principle**

# **UNILATERAL TAX REFORM UNDER THE RESTRICTED ORIGIN PRINCIPLE**

**Andreas  Haufler**

**Serie II - Nr. 142**

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# Unilateral Tax Reform under the Restricted Origin Principle

Andreas Haufler \*

## Abstract

We analyze the restricted origin principle for taxing international trade in a three-country, three-commodity model where two of the countries form an economic union. Using simplifying assumptions with respect to the initial tax equilibrium and the structure of preferences, the effects of a variation in one union country's general commodity tax rate on relative prices and national welfare in each of the trading nations are derived. It is argued that each of the union countries can increase the domestic tax base at the expense of its union partner by reducing the general commodity tax rate. This suggests that a process of downward tax competition between union members might take place under the restricted origin principle.

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# 1 Introduction

One major problem in the European Community's (EC) current internal market program is the administration of the value-added tax (VAT) for intra-EC trade when border controls within the Community are abolished by the end of 1992. The absence of border controls implies that final consumers can only be taxed in the country of purchase so that a *general* destination principle cannot be administered any more. It has been shown that maintaining the destination principle for trade between VAT-registered traders under these circumstances distorts Community trade when tax rates differ between countries, and it potentially leads to a process of downward tax competition between EC member states<sup>1</sup>.

As a solution to this problem, it has been proposed to tax *all* intra-Community trade under the origin principle. For the case of the European multi-stage value-added tax, the origin principle requires the so-called 'subtraction method' for the taxation of intermediate goods, where the (net-of-tax) value of imported inputs can be deducted from the value of final sales in the destination country<sup>2</sup>. If the use of the origin principle is restricted to the European Community while trade with third countries remains to be based on the destination principle, this proposal implies the adoption of the 'restricted origin principle' from a European perspective.

The restricted origin principle has been analyzed by Shibata (1967, pp. 206ff.), and later by Whalley (1979, 1981), Berglas (1981), and Georgakopoulos (1989). These contributions identify the conditions under which the restricted origin principle causes neither allocative distortions nor a redistribution of tax revenues between union countries. The neutrality conditions are derived from models with fixed relative prices and trade flows, however, so that the comparative statics effects of *changes in* tax rates cannot be analyzed in this framework. As a consequence, little is known about *fiscal externalities* that exist under the restricted origin principle, and about a possible process of tax competition which might take place if union countries are allowed to set their tax rates freely.

Our paper addresses these issues and attempts to link the analysis of taxes under the restricted origin principle to recent work in the field of commodity tax competition and tax harmonization<sup>3</sup>. Using simplifying assumptions with respect to the initial tax equilibrium

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<sup>1</sup>Cf., e.g., Sinn (1990) and Haufier (1991), who analyzes the tax credit method cum clearing and the deferred payment system under the conditions of the internal market.

<sup>2</sup>This proposal has been made among others by Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (Council of Economic Advisers to the West German Ministry of Economics, 1986), para. 15 and Sinn (1990) pp. 496f. Cf. McLure (1987), pp. 71ff. for a comparison of the 'subtraction method' vs. the 'credit method' in the computation of value-added tax liability.

<sup>3</sup>Our approach is closest to Keen's (1987, 1989) analysis of the welfare effects of harmonizing specific

and the structure of preferences, the effects of a change in the general tax rate in one of the union countries are analyzed. This allows to indicate the direction that tax competition might take under the restricted origin principle although a full analysis of non-cooperative behavior is left for future work.

The paper is organized as follows. Section 2 outlines the model and briefly restates the results obtained in the earlier literature on the restricted origin principle. Section 3 derives the effects of a unilateral tax reform on relative prices and national welfare in each of the trading countries. Section 4 links the results to the political and the theoretical discussion.

## 2 A Three-Country Model

Our analysis is based on a simple international trade model that applies the Heckscher-Ohlin framework to the case of three countries and three tradeable goods. The production possibility set is assumed strictly convex in each country and each country produces all goods in a trade equilibrium<sup>4</sup>. Factor supply is fixed and factors are internationally immobile so that *multilateral* trade must be balanced for each country. Countries are denoted by superscript letters  $k \in [A, B, C]$ , while subscript numbers  $i \in [1, 2, 3]$  indicate goods. Countries A and B form an economic union and apply the origin principle for their mutual trade while trade between each of the union countries and the rest of the world (country C) follows the destination principle (using border tax adjustments).

In contrast to Berglas (1981), there are no tariffs in our model and the only obstacle to free trade is a general consumption tax levied at a uniform ad valorem rate in each country. Due to the assumption of fixed factor supplies, such a tax creates no excess burden in a domestic setting but it may prevent the equalization of relative prices across countries. There is one representative consumer in each country to whom national tax revenues are redistributed lump sum. Finally, production is assumed to take place under competitive conditions.

The paper uses the basic duality concepts of the expenditure and the national product function:

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taxes under a general destination principle. Abe/Okamura (1989) extend Keen's analysis to the case of three countries. Furthermore, we draw on Mintz/Tulkens' (1986) study of non-cooperative behavior in a two-country model and Dixit's (1985) survey of the literature on optimal taxation and tax reform in an open economy.

<sup>4</sup>The latter assumption requires that factor endowments lie within the diversification cone. Cf., e.g., Dixit/Norman (1980), p. 52.

- $e^k(q^k, u^k)$  : national expenditure in country  $k$ ,
- $r^k(p^k)$  : national product in country  $k$ ,

where

- $p^k$  : vector of producer prices in country  $k$ ,
- $q^k = p^k(1 + t^k)$  : vector of consumer prices in country  $k$ ,
- $t^k$  : general commodity tax rate in country  $k$ ,
- $u^k$  : national utility in country  $k$ .

First and second order derivatives of the national expenditure and revenue functions are given by:

- $\frac{\partial e^k}{\partial u^k}$  : inverse of the marginal utility of income in country  $k$ ,
- $\frac{\partial e^k}{\partial q_i^k} = c_i^k$ : (compensated) demand for good  $i$  in country  $k$ ,
- $\frac{\partial r^k}{\partial p_i^k} = x_i^k$ : supply of good  $i$  in country  $k$ ,
- $\frac{\partial^2 e^k}{\partial q_i^k \partial q_j^k} = \frac{\partial c_i^k}{\partial q_j^k} < 0 \quad \forall \quad i = j$ ,
- $\frac{\partial^2 r^k}{\partial p_i^k \partial p_j^k} = \frac{\partial x_i^k}{\partial p_j^k} > 0 \quad \forall \quad i = j$ .

A trade equilibrium in our model can be described by three national budget constraints and two market-clearing conditions. Market clearing for the third commodity is implied by Walras' law. Using the symbols introduced above and denoting total tax revenues in each country by  $T^k$ , the model is given by the following set of equations:

$$\begin{aligned} e^k(q^k, u^k) &= r^k(p^k) + T^k & \forall \quad k \in [A, B, C], \\ \sum_{k=A,B,C} c_i^k(p^k, u^k) &= \sum_{k=A,B,C} x_i^k(p^k) & \forall \quad i \in [1, 2]. \end{aligned} \quad (1)$$

Note that while *absolute* consumer prices enter the expenditure function, consumption decisions in each country are based on *relative* consumer prices. Since the tax is applied uniformly, the latter are equal to relative producer prices in each country. To solve the model, equation set (1) must be completed by

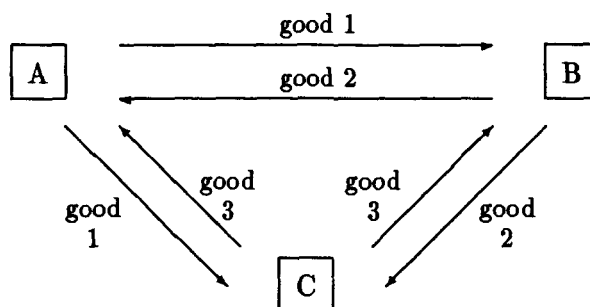
- tying together relative producer (and consumer) prices in different countries through consumer price arbitrage,
- specifying national tax revenues  $T^k$  under the restricted origin principle.

In our model, both consumer arbitrage conditions and the specification of national tax bases depend on the underlying pattern of trade.

**Trade Flows:** A general characteristic of multi-country models is the large number of possible trade patterns which are consistent with the properties of the model. Furthermore, it is known that the assumptions made with respect to the trade structure can affect the results obtained<sup>5</sup>. On the other hand, most multi-country models cannot be solved unless the trade structure is predetermined. Following standard practice, we therefore postulate an initial trade pattern and we further assume that the direction of trade flows does not change following the introduction of taxes.

We assume a symmetric trade structure where each country exports only one commodity (Figure 1). This pattern of trade follows Whalley (1979), and there is only a minor difference to the trade pattern used by Berglas (1979, 1981)<sup>6</sup>.

**Figure 1: Trade Flows in the Three-Country Model**



<sup>5</sup>Cf. Lloyd (1982), p. 50 for a systematic enumeration of possible trade patterns in three-country models. Lloyd compares four different customs union models and shows that differing conclusions are due mostly to diverse assumptions concerning the trilateral pattern of trade. I thank Albert Schweinberger (University of Konstanz) for this reference.

<sup>6</sup>Berglas assumes that the union country B is small and does not export to country C. He emphasizes, however, (1981, p. 384) that the neutrality results derived in his (1981) analysis are independent of the direction of commodity flows.



**Arbitrage Conditions and Relative Prices:** In order to focus on the effects of international differences in tax rates, we assume that there are no transportation costs for *direct* trade between any two countries. On the other hand, it is known that *trade deflection* can arise under the restricted origin principle when tax rates differ between union countries<sup>7</sup>. We rule out the possibility of trade deflection by assuming that transaction costs for *deflected* trade are too high to make this form of tax saving worthwhile<sup>8</sup>.

Goods traded between countries A and B are taxed in the country of origin while all commodities traded with country C are taxed in the destination country. International differences in tax rates enter consumer price arbitrage under the origin principle but play no role under the destination principle. Thus, the following set of arbitrage conditions must hold in equilibrium:

$$\begin{aligned} p_1^A &= \frac{(1+t^B)}{(1+t^A)} p_1^B = p_1^C, \\ \frac{(1+t^A)}{(1+t^B)} p_2^A &= p_2^B = p_2^C, \\ p_3^A &= p_3^B = p_3^C. \end{aligned} \tag{2}$$

Arbitrage conditions for commodity 3 guarantee that  $p_3$  will be equalized worldwide; commodity 3 is therefore chosen as the numeraire good and its producer price is set equal to one in each country

$$p_3^A = p_3^B = p_3^C \equiv 1.$$

Equation set (2) shows that the introduction of taxes under the restricted origin principle will distort production decisions unless tax rates in countries A and B are equal. This reproduces Proposition 1 in Berglas (1981, p. 378).

Note, finally, that country C's tax rate does not affect relative prices in any country since country C operates a general destination principle for its trade. Without loss of generality, we will therefore set  $t^C$  equal to zero in the further analysis<sup>9</sup>.

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<sup>7</sup>The term 'trade deflection' refers to the possibility that importers in the high-tax union country channel their imports from the rest of the world through the low-tax union partner in order to save taxes. Cf. Shibata (1967), pp. 212ff. and Georgakopoulos (1989) for a more detailed discussion.

<sup>8</sup>This follows a standard assumption in three-country customs union models. See e.g. Berglas (1979), p. 318.

<sup>9</sup>An immediate policy implication of this result is, of course, that there is no need for tax rate harmonization between the union and the rest of the world under the restricted origin principle.

**National Tax Bases:** According to the trade pattern in Figure 1, country A's tax base under the restricted origin principle consists of domestic consumption of good 3, domestic production of good 2 and domestic consumption plus the exports to country B of the export good 1. Country B's tax base is derived analogously. This yields

$$\begin{aligned} T^A &= t^A(p_1^A c_1^A + p_1^A m_1^B + p_2^A x_2^A + c_3^A), \\ T^B &= t^B(p_1^B x_1^B + p_2^B c_2^B + p_2^B m_2^A + c_3^B). \end{aligned} \quad (3)$$

We know from the previous discussion that the restricted origin principle does not distort relative prices if  $t^A = t^B$ . For this case, it is possible to isolate pure income effects due to different distributions of tax revenues. Under a general destination principle, country A's tax revenues are given by<sup>10</sup>

$$T_{DP}^A = t^A(p_1^A c_1^A + p_2^A c_2^A + c_3^A).$$

Comparing this to the respective expression for  $T^A$  in (3) shows that the switch from a general destination principle to the restricted origin principle does not change country A's tax base and thus has no redistributive effects iff

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

This is just the condition for *bilaterally* balanced trade (valued in country A's prices) between countries A and B, reproducing Proposition 2 in Berglas (1981, p. 378).

The analysis of Whalley and Berglas allows to identify conditions under which taxes imposed under the restricted origin principle neither distort relative prices nor redistribute tax revenue between countries. If tax rates differ between union countries, however, changes in relative prices and national income interact. The comparative statics analysis of a change in tax rates under the restricted origin principle thus requires a full specification of demand and supply responses to changes in relative prices and national income.

Our model is completed by substituting arbitrage conditions (2) and tax revenues (3) into equation set (1). The notation can be simplified by introducing import demands

$$m_i^k(p^k, u^k) = c_i^k(p^k, u^k) - x_i^k(p^k).$$

Expressing relative prices in each country in terms of  $p_1^A$  and  $p_2^B$  yields a set of five simultaneous equations with the five endogenous variables  $u^A, u^B, u^C, p_1^A, p_2^B$  which depend

<sup>10</sup>The comparison could equally be made with respect to a general origin principle. See Berglas (1981), pp. 382ff.

on the exogenous tax rates  $t^A, t^B$ . A special feature of our model is that utility levels in the union countries are interrelated through the composition of national tax bases.

$$\begin{aligned}
e^A [p_1^A, p_2^B, u^A, u^B, t^A, t^B] &= r^A [p_1^A, p_2^B, t^A, t^B] + T^A [p_1^A, p_2^B, u^A, u^B, t^A, t^B], \\
e^B [p_1^A, p_2^B, u^A, u^B, t^A, t^B] &= r^B [p_1^A, p_2^B, t^A, t^B] + T^B [p_1^A, p_2^B, u^A, u^B, t^A, t^B], \\
e^C [p_1^A, p_2^B, u^C] &= r^C [p_1^A, p_2^B], \\
m_1^A [p_1^A, p_2^B, u^A, u^B, t^A, t^B] + m_1^B [p_1^A, p_2^B, u^A, u^B, t^A, t^B] + m_1^C [p_1^A, p_2^B, u^C] &= 0, \\
m_2^A [p_1^A, p_2^B, u^A, u^B, t^A, t^B] + m_2^B [p_1^A, p_2^B, u^A, u^B, t^A, t^B] + m_2^C [p_1^A, p_2^B, u^C] &= 0. \quad (4)
\end{aligned}$$

### 3 Tax Reform in One Union Country

The tax reform analyzed in this section is a marginal variation in the general tax rate of one union country. Without loss of generality, we vary  $t^A$  while holding  $t^B$  constant.

It is well-known in piecemeal welfare theory that the analysis of national welfare effects (or actual Pareto improvements) is far more complicated than the analysis of global efficiency effects (or potential Pareto improvements) since in the first case, purely redistributive effects and changes in deadweight loss interact. In our model, comparative statics results cannot be derived for an arbitrary initial equilibrium<sup>11</sup>. Since the focus of our analysis is on redistributive effects, we exclude changes in deadweight loss by setting up

#### Assumption 1:

*There are no distortions in the initial equilibrium. Thus,*

$$t^A = t^B = t \quad \text{and} \quad p_i^A = p_i^B = p_i^C = p_i \quad \text{initially.}$$

Using this assumption, perturbation of equation set (4) yields<sup>12</sup>

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<sup>11</sup>In a similar way, Keen (1989), pp. 6ff. restricts the initial tax equilibrium in order to derive actual Pareto improvements under a 'harmonizing' tax scheme.

<sup>12</sup>The derivation uses the relationship  $p_1^k dc_1^k + p_2^k dc_2^k + dc_3^k = 0$ ; this is a direct outcome of expenditure minimization under a given vector of prices.

$$\begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} \frac{\partial e^A}{\partial u^A} du^A \\ \frac{\partial e^B}{\partial u^B} du^B \\ \frac{\partial e^C}{\partial u^C} du^C \\ dp_1^A \\ dp_2^B \end{bmatrix} = \begin{bmatrix} p_1 m_1^B + \frac{t}{(1+t)} \left( p_1 p_1 \frac{\partial m_1^B}{\partial p_1^B} + p_2 p_2 \frac{\partial m_2^A}{\partial p_2^A} \right) \\ -p_1 m_1^B - \frac{t}{(1+t)} \left( p_1 p_1 \frac{\partial m_1^B}{\partial p_1^B} + p_2 p_2 \frac{\partial m_2^A}{\partial p_2^A} \right) \\ 0 \\ \frac{1}{(1+t)} \left( -p_1 \frac{\partial m_1^B}{\partial p_1^B} + p_2 \frac{\partial m_1^A}{\partial p_2^A} \right) \\ \frac{1}{(1+t)} \left( -p_1 \frac{\partial m_2^B}{\partial p_1^B} + p_2 \frac{\partial m_2^A}{\partial p_2^A} \right) \end{bmatrix} dt^A, \quad (5)$$

where

$$A_{11} = \begin{bmatrix} 1 + tp_2 \frac{\partial c_2^A}{\partial y^A} & -tp_1 \frac{\partial c_1^B}{\partial y^B} & 0 \\ -tp_2 \frac{\partial c_2^A}{\partial y^A} & 1 + tp_1 \frac{\partial c_1^B}{\partial y^B} & 0 \\ 0 & 0 & 1 \end{bmatrix},$$

$$A_{12} = \begin{bmatrix} m_1^A - tm_1^B + tp_2 \frac{\partial m_2^A}{\partial p_1^A} - tp_1 \frac{\partial m_1^B}{\partial p_1^B} & (1+t)m_2^A + tp_2 \frac{\partial m_2^A}{\partial p_2^A} - tp_1 \frac{\partial m_1^B}{\partial p_2^B} \\ (1+t)m_1^B - tp_2 \frac{\partial m_2^A}{\partial p_1^A} + tp_1 \frac{\partial m_1^B}{\partial p_1^B} & m_2^B - tm_2^A - tp_2 \frac{\partial m_2^A}{\partial p_2^A} + tp_1 \frac{\partial m_1^B}{\partial p_2^B} \\ -m_1^A - m_1^B & -m_2^A - m_2^B \end{bmatrix},$$

$$A_{21} = \begin{bmatrix} \frac{\partial c_1^A}{\partial y^A} & \frac{\partial c_1^B}{\partial y^B} & \frac{\partial c_1^C}{\partial y^C} \\ \frac{\partial c_2^A}{\partial y^A} & \frac{\partial c_2^B}{\partial y^B} & \frac{\partial c_2^C}{\partial y^C} \end{bmatrix},$$

$$A_{22} = \begin{bmatrix} \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial m_1^B}{\partial p_1^B} + \frac{\partial m_1^C}{\partial p_1^C} & \frac{\partial m_1^A}{\partial p_2^A} + \frac{\partial m_1^B}{\partial p_2^B} + \frac{\partial m_1^C}{\partial p_2^C} \\ \frac{\partial m_2^A}{\partial p_1^A} + \frac{\partial m_2^B}{\partial p_1^B} + \frac{\partial m_2^C}{\partial p_1^C} & \frac{\partial m_2^A}{\partial p_2^A} + \frac{\partial m_2^B}{\partial p_2^B} + \frac{\partial m_2^C}{\partial p_2^C} \end{bmatrix}.$$

In  $A_{11}$  and  $A_{21}$ , partial derivatives  $\partial c_i^k / \partial u^k$  have been substituted by Marshallian marginal propensities to consume using<sup>13</sup>

$$\frac{\partial c_i^k}{\partial u^k} = \frac{\partial c_i^k}{\partial y^k} \frac{\partial e^k}{\partial u^k} \quad \forall i \in [1, 2],$$

where  $y$  denotes nominal income.

The matrices  $A_{ij}$  can be given the following economic interpretation:  $A_{11}$  is a matrix of income multipliers which captures the repercussions of a change in one country's welfare (or income) through induced changes in national spending.  $A_{12}$  contains the partial equilibrium effects of a tax change on each country's welfare.  $A_{21}$  is the matrix of propensities to consume and  $A_{22}$  is the matrix of isolated (Hicksian) substitution terms. It follows from the properties of the expenditure and the national product function that, with some substitutability in demand or production between the numeraire good and other goods,  $A_{22}$  is negative definite<sup>14</sup> so that

$$S \equiv |A_{22}| > 0.$$

Using the economic interpretation of the matrices  $A_{ij}$ , it is easily seen that  $|A| > 0$  is a stability condition of the system (5).

The ensuing analysis requires, however, a further assumption which excludes the possibility of income paradoxes (the so-called Metzler paradox) arising from differences in national propensities to consume. Again, the purpose of this assumption is to permit the derivation of comparative statics results by eliminating effects which are not central to our problem.

#### **Assumption 2:**

*Preferences are homothetic and identical in the trading countries. With  $p_i^A = p_i^B = p_i^C$  in the initial equilibrium (Assumption 1), it follows that marginal propensities to consume good  $i$  are equal in each country*

$$\frac{\partial c_i^A}{\partial y^A} = \frac{\partial c_i^B}{\partial y^B} = \frac{\partial c_i^C}{\partial y^C} = \frac{\partial c_i}{\partial y} \quad \forall i \in [1, 2].$$

<sup>13</sup>The derivation follows from solving the basic no-tax identity  $y = e(p^k, u^k)$  for  $u^k$ , substituting into  $c_i^k(p^k, u^k)$ , and partially differentiating with respect to  $u^k$ . See Dixit/Norman (1980), pp. 60f. and p. 131.

<sup>14</sup>See e.g. Dixit/Norman (1980), p. 130.

Note that Assumption 2 does not eliminate the interdependence of national utilities in the union countries, which is a basic feature of our model<sup>15</sup>.

Using Assumption 2 and defining the determinant of the multiplier submatrix as

$$M \equiv |A_{11}| = \left(1 + tp_1 \frac{\partial c_1}{\partial y} + tp_2 \frac{\partial c_2}{\partial y}\right) > 0, \quad (6)$$

$|A|$  reduces to

$$|A| = |A_{11}||A_{22}| = M S > 0. \quad (7)$$

Equation (7) is used in the ensuing analysis of relative price and national welfare effects.

### 3.1 Relative Price Effects

Applying Cramer's rule to (5) yields for the relative price of good 1 in country A:

$$\frac{dp_1^A}{dt^A} = \frac{-\alpha}{(1+t)S}, \quad (8)$$

where

$$\begin{aligned} \alpha = & \left(p_1 \frac{\partial m_1^B}{\partial p_1^B} - p_2 \frac{\partial m_1^A}{\partial p_2^A}\right) \left(\frac{\partial m_2^A}{\partial p_2^A} + \frac{\partial m_2^B}{\partial p_2^B} + \frac{\partial m_2^C}{\partial p_2^C}\right) \\ & - \left(p_1 \frac{\partial m_2^B}{\partial p_1^B} - p_2 \frac{\partial m_2^A}{\partial p_2^A}\right) \left(\frac{\partial m_1^A}{\partial p_2^A} + \frac{\partial m_1^B}{\partial p_2^B} + \frac{\partial m_1^C}{\partial p_2^C}\right). \end{aligned}$$

Recalling  $p_1^B(1+t^B) = p_1^A(1+t^A)$ , the change in country B's relative price of good 1 is obtained by

$$\frac{dp_1^B}{dt^A} = \frac{dp_1^A}{dt^A} + \frac{p_1}{(1+t)} = \frac{p_1 S - \alpha}{(1+t)S}. \quad (9)$$

The signs of  $dp_1^A/dt^A$  and  $dp_1^B/dt^A$  can be determined by setting up the following condition which excludes the possibility that cross-price effects dominate own-price effects in  $\alpha$ :

**Condition 1:**

$$p_1 S > \alpha > 0.$$

If this condition holds, we get

$$\frac{dp_1^A}{dt^A} < 0 \quad \text{and} \quad \frac{dp_1^B}{dt^A} > 0.$$

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<sup>15</sup>This interdependence of national utilities would instead be eliminated if  $\partial c_i^k/\partial y^k$  were set equal to zero; see Keen (1989), p. 5 for the latter assumption. A more technical advantage of our formulation is that it does not violate the law of non-satiation in consumer theory.

Condition 1 thus implies a positive but incomplete shifting of the tax increase: the net-of-tax price  $p_1^A$  falls while the gross-of-tax price  $p_1^B$  rises.

The relative price changes for good 2 can be obtained analogously. Cramer's rule yields

$$\frac{dp_2^B}{dt^A} = \frac{\beta}{(1+t)S}, \quad (10)$$

where

$$\begin{aligned} \beta = & \left( p_2 \frac{\partial m_2^A}{\partial p_2^A} - p_1 \frac{\partial m_2^B}{\partial p_1^B} \right) \left( \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial m_1^B}{\partial p_1^B} + \frac{\partial m_1^C}{\partial p_1^C} \right) \\ & - \left( p_2 \frac{\partial m_1^A}{\partial p_2^A} - p_1 \frac{\partial m_1^B}{\partial p_1^B} \right) \left( \frac{\partial m_2^A}{\partial p_1^A} + \frac{\partial m_2^B}{\partial p_1^B} + \frac{\partial m_2^C}{\partial p_1^C} \right). \end{aligned}$$

The change in the relative price of good 2 in country A is given by

$$\frac{dp_2^A}{dt^A} = \frac{dp_2^B}{dt^A} - \frac{p_2}{(1+t)} = \frac{\beta - p_2 S}{(1+t)S}. \quad (11)$$

To determine the signs of the relative price changes for good 2 we set up

**Condition 2:**

$$p_2 S > \beta > 0,$$

which implies

$$\frac{dp_2^A}{dt^A} < 0 \quad \text{and} \quad \frac{dp_2^B}{dt^A} > 0.$$

If Conditions 1 and 2 hold, the relative prices of *both* non-numeraire goods rise in country B and fall in country A. Taking commodity 1 as an example, a rise in country A's general tax rate acts like a specific tax on this good *from the viewpoint of country B* and raises its price in country B. Following this price change, country B reduces its import demand for good 1. This fall in world demand for good 1 lowers its net-of-tax price in country A (and also in country C). In equilibrium, the fall in country A's export supply just matches the net change in foreign import demand. Analogous reasoning applies to commodity 2. The discussion is summarized in Table 1.

**Table 1: Relative Price Effects of a Tax Change in Country A**

	country A	country B	country C
$dp_1^k/dt^A$	negative	positive	negative
$dp_2^k/dt^A$	negative	positive	positive

### 3.2 National Welfare Effects

Changes in national welfare are obtained using Cramer's rule and substituting in the relative price changes (8)–(11). Aggregate changes in national welfare can be decomposed into a trade volume or tax base effect (TAX), a relative price or terms of trade effect (TOT), and an indirect or general equilibrium effect (GEQ)<sup>16</sup>:

$$\frac{\partial e^k}{\partial u^k} \frac{du^k}{dt^A} = TAX^k + TOT^k + GEQ^k.$$

In the following, these effects are discussed separately for each country.

**Country A:** Repeating equation (6) for convenience

$$M = \left( 1 + tp_1 \frac{\partial c_1}{\partial y} + tp_2 \frac{\partial c_2}{\partial y} \right) > 0,$$

country A's isolated trade volume or tax base effect is given by

$$TAX^A = \frac{t}{M} \left[ m_1^B \frac{dp_1^B}{dt^A} + p_1 \frac{\partial m_1^B}{\partial p_1^B} \frac{dp_1^B}{dt^A} + p_1 \frac{\partial m_1^B}{\partial p_2^B} \frac{dp_2^B}{dt^A} - m_2^A \frac{dp_2^B}{dt^A} - p_2 \frac{\partial m_2^A}{\partial p_2^A} \frac{dp_2^A}{dt^A} - p_2 \frac{\partial m_2^A}{\partial p_1^A} \frac{dp_1^A}{dt^A} \right]. \quad (12)$$

Equation (12) is just the total differential of country A's bilateral trade balance with country B. Assuming that own-price effects dominate cross-price effects, the change in the value of country A's exports of good 1 to country B is ambiguous because the export price rises but export volume falls following an increase in country A's tax rate. On the other hand, the value of country A's imports of good 2 from country B unambiguously increases following a rise in  $t^A$  since price and volume effects are of the same sign. Country A's imports of good 2 increase despite the rise in the (gross-of-tax) import price because the (net-of-tax) relative price of commodity 2 falls in country A, increasing import demand.

Thus, direct substitution effects are clearly negative for a rise in  $t^A$  while the sign of cross-price effects and relative price changes is ambiguous. To ensure that direct substitution effects outweigh all other (net) effects, we set up

**Condition 3:**

$$\frac{d[p_1 m_1^B - p_2 m_2^A]}{dt^A} < 0.$$

<sup>16</sup>Cf. Mintz/Tulkens (1986), pp. 148f. for a similar decomposition of national welfare effects. The 'private consumption effect' in the Mintz/Tulkens analysis corresponds to our 'terms of trade effect' while their 'public consumption effect' is termed a 'tax base effect' here.



If Condition 3 holds, country A's bilateral trade balance with country B is worsened following an increase in  $t^A$  while its bilateral trade balance with country C improves to maintain multilaterally balanced trade<sup>17</sup>. This shift in country A's trade pattern erodes country A's tax base because trade between the union countries is based on the origin principle, benefitting net exporters, while trade with country C is based on the destination principle which benefits net importers<sup>18</sup>.

Finally, the term  $M$  in the denominator of (12) captures the property of the model that a redistribution of tax revenues between union countries induces a secondary income effect that feeds back on the trade balance<sup>19</sup>.

Turning to the isolated terms of trade effect, we get

$$TOT^A = \frac{1}{M} \left[ m_1^B \frac{dp_1^B}{dt^A} + \left( 1 + tp_1 \frac{\partial c_1}{\partial y} \right) m_1^C \frac{dp_1^A}{dt^A} - m_2^A \frac{dp_2^B}{dt^A} \right]. \quad (13)$$

Equation (13) corresponds to the theoretical derivation of a country's change in the terms of trade as the change in export prices less the change in import prices (recall from Figure 1 that  $m_1^B > 0$ ,  $m_1^C > 0$ ,  $m_2^A > 0$ ). Using the results from Table 1, it is seen that a rise in  $t^A$  increases the (gross-of-tax) price for country A's exports to country B. On the other hand, the price for country A's (net-of-tax) exports to country C falls and the (gross-of-tax) price for country A's imports of good 2 from country B rises. While the first effect tends to improve country A's terms of trade, the two latter effects work in the opposite direction and the net effect on the terms of trade is indeterminate. Thus, even if country A is large enough to affect world prices, it cannot achieve clear-cut terms of trade gains by varying its *general* tax rate<sup>20</sup>.

Note that in contrast to redistributive terms of trade effects between the union countries, changes in country C's terms of trade do not feed back on country A's tax base. This asymmetry is incorporated in (13) through a multiplier term in the *numerator* which precedes the respective terms of trade effect.

<sup>17</sup>Condition 3 can thus be interpreted in a similar way as the well-known Marshall-Lerner condition which determines the sign of changes in the overall trade balance following a variation in the exchange rate.

<sup>18</sup>Compare the discussion in section 2 on the role of the bilateral trade balance between countries A and B for a switch from the general destination (or origin) principle to the restricted origin principle at unchanged tax rates.

<sup>19</sup>This is another similarity to macroeconomic models postulating a deterioration of the *overall* trade balance as a response to increased national income. In our microeconomic framework, country A's *bilateral* trade balance is a negative function of country A's national income.

<sup>20</sup>This is in contrast to the use of *specific* taxes as instruments to manipulate the terms of trade; the latter underlies, e.g., Keen's (1987, 1989) analysis of welfare-enhancing 'harmonizing' multilateral tax reforms.

Finally, isolation of the indirect or general equilibrium effect yields

$$GEQ^A = \frac{tp_1}{M} \frac{\partial c_1}{\partial y} m_2^C \frac{dp_2^B}{dt^A}. \quad (14)$$

Since  $m_2^C(dp_2^B/dt^A) > 0$ , this effect is derived from an improvement in country B's terms of trade vis-a-vis country C. The ensuing increase in country B's national spending indirectly improves country A's bilateral trade balance with country B and augments country A's tax base.

**Country B:** In the same way, we obtain the changes in country B's national welfare:

$$TAX^B = \frac{-t}{M} \left[ m_1^B \frac{dp_1^B}{dt^A} + p_1 \frac{\partial m_1^B}{\partial p_1^B} \frac{dp_1^B}{dt^A} + p_1 \frac{\partial m_1^B}{\partial p_2^B} \frac{dp_2^B}{dt^A} - m_2^A \frac{dp_2^B}{dt^A} - p_2 \frac{\partial m_2^A}{\partial p_2^A} \frac{dp_2^A}{dt^A} - p_2 \frac{\partial m_2^A}{\partial p_1^A} \frac{dp_1^A}{dt^A} \right], \quad (15)$$

$$TOT^B = \frac{1}{M} \left[ -m_1^B \frac{dp_1^B}{dt^A} + \left( 1 + tp_2 \frac{\partial c_2}{\partial y} \right) m_2^C \frac{dp_2^B}{dt^A} + m_2^A \frac{dp_2^B}{dt^A} \right], \quad (16)$$

$$GEQ^B = \frac{tp_2}{M} \frac{\partial c_2}{\partial y} m_1^C \frac{dp_1^A}{dt^A}. \quad (17)$$

Equations (15)–(17) can be interpreted by analogy to the discussion of country A. Note that the tax base effect of country B is the exact counterpart to that of country A, demonstrating that changes in the tax base of the union countries depend only on their bilateral trade balance. It thus follows that country B's tax base is positively affected by a tax increase in country A iff Condition 3 holds.

**Country C:** The change in country C's national welfare is given by

$$TOT^C = -m_1^C \frac{dp_1^A}{dt^A} - m_2^C \frac{dp_2^B}{dt^A}. \quad (18)$$

There are only terms of trade effects for country C; as for the union countries, they are indeterminate. Note that there is no multiplier in the denominator of country C's terms of trade effect because country C's welfare is unaffected by changes in bilateral trade balances.

Adding up equations (12)–(18) demonstrates that all welfare effects are redistributive<sup>21</sup>. Of course, this is an immediate result of Assumption 1 which excludes the

<sup>21</sup>Note that this aggregation of national welfare effects is not made to compare welfare across countries, but solely to round off the algebra.

possibility that a marginal variation in  $t^A$  causes a deadweight loss (or reduces an existing one). The discussion is summarized in Table 2.

**Table 2: Welfare Effects of a Tax Rise in Country A**

effect on	tax base effect	terms of trade effect	general equilibrium effect
country A	negative	indeterminate	positive
country B	positive	indeterminate	negative
country C	zero	indeterminate	zero

In view of the ambiguous change in the terms of trade and the indirect nature of the general equilibrium effect, policymakers in the union countries which pursue strategic goals might be led to focus on the tax base effect of changes in tax rates. Under these conditions, the model suggests an incentive for country A to *cut* the domestic tax rate in order to increase its tax base. By the symmetry of the model with respect to union countries, the same incentive applies to country B. Thus, the model indicates the possibility of a downward competition of tax rates between the member states of the union.

Equal cuts in union countries' tax rates have no harmful effects in the model used here because the only purpose for raising taxes is to redistribute the revenue lump sum to the domestic consumer. 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 well-known that in a non-cooperative Nash equilibrium, the outcome will be an underprovision of the public good in each country<sup>22</sup>.

## 4 Conclusions

The unilateral tax reform analyzed in this paper can be seen as a first step to analyze non-cooperative behavior in the union countries under the restricted origin principle. While we do not explicitly model strategic behavior (in the sense of optimizing national welfare) in country A and do not take into account country B's reaction<sup>23</sup>, the analysis indicates that a process of downward tax competition can occur under the restricted origin principle

<sup>22</sup>This assumes that in the absence of tax competition, the level of public good supply is pareto-optimal. See, e.g., Zodrow/Mieszkowski (1986) in a setting where the tax base is mobile capital.

<sup>23</sup>See, e.g., Mintz/Tulkens (1986) for the derivation of non-cooperative fiscal equilibria in a two-country setting.

when countries are allowed to set their tax rates freely. The limitations of the analysis must be repeated, however. Our analysis has made use of rather strong assumptions with respect to factor mobility, the initial tax equilibrium, and the structure of preferences – to name only the most prominent. While restrictive assumptions of this kind have become standard in the (piecemeal) welfare analysis of multi-country models, they severely limit the application of model results to real-world situations.

Nevertheless, some cautious policy conclusions will be drawn. The case for taxing all intra-Community trade under the origin principle by way of the 'subtraction method' has been made on the grounds that this switch can serve as a substitute for a harmonization of tax rates in the European Community. The recommendation has been explicitly based on the assumption that trade with *third countries* can be taxed under the origin principle as well<sup>24</sup>. There is, however, no indication that current GATT rules will be changed in the near future; policy recommendations for the European Community must therefore be based on a restricted rather than a worldwide origin principle. In addition to the static distortions pointed out in the earlier literature on the restricted origin principle, we have argued that a mutually harmful process of downward tax competition might occur if tax rates are not harmonized within the union. Thus, as long as current GATT rules must be taken as a given, there seems to be no qualitative advantage to be derived from a switch to the 'subtraction method' for taxing intra-Community trade (and there are potentially high administrative costs to it).

From a more theoretical viewpoint, the literature on the strategic setting of commodity taxes has traditionally focused on the terms of trade effects of *specific* taxes (or subsidies) which serve as partial substitutes for a nationally optimal tariff<sup>25</sup>. Under *general* consumption taxes, terms of trade effects are less clear-cut and the focus of attention shifts to changes in the tax base. It is certainly no coincidence that proposals for the harmonization of indirect tax rates made by the Commission of the European Communities in its White Paper (1985, para. 173ff.) have been based exclusively on the concern that member states might compete for value-added tax bases under the conditions of the internal market. This example demonstrates that the competition for internationally mobile tax bases might become a more important source for beggar-thy-neighbor policies in the context of European economic integration than the traditional terms of trade argument - a point that has been

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<sup>24</sup>See Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1986), para. 15. It is well known that the introduction of a *worldwide* origin principle is neutral with respect to relative prices and national welfare in setting with multilaterally balanced trade.

<sup>25</sup>The classic reference is Friedlaender/Vandendorpe (1968), who derive optimal production and consumption taxes when the tariff instrument is not available.

stressed for some time in the literature on capital taxation<sup>26</sup>.

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<sup>26</sup>See, e.g., Schulze/Koch (1990) for a recent game-theoretic analysis.

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