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Working Paper

Public goods, international trade, and tax competition

Diskussionsbeiträge - Serie II, No. 188

Provided in Cooperation with:

Department of Economics, University of Konstanz

Suggested Citation: Haufler, Andreas (1992) : Public goods, international trade, and tax competition, Diskussionsbeiträge - Serie II, No. 188, Universität Konstanz, Sonderforschungsbereich 178 - Internationalisierung der Wirtschaft, Konstanz

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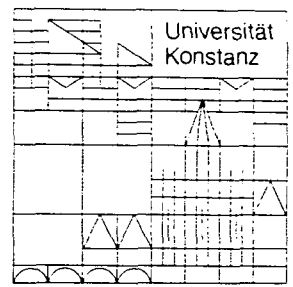
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Sonderforschungsbereich 178
„Internationalisierung der Wirtschaft“

Diskussionsbeiträge

Juristische
Fakultät

Fakultät für Wirtschafts-
wissenschaften und Statistik

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**Public Goods, International Trade,
and Tax Competition**

1 5. DEZ. 1992 Weltwirtschaft
Kiel

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D-7750 Konstanz

Serie II — Nr. 188
September 1992

**PUBLIC GOODS, INTERNATIONAL TRADE,
AND TAX COMPETITION**

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Serie II - Nr. 188

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Public Goods, International Trade, and Tax Competition

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University of Konstanz

Workshop on "International Political Economics of Taxation"

July 2-3, 1992

University of Konstanz

Abstract

The paper sets up an analytical framework within which the arguments for centralized vs. decentralized tax policy can be represented and weighed against each other. Two aspects of the debate are considered: first, the global welfare effects of 'harmonizing' tax reforms are discussed when preferences for public goods differ across countries and non-distorting taxes are not available. Second, the welfare implications of tax competition and tax harmonization are evaluated in a setting where both fiscal and political externalities (Leviathan-type governments) exist.

1 Introduction

Border controls will be abolished in the European Community (EC) by the end of 1992. For the taxation of intra-EC trade, this implies that final consumers can only be taxed in the country of purchase so that a *general* destination principle cannot be administered any more. On the other hand, a *general* origin principle is precluded by current GATT rules.

Given this situation, the Commission of the European Communities has concluded that

”(...) the removal of fiscal frontiers necessitates approximation of VAT [value added tax] and the main excise duties if unacceptable levels of distortion of competition, diversion of trade, and tax fraud are to be avoided.” *European Communities-Commission (1987), p. 7*

Originally, the Commission proposed that the standard rate for member states' value added tax should lie within a range of 14 to 20 percent. This proposal was subsequently modified and replaced by an EC-wide minimum tax rate of 15 percent. The latter proposal has been adopted by the Council of the European Communities in June, 1991.

The proposals by the EC Commission have been widely discussed in the political and in the academic arena. In the literature directly applied to the EC situation, an increased scope for decentralized decision-making within the Community has been stressed as a general guideline which should also be adhered to in the context of indirect tax harmonization¹.

In the theoretical discussion of centralized vs. decentralized decision-making in fiscal policy, the case for tax harmonization rests on two main arguments. First, in the absence of a *general* principle for taxing international trade, tax rates must be

¹Cf. the influential report by Padoa-Schioppa et. al. (1988, pp. 38-39).

fully harmonized if distortions of international trade are to be avoided². Second, fiscal externalities may lead to strategic behavior in EC member states and result in an inefficient equilibrium unless tax harmonization "saves the states from themselves" (Oates/Schwab 1988, p. 334).

On the other hand, two main arguments have been raised in favor of decentralized tax policy. The first argument can be traced back to Tiebout (1956) who showed that local governments are able to provide an efficient supply of (local) public goods even when preferences for public goods differ across the overall population. Second, Brennan/Buchanan (1980) have argued that tax competition between governments may increase consumer welfare by reducing the inefficiencies in national public sectors. While these arguments have been well established in the literature³, there is so far no formal model which meets the demand, expressed, e.g., by Genser (1992, p. 207), that "the pros and cons for decentralized taxation in a federal system must be weighed in an overall cost-benefit analysis within a multi-state general equilibrium model" .

Our paper tries to go a first step towards this goal. We use an approach of piecemeal tax reform to integrate the above arguments in a common analytical framework. This allows to describe the trade-offs inherent in the discussion of centralized vs. decentralized tax policy in a more precise way. A 'resolution' of the debate is, of course, left to empirical work.

This paper is set up as follows: Section 2 presents the general framework for our analysis, extending the model in Haufler (1992) to incorporate a (local) public good in each country. Section 3 discusses the global trade-off between efficiency in international trade and efficiency in domestic public good supply when preferences for public goods differ across countries and non-distorting taxes are not available. Section 4 evaluates the role of fiscal externalities and tax competition on national

²Sinn (1990a, pp. 493–496) derives this result for the credit method of value added taxation in the EC. Berglas (1981) shows that a similar result holds under a restricted origin principle.

³For recent surveys of the discussion on tax harmonization vs. tax competition, see Frey (1990), Musgrave/Musgrave (1990), and Genser (1992, pp. 206–208).

welfare under alternative assumptions with respect to government behavior. A brief survey of empirical results is added to the theoretical discussion. Section 5 summarizes the argument and applies it to the debate in the European Community.

2 A Dual Framework with Public Goods

The analysis is based on a standard two-country model with international trade in private goods and internationally immobile factors of production. The dual approach is used throughout the analysis. Countries are denoted by superscript letters $k \in [A, B]$. In each region, there are two private goods and a privately produced public good. Private goods are denoted by subscript numbers $i \in [1, 2]$ and the public good by the index z .

Production: Production takes place under conditions of perfect competition and uses a fixed factor endowment in each country. Since all output is privately produced, the national product function is unaffected by the existence of the public good and is given by

$$r^k(p_1^k, p_2^k) \quad \forall \quad k \in [A, B],$$

where r^k is national product and p_i^k denotes the producer price of good i in country k .

Consumption: There is one representative consumer (or an aggregate of identical consumers) in each country who consumes the two private goods and the public good. The consumer is characterized by the expenditure function

$$e^k(q_1^k, q_2^k, z^k, u^k) \quad \forall \quad k \in [A, B].$$

where e^k is private expenditure in country k , q_i^k denotes the consumer price of good i , z^k is the amount of public good consumption and the national utility level in country k is given by u^k .

First-order derivatives of the national product and expenditure functions are given by:

- $\frac{\partial r^k}{\partial p_i^k} = x_i^k$ supply of good i in country k ,
- $\frac{\partial e^k}{\partial q_i^k} = c_i^k$ (compensated) demand for good i in country k ,
- $\frac{\partial e^k}{\partial z^k} = -q_z^k$ shadow price of the public good z in country k .

The shadow price of the public good in country k can alternatively be interpreted as the consumer's willingness to pay for a marginal increase in the public good; in the case of many identical consumers, q_z^k gives the *sum* of individual valuations of a marginal increase in public good supply. The partial derivative $\partial e^k / \partial z^k$ has a negative sign because a marginal increase in public good supply allows a reduction in private expenditures while holding national utility constant⁴.

We assume that the national product and the expenditure function are twice differentiable. In the case of two private goods, the signs of second-order derivatives are unambiguous and given by

- $\frac{\partial^2 r^k}{\partial p_i^k \partial p_j^k} = \frac{\partial x_i^k}{\partial p_j^k} \begin{cases} > 0 & \forall i = j \\ < 0 & \forall i \neq j, \end{cases}$
- $\frac{\partial^2 e^k}{\partial q_i^k \partial q_j^k} = \frac{\partial c_i^k}{\partial q_j^k} \begin{cases} < 0 & \forall i = j \\ > 0 & \forall i \neq j, \end{cases}$
- $\frac{\partial^2 e^k}{\partial q_i^k \partial u^k} = \frac{\partial c_i^k}{\partial u^k} = \frac{\partial c_i^k}{\partial y^k} \frac{\partial e^k}{\partial u^k} > 0,$
- $\frac{\partial^2 e^k}{\partial q_i^k \partial z^k} = \frac{\partial c_i^k}{\partial z^k} = \frac{\partial c_i^k}{\partial y^k} \frac{\partial e^k}{\partial z^k} = -\frac{\partial c_i^k}{\partial y^k} q_z^k < 0.$

At a constant level of utility in country k , an increase in public good supply leads to a reduction in private demand for good i equal to the product of the shadow price of the public good and the marginal propensity to consume good i .

⁴Cf. Tresch (1981, pp. 417–419) for a textbook treatment of the dual consumer problem in the presence of public goods.

Government: The government in each country is constrained to balance its budget. On the revenue side, we model an ad valorem commodity tax levied on both private goods at a uniform rate while the public good remains untaxed⁵. Consumer prices are thus linked to producer prices by

$$q_i^k = p_i^k(1 + t^k) \quad \forall i \in [1, 2], k \in [A, B],$$

where t^k denotes the ad valorem tax rate in each country.

The ad valorem tax is distortive in an international setting when a non-general scheme for international taxation is introduced. We assume that good 1 is taxed under the origin principle while good 2 is taxed under the destination principle; this scheme will be labelled *restricted destination principle* in the following⁶. In the absence of tariffs and transportation costs, arbitrage ensures that *consumer prices* are equalized for good 1 while arbitrage equalizes producer prices for good 2 under the destination principle. We thus normalize the producer price of good 2 in each country. This yields

$$\begin{aligned} p_1^A(1 + t^A) &= p_1^B(1 + t^B) \\ p_2^A &= p_2^B \equiv 1. \end{aligned} \tag{1}$$

Under the restricted destination principle, the national tax base T^k is given by the

⁵In a setting with fixed and internationally immobile factor supplies, any direct tax has a lump-sum character. To derive a direct link between the general commodity tax rate and the level of public good supply in each country, such taxes must be ruled out. This assumption can be rationalized by external constraints on the setting of direct tax rates; an upward adjustment of direct tax rates may be precluded by disincentive effects when marginal income tax rates are already high (as in Denmark) or by the concern about increased tax evasion (as in some southern EC countries). Alternatively, and leaving our framework of analysis, it can be argued that international factor mobility in the internal market constrains the ability of national governments to set direct tax rates independently in the same way as it is argued here for the case of commodity taxes.

⁶The modeling of the restricted destination principle follows the analysis in Hauffer (1992, pp. 251–255). It tries to capture the conditions in the EC internal market which will feature destination taxation for goods purchased by registered traders (intermediate goods) and origin taxation for goods typically purchased by final consumers.

domestic production of good 1 and the domestic consumption of good 2

$$\begin{aligned}T^A &= p_1^A x_1^A + c_2^A, \\T^B &= p_1^B x_1^B + c_2^B.\end{aligned}\tag{2}$$

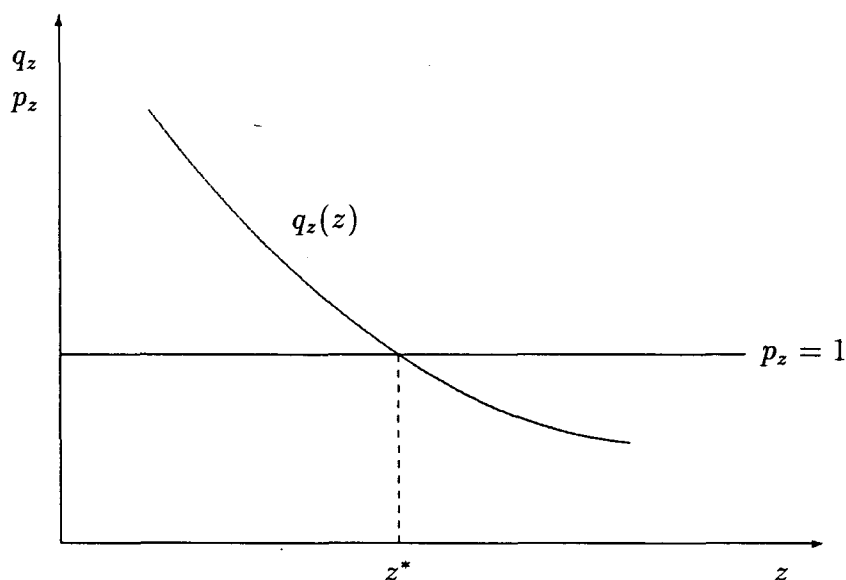
Government tax revenues are used to finance a local public good. The public good is modelled as a government purchase of some fraction (restricted to be less than one) of the privately produced output of the numeraire good 2. This implies that the marginal costs of providing the public good are constant and equal to one in both countries⁷. Figure 1 illustrates the costs and benefits of increased public good supply in a first-best setting where the public good can be financed by lump-sum taxes. It is seen that q_z^k is a downward sloping function of the quantity of public good consumption, as is the case with the compensated demand for any private good. In a first-best equilibrium, the optimal level of public good supply is thus reached when the marginal valuation of z equals the marginal cost of public good supply⁸. This first-best level of public good supply is indicated by z^* in Figure 1.

Note that, in addition to the distortion of international trade, the modelling of the public good introduces a second (domestic) distortion whenever the marginal valuation for this good deviates from its marginal cost. This domestic wedge (and changes therein) is at the core of the ensuing analysis. Two different versions of the general framework outline here will be used in the following in order to discuss two

⁷Strictly speaking, there is no possibility of free-riding in a one-consumer economy and thus no necessity for the public provision of certain goods. Furthermore, the fact that a public good simultaneously enters the utility function of many households is irrelevant in a single-consumer framework. Instead, the modelling of a public good in the present context serves as a way of incorporating inefficiencies in the allocation of resources between the public and the private sector of the economy. This setting is common in models of tax competition; cf., e.g., Mintz/Tulkens (1986, pp. 135–137).

⁸In the one-consumer case, the marginal rate of substitution and the marginal rate of transformation between the public good and the numeraire good must be equal. In a many-consumer economy, the sum of marginal rates of substitution must equal the marginal rate of transformation between the public good and the numeraire good. This is, of course, the well-known Samuelson rule of optimal public good supply. Cf., e.g., Tresch (1981, p. 111 and p. 417).

Figure 1: Costs and Benefits of Public Goods in a First-Best Setting



different aspects of the debate on centralized vs. decentralized decision-making in fiscal policy. The discussion in section 3 focuses on the global efficiency effects of tax rate harmonization when preferences differ within the Community but strategic interactions between national tax policies are excluded. In section 4, the focus is reversed and the effects of strategic tax policy are studied in a setting with two identical countries.

3 Heterogeneous Preferences for Public Goods

The analysis in this section is concerned with the global efficiency effects of 'harmonizing' tax reforms when preferences for public goods differ across countries. Following standard practice in the analysis of global welfare changes⁹, we introduce a hypothetical transfer (positive or negative) from country A to country B which ensures that the welfare of the consumer in country B is held constant throughout

⁹For an application of this procedure in the two-country case see, e.g., Keen (1987, pp. 109–110).

the analysis. Global efficiency changes thus coincide with welfare changes in country A. Furthermore, since the distortion of international trade depends solely on the tax *differential* between the two regions, there is a degree of freedom for choosing the tax rate in country B. It will thus be assumed that country B always chooses the tax rate which finances an efficient level of public good supply in this country. If domestic efficiency is always attained in country B, there is no need to model a public good in this country. Therefore, we assume in this section that tax revenues in country B are redistributed to domestic consumers lump sum¹⁰. The model is then given by

$$e^A[p_1^A(1+t^A), (1+t^A), z^A, u^A] + e^B[p_1^B(1+t^B), (1+t^B), \bar{u}^B] = r^A(p_1^A, 1) + r^B(p_1^B, 1) + t^B(p_1^B x_1^B + c_2^B), \quad (3)$$

$$t^A(p_1^A x_1^A + c_2^A) = z^A, \quad (4)$$

$$c_1^A(p_1^A, z^A, u^A) + c_1^B(p_1^B, \bar{u}^B) = x_1^A(p_1^A) + x_1^B(p_1^B). \quad (5)$$

Equation (3) gives the joint consumer budget constraint in countries A and B where the bar indicates that \bar{u}^B is held constant. Equation (4) is the government budget constraint in country A. Equation (5) represents the market-clearing condition for good 1; recall that good 1 is demanded exclusively by private consumers in the present model¹¹. Together with the arbitrage condition (1), there are four equations for the four unknowns u^A, p_1^A, p_1^B, z^A .

We perturb equation set (3)–(5) and substitute the total differential of (1) in the remaining equations. The import demand for good 1 by country k is defined as

$$m_1^k(p_1^k, z^k, u^k) = c_1^k(p_1^k, z^k, u^k) - x_1^k(p_1^k) \quad \forall k \in [A, B]$$

and the derivative with respect to p_1^k is given by

$$\frac{\partial m_1^k}{\partial p_1^k} = \frac{\partial c_1^k}{\partial p_1^k} - \frac{\partial x_1^k}{\partial p_1^k} < 0.$$

¹⁰This simplification implies that a tax change in country A has no effects on the mix of private and public goods in country B for a given level of \bar{u}^B .

¹¹Note that *absolute* consumer prices enter the expenditure function. In contrast, 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.

It is seen from the trade balance condition $m_1^k + m_2^k = 0 \forall k \in [A, B]$ that the change in the import demand for good 1 is a complete description of the adjustment of international trade flows to a change in relative prices¹².

Using these relationships, we get the following set of equations, where t^A is the only exogenous variable of interest:

$$\Theta \begin{bmatrix} \frac{\partial e^A}{\partial u^A} du^A \\ dp_1^B \\ dz^A \end{bmatrix} = \begin{bmatrix} -\frac{p_1^A x_1^A}{(1+t^A)} - c_2^A \\ \frac{p_1^A}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A} \\ \frac{t^A p_1^A p_1^A}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A} + \frac{p_1^A x_1^A}{(1+t^A)} + c_2^A \end{bmatrix} dt^A, \quad (6)$$

where Θ denotes the matrix

$$\Theta = \begin{bmatrix} 1 & t^B p_1^B \frac{\partial m_1^B}{\partial p_1^B} + \frac{(1+t^B)}{(1+t^A)} t^A x_1^A & -q_z^A \\ \frac{\partial c_1^A}{\partial y^A} & \frac{(1+t^B)}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial m_1^B}{\partial p_1^B} & -q_z^A \frac{\partial c_1^A}{\partial y^A} \\ -t^A \frac{\partial c_2^A}{\partial y^A} & \frac{(1+t^B)}{(1+t^A)} \left(t^A p_1^A \frac{\partial m_1^A}{\partial p_1^A} - t^A x_1^A \right) & 1 + q_z^A t^A \frac{\partial c_2^A}{\partial y^A} \end{bmatrix}.$$

Using the Engel aggregation property of marginal propensities to consume, the

¹²To eliminate the derivative $\partial c_2^k / \partial p_1^k$ from equation (3) above, we employ the relationship

$$\frac{\partial c_2^k}{\partial p_1^k} = -p_1^k \frac{\partial c_1^k}{\partial p_1^k} \quad \forall k \in [A, B].$$

This condition follows from the properties of the expenditure function that a) the first-order derivatives (the compensated demand functions) are homogeneous of degree zero in prices and b) the matrix of second-order derivatives (the Slutsky matrix) is symmetric. Cf., e.g., Diamond/McFadden (1974, pp. 18–20).

determinant of the matrix Θ is given by

$$|\Theta| = \underbrace{\frac{(1+t^B)}{(1+t^A)} \left(\frac{\partial m_1^A}{\partial p_1^A} - t^A x_1^A \frac{\partial c_1^A}{\partial y^A} \right)}_{(1)} + \underbrace{\left(p_1^B \frac{\partial c_1^A}{\partial y^A} + (1+t^A) \frac{\partial c_2^A}{\partial y^A} \right) \frac{\partial m_1^B}{\partial p^B}}_{(2)}. \quad (7)$$

Stability requires $|\Theta| < 0$ and will be assumed in the following. A sufficient (but not a necessary) condition for stability is that both goods are normal in country A¹³.

Relative Prices: The effect of a change in t^A on the relative price in country B is given by

$$\frac{dp_1^B}{dt^A} = \frac{1}{|\Theta|} \left[\underbrace{\frac{p_1^A}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A}}_{(1) (+)} + \underbrace{\frac{\partial c_1^A}{\partial y^A} \left(\frac{p_1^A x_1^A}{(1+t^A)} + c_2^A \right)}_{(2) (-)} \right]. \quad (8)$$

It is seen that there are counteracting effects on the relative price p_1^B if good 1 is a normal good in country A.

- (1) For given producer prices in country A, a rise in t^A increases country A's import demand for good 1 as consumers avoid the tax increase by shopping in the neighboring country B (where the tax rate has remained unchanged). This international substitution effect will thus tend to increase the relative price of good 1 in country B.
- (2) An increase in t^A redistributes real purchasing power from the private to the public sector of country A. Since the government demands only the numeraire good, this change in the mix of public and private consumption in country A will put downward pressure on the relative price of good 1 in both countries¹⁴.

¹³Cf. Hatta (1977) for a more detailed discussion of the necessary and sufficient conditions for stability.

¹⁴This is an example of relative price effects induced by a redistribution of purchasing power similar to the secondary terms of trade effects following an international transfer of resources. Cf., e.g., Dixit/Norman (1980, pp. 131–132) for a textbook treatment of the latter case.

The ambiguity in equation (8) is a direct consequence of our assumption that governments have a zero propensity to consume the non-numeraire good. The analytical convenience of this assumption has been stressed elsewhere; in the present context it does, however, distract from the role of international substitution effects on which the analysis is focused. For this reason, the following condition is set up:

Condition 1: *If the international substitution effect induced by a variation in t^A dominates the effect of a redistribution of real income between the private and the public sector in country A, then*

$$\frac{dp_1^B}{dt^A} = \frac{1}{|\Theta|} \left[\frac{p_1^A}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial c_1^A}{\partial y^A} \left(\frac{p_1^A x_1^A}{(1+t^A)} + c_2^A \right) \right] > 0.$$

Global Welfare: The analysis focuses on the global welfare effect induced by a marginal change in t^A . This is given by

$$\frac{\partial e^A}{\partial u^A} \frac{du^A}{dt^A} = \underbrace{\left[\frac{1}{(1+t^A)} q_z^A - 1 \right]}_{(1) (+)} \varepsilon + \underbrace{(t^A - t^B) \frac{q_z^A p_1^B}{(1+t^A)} \frac{\partial m_1^B}{\partial p_1^B} \frac{dp_1^B}{dt^A}}_{(2) (+)}, \quad (9)$$

where

$$\varepsilon = \frac{1}{|\Theta|} \left[\underbrace{\left[p_1^A x_1^A + c_2^A \right] \frac{(1+t^B)}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A}}_{(1A) (+)} + \underbrace{\left[\frac{p_1^A x_1^A}{(1+t^A)} + c_2^A \right] \frac{\partial m_1^B}{\partial p_1^B}}_{(1B) (-)} + \frac{t^B p_1^A p_1^B}{(1+t^A)} \frac{\partial m_1^A}{\partial p_1^A} \frac{\partial m_1^B}{\partial p_1^B} \right].$$

To interpret equation (9), we first discuss the terms (1A) and (1B) in ε , which give the effect on country A's tax revenues induced by a variation in t^A . For a given tax base, an increase in the tax rate (1A) unambiguously raises tax revenues¹⁵. On the other hand, the tax-induced fall in p_1^A causes production of good 1 to fall and production of good 2 to rise in country A. Under the restricted destination principle analyzed here, this response of domestic production will lower the tax base in country A, as is shown by (1B).

¹⁵Note that this effect includes the repercussions that a tax-induced fall in p_1^A has on the *value* of the tax base at unchanged volumes of production and consumption.

The ambiguity inherent in effects (1A) and (1B) is familiar from the analysis of tax reforms in a national setting. In general, the possibility cannot be excluded that the net effect of a tax increase in country A is to reduce overall tax receipts¹⁶. For the discussion that follows, we rule out the possibility of 'Laffer effects' and assume a positive relationship between the commodity tax rate t^A and overall tax revenues (and thus public good supply) in country A. This is given in

Condition 2: *If the isolated effect of a change in the tax rate (1A) dominates the isolated effect of the tax-induced change in the tax base (1B) in equation (9), the following inequality holds:*

$$\varepsilon > 0.$$

Using Conditions 1 and 2, the interpretation of equation (9) is straightforward.

- (1) The *public goods effect* gives the change in the efficiency of domestic resource allocation in country A. An increase in t^A increases domestic and global welfare iff the shadow price of the public good, appropriately 'discounted' by the tax rate in country A, exceeds its marginal cost (which is constant and equals one). The adjustment of q_z^A for the domestic tax rate takes account of the fact that the private use of the numeraire good is taxed while the public use is not. If $q_z^A(1 + t^A)^{-1} > 1$, public goods are undersupplied in country A in the initial equilibrium while the opposite inequality indicates an oversupply of public goods in country A. If $q_z^A(1 + t^A)^{-1} = 1$ holds in the initial equilibrium, public good supply is efficient in country A and the public goods effect is zero at the margin.
- (2) The *international trade effect* of an increase in t^A is discussed for the case that $t^A > t^B$ initially. The tax increase in country A will then widen the tax-induced wedge in international producer prices for $dp_1^B/dt^A > 0$ and increase the deadweight loss from an inefficient international resource allocation. The

¹⁶In this case, the government operates on the falling branch of the so-called 'Laffer curve'. Cf., e.g., Stiglitz (1986, pp. 118–119) for an introductory textbook treatment.

sign of the effect is reversed if country A has the lower tax rate in the initial equilibrium. For $t^A = t^B$ initially, the isolated international trade effect is zero for a marginal change in t^A .

The global efficiency change induced by a variation in t^A thus depends on the sign of the international tax rate differential on the one hand and the shadow price of the public good in country A on the other. Since each effect can be positive, negative, or zero, nine possible cases have to be distinguished. The next step is to link the conditions prevailing in the initial equilibrium to international differences in preferences for the public good. For this purpose, it is assumed in this section that governments use public funds efficiently and are fully responsive to the wishes of their citizens. Recalling that t^B finances an efficient level of public good supply in country B (so that $q_z^B(1+t^B)^{-1} = 1$ holds implicitly in the analysis of this section), the following definition can be introduced:

- Definition 5.1:** (1) If $t^A \geq t^B$ and $q_z^A(1+t^A)^{-1} \geq 1$ holds in the initial equilibrium with at least one strict inequality, preferences for public goods are higher in country A as compared to country B; this is denoted by $P(A) > P(B)$.
- (2) If the initial equilibrium is characterized by $t^A \leq t^B$ and $q_z^A(1+t^A)^{-1} \leq 1$ with at least one strict inequality, preferences for public goods are lower in country A as compared to country B; this is denoted by $P(A) < P(B)$.
- (3) If the initial equilibrium is characterized by $t^A = t^B$ and $q_z^A(1+t^A)^{-1} = 1$, preferences for public goods are identical in countries A and B; this is denoted by $P(A) = P(B)$.

Using this definition, Table 1 summarizes the global welfare effects of a marginal increase in t^A for each of the possible initial equilibria. It is seen from this table that cases 1–3 imply a higher preference for public goods in country A vis-a-vis country B while the reverse is true in cases 4–6. Case 7 describes the situation where preferences are identical in both countries. National preferences for public goods cannot be ranked in cases 8–9.

Table 1: Global Welfare Effects of a Rise in t^A and Preferences for Public Goods

	international trade effect	domestic public goods effect	preferences for public goods
case 1: $t^A > \bar{t}^B, q_z^A(1+t^A)^{-1} > 1$	negative	positive	$P(A) > P(B)$
case 2: $t^A > \bar{t}^B, q_z^A(1+t^A)^{-1} = 1$	negative	zero	$P(A) > P(B)$
case 3: $t^A = \bar{t}^B, q_z^A(1+t^A)^{-1} > 1$	zero	positive	$P(A) > P(B)$
case 4: $t^A < \bar{t}^B, q_z^A(1+t^A)^{-1} < 1$	positive	negative	$P(A) < P(B)$
case 5: $t^A < \bar{t}^B, q_z^A(1+t^A)^{-1} = 1$	positive	zero	$P(A) < P(B)$
case 6: $t^A = \bar{t}^B, q_z^A(1+t^A)^{-1} < 1$	zero	negative	$P(A) < P(B)$
case 7: $t^A = \bar{t}^B, q_z^A(1+t^A)^{-1} = 1$	zero	zero	$P(A) = P(B)$
case 8: $t^A > \bar{t}^B, q_z^A(1+t^A)^{-1} < 1$	negative	negative	$P(A) <> P(B)$
case 9: $t^A < \bar{t}^B, q_z^A(1+t^A)^{-1} > 1$	positive	positive	$P(A) <> P(B)$

Turning first to the set of initial equilibria where $P(A) > P(B)$, case 1 shows that the global welfare effects of a marginal change in t^A are ambiguous in general. A rise in t^A reduces the domestic wedge between the marginal valuation and the marginal cost of the public good in country A. At the same time, however, the increase in t^A increases the wedge between relative producer prices in the two trading countries. This case illustrates the basic trade-off that exists for tax reform when preferences for public goods differ across countries and non-distorting taxes are not available. It is possible, however, to identify welfare-improving tax reforms in the two 'borderline cases' 2 and 3.

Case 2 describes a situation where domestic public good supply is efficient in country A but international trade is distorted. In this case, a small *reduction* in t^A unambiguously increases world welfare because the public goods effect of this tax reform is zero at the margin while the international trade effect is positive. Since the initial equilibrium is characterized by $t^A > t^B$ in this case, a reduction in t^A can be described as a 'harmonizing tax reform'. Vice versa, case 3 describes a situation where tax rates are completely equalized in the two trading countries. In this case, a small *increase* in t^A unambiguously raises world welfare because the public goods effect in country A is positive while the welfare cost of a marginal distortion of international trade is zero at the margin.

The remaining cases can be treated briefly. Cases 4–6 are symmetric to the initial equilibria just discussed and offer no additional insights. In the special case where preferences for public goods are identical in the trading countries (case 7), a first-best optimum can be attained because identical tax rates in the two countries simultaneously ensure efficiency in domestic good supply and efficiency in international trade. This case corresponds to commodity tax models of international trade which do not incorporate local public goods but redistribute tax revenues to domestic consumers lump sum. Finally, welfare-improving tax reforms are obvious in cases 8–9, where country A's tax rate is unambiguously 'too high' (case 8) or 'too low' (case 9) in the initial equilibrium. However, these cases are not associated with systematic differences in preferences, on which the present discussion is focused.

Figure 2: Tax Rate Harmonization with Different Preferences for Public Goods

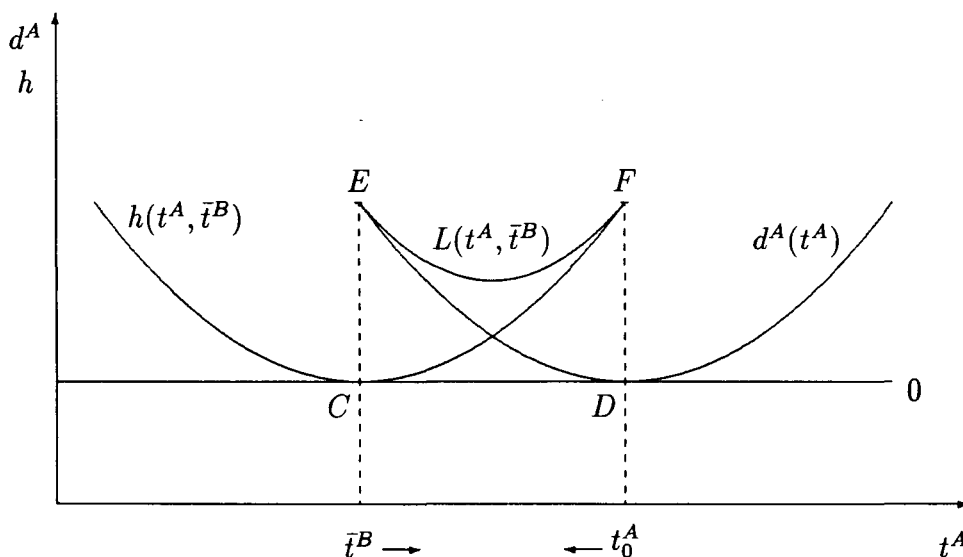


Figure 2 provides a graphical illustration of this discussion for the case that country A has a higher preference for public goods as compared to country B (cases 1–3). The figure assumes a strictly positive relationship between the tax rate in country A and domestic public good supply, as was discussed in condition 2. The functions $d^A(t^A)$ and $h(t^A, \bar{t}^B)$ give the domestic efficiency loss in country A and the efficiency loss in international trade, respectively. The overall loss in global welfare, $L(t^A, \bar{t}^B)$, is obtained by vertically adding up domestic and international efficiency losses¹⁷.

It is seen that a trade-off between an efficient domestic provision of public goods in country A and the efficiency of international trade exists for any initial equilibrium along the segment (C, D) . For $t^A = \bar{t}^B$, international trade is undistorted and $h(t^A, \bar{t}^B) = 0$, but public goods are underprovided in country A as indicated by the distance \overline{CE} . For $t^A = t_0^A$, public good supply is efficient in country A, but international trade is distorted as shown by \overline{DF} . It follows from the convexity of

¹⁷Note that the symmetry of the functions $d^A(t^A)$ and $h(t^A, \bar{t}^B)$ in Figure 2 is purely a matter of graphical convenience. While the shape of the two functions will differ, in general, the only property relevant to the discussion here is that both functions are convex.

the functions $h(t^A, \bar{t}^B)$ and $d^A(t^A)$ that the overall loss function must be convex as well¹⁸. Hence, the minimum of $L(t^A, \bar{t}^B)$ must lie in between $t^A = \bar{t}^B$ and $t^A = t_0^A$. However, the precise shape of $L(t^A, \bar{t}^B)$ depends on the exact specification of preferences in the trading countries so that it will generally not be possible to identify Pareto improving tax reforms for $\bar{t}^B < t^A < t_0^A$.

Summing up, the results derived in this section differ substantially from the analysis of 'harmonizing' tax reforms in Keen (1987). In Keen's model, government tax receipts are redistributed to consumers lump sum and international trade distortions are the only source of global welfare losses. In this setting, Keen finds that harmonizing tax reforms generally improve global efficiency. In contrast, the present discussion has added an argument for tax rate diversity by incorporating different preferences for public goods in the trading countries. In this more general setting, an overall tax policy which minimizes the global deadweight loss will imply some convergence of tax rates if, in the initial situation, both countries are exclusively concerned with the efficiency of domestic public good supply. On the other hand, a complete equalization of tax rates will not be optimal. Therefore, the discussion in this section provides a rather general argument for a 'partial' harmonization of tax rates on the grounds of overall efficiency.

However, the discussion so far has neglected the role of both fiscal and political externalities which have received much attention in the discussion on tax rate harmonization. In the following, these externalities are taken into account and the focus of attention shifts from the *global* to the *national* welfare effects of tax reform.

4 Tax Competition and Public Good Supply

The analysis in this section is concerned with the issue whether decentralized or centralized decision-making in fiscal policy leads to a more efficient level of public goods supply when both fiscal and political externalities exist. This issue is also

¹⁸This argument is very similar to the analysis of the global welfare effects of 'harmonizing' tax reforms in Keen (1987, p. 113).

known under the heading of 'tax (rate) competition vs. tax (rate) harmonization'. To derive the national welfare effects of tax reform, consumer budget constraints must be met separately. Furthermore, a public good is introduced in country B so that the treatment of both countries is symmetric. The model is given by

$$e^A[p_1^A(1+t^A), (1+t^A), z^A, u^A] = r^A(p_1^A, 1), \quad (10)$$

$$e^B[p_1^B(1+t^B), (1+t^B), z^B, u^B] = r^B(p_1^B, 1), \quad (11)$$

$$t^A(p_1^A x_1^A + c_2^A) = z^A, \quad (12)$$

$$t^B(p_1^B x_1^B + c_2^B) = z^B, \quad (13)$$

$$c_1^A(p_1^A, z^A, u^A) + c_1^B(p_1^B, z^B, u^B) = x_1^A(p_1^A) + x_1^B(p_1^B). \quad (14)$$

Equations (10)–(11) are the consumer budget constraints in each region while equations (12)–(13) represent the respective government budget constraints. Market-clearing for good 1 is given by equation (14). Together with (1), there are six equations for the six unknowns $u^k, p_1^k, z^k \forall k \in [A, B]$.

Again, a tax reform approach is adopted initially which allows a detailed discussion of individual effects. It is straightforward to transform this approach into a study of optimal tax rules; this will be done in section 4.2. To derive the comparative statics effects of tax reform in this model, it is necessary, however, to restrict the initial equilibrium. Since the arguments presented in this section do not depend on international differences in preferences, the following simplifying assumptions will be made:

Assumption 1: *Tax rates in both countries are equal in the initial equilibrium,*

i.e. $t^A = t^B = t$. It then follows that $p_i^A = p_i^B = p_i \forall i \in [1, 2]$ initially.

Assumption 2: *Utility is separable between private and public goods in each country and preferences for private goods are identical and homothetic in the trading countries. In conjunction with Assumption 1, this implies*

$$\partial c_i^A / \partial y^A = \partial c_i^B / \partial y^B = \partial c_i / \partial y \forall i \in [1, 2].$$

Assumption 3: *The shadow price of the public good is equal in both countries initially, i.e. $q_z^A = q_z^B = q_z$.*

Assumption 1 eliminates the international trade effect discussed in the previous section so that the analysis focuses on the efficiency of domestic public good supply in both countries. The assumption implies that consumers in both countries face identical price vectors initially. Together with Assumption 2, the conditions for aggregating demand across consumers in both countries are met (Deaton/Muellbauer, 1980, pp. 148–153), implying that redistributions of private purchasing power do not affect overall demand for private goods. Finally, Assumption 3 guarantees that international redistributions of *tax revenues* have no effect on global efficiency because the tax loss in one country is given the same weight as the tax gain in the neighboring state. By Definition 1 of the previous section, Assumptions 1 and 3 imply that preferences for public goods are identical in the two trading countries. However, the *common* marginal valuation of the public good, q_z , can take on an arbitrary value so that a domestic distortion will generally exist in the initial equilibrium.

To analyze a small tax reform in either country A or country B, we perturb equation set (10)–(14) and insert the total differential of (1). Using Assumption 1–3, the resulting equation set is given by

$$\Gamma \begin{bmatrix} \frac{\partial e^A}{\partial u^A} du^A \\ \frac{\partial e^B}{\partial u^B} du^B \\ dp_1^B \\ dz^A \\ dz^B \end{bmatrix} = \mu_1 dt^A + \mu_2 dt^B, \quad (15)$$

where Γ denotes the matrix

$$\Gamma = \begin{bmatrix} 1 & 0 & -m_1^B(1+t) + tx_1^A & -q_z & 0 \\ 0 & 1 & m_1^B(1+t) + tx_1^B & 0 & -q_z \\ \frac{\partial c_1}{\partial y} & \frac{\partial c_1}{\partial y} & \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial m_1^B}{\partial p_1^B} & -q_z \frac{\partial c_1}{\partial y} & -q_z \frac{\partial c_1}{\partial y} \\ -t \frac{\partial c_2}{\partial y} & 0 & tp_1 \frac{\partial m_1^A}{\partial p_1^A} - tx_1^A & 1 + q_z t \frac{\partial c_2}{\partial y} & 0 \\ 0 & -t \frac{\partial c_2}{\partial y} & tp_1 \frac{\partial m_1^B}{\partial p_1^B} - tx_1^B & 0 & 1 + q_z t \frac{\partial c_2}{\partial y} \end{bmatrix}$$

and μ_1, μ_2 are the vectors

$$\mu_1 = \begin{bmatrix} -\frac{p_1 x_1^A}{(1+t)} - c_2^A \\ 0 \\ \frac{p_1}{(1+t)} \frac{\partial m_1^A}{\partial p_1^A} \\ \frac{p_1}{(1+t)} \left(tp_1 \frac{\partial m_1^A}{\partial p_1^A} + x_1^A \right) + c_2^A \\ 0 \end{bmatrix}, \quad \mu_2 = \begin{bmatrix} p_1 m_1^B - \frac{p_1 t x_1^A}{(1+t)} \\ -p_1 c_1^B - c_2^B \\ -\frac{p_1}{(1+t)} \frac{\partial m_1^A}{\partial p_1^A} \\ \frac{p_1 t x_1^A}{(1+t)} - \frac{tp_1 p_1}{(1+t)} \frac{\partial m_1^A}{\partial p_1^A} \\ p_1 x_1^B + c_2^B \end{bmatrix}.$$

The determinant of the matrix Γ is given by

$$|\Gamma| = \frac{\partial m_1^A}{\partial p_1^A} + \frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} (tx_1^A + tx_1^B) < 0. \quad (16)$$

Stability is guaranteed in this model if good 1 is a normal good. The income term arises from the property of the model that an increase in p_1 raises the real value of tax revenues in each country. Since governments do not demand good 1, overall demand for this good will be reduced.

4.1 Tax Reform in One Country

We analyze an isolated change in t^A , setting $dt^B = 0$ in equation (15). The effects of a change in country A's tax rate on each of the endogenous variables are derived using Cramer's rule. The following discussion and the signing of individual effects is based on the assumption that both private goods are normal, implying positive propensities to consume each good.

Relative Prices: The effect of a change in t^A on the relative price in country B is given by

$$\frac{dp_1^B}{dt^A} = \frac{1}{|\Gamma|} \left[\underbrace{\frac{p_1}{(1+t)} \frac{\partial m_1^A}{\partial p_1^A}}_{(1) (+)} + \underbrace{\frac{\partial c_1}{\partial y} \left(\frac{p_1 x_1^A}{(1+t)} + c_2^A \right)}_{(2) (-)} \right]. \quad (17)$$

The discussion of equation (17) is analogous to the discussion of equation (8) in the previous section. Condition 1 is invoked to ensure that the substitution effect (1) dominates the income effect (2) and $dp_1^B/dt^A > 0$ holds in the present analysis. The change in the relative price of good 1 in country A can be obtained from (17) and the total differential of equation (1). It is given by

$$\frac{dp_1^A}{dt^A} = \frac{1}{|\Gamma|} \left[\underbrace{-\frac{p_1}{(1+t)} \frac{\partial m_1^B}{\partial p_1^B}}_{(1) (-)} + \underbrace{\frac{\partial c_1}{\partial y} \left(p_1 x_1^A + c_2^A + \frac{p_1 t x_1^B}{(1+t)} \right)}_{(2) (-)} \right] < 0. \quad (18)$$

It is seen that the relative price of good 1 in country A unambiguously falls following an increase in t^A . Consumers in country B will reduce their imports of good 1 from country A by the isolated substitution effect (1). The income effect (2) gives the reduction in real private purchasing power in both countries¹⁹ which further lowers the demand for good 1 faced by country A.

¹⁹In country B, this effect derives from the increase in p_1^B which increases the real value of government revenues.

Public Good Supply: The effect of a tax increase in country A on public good supply in that country is given by²⁰

$$\frac{dz^A}{dt^A} = \underbrace{\frac{1}{(1+t)}\psi}_{(1)(+)} + \underbrace{tp_1 \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} tx_1^B \right) \frac{dp_1^B}{dt^A}}_{(2)(-)} + \underbrace{(1+t)m_1^B t \frac{\partial c_2}{\partial y} \frac{dp_1^B}{dt^A}}_{(3)(+-)}, \quad (19)$$

where

$$\psi = \frac{1}{|\Gamma|} \left[(p_1 x_1^A + c_2^A) \frac{\partial m_1^A}{\partial p_1^A} + \left(\frac{p_1 x_1^A}{(1+t)} + c_2^A \right) \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} tx_1^B \right) \right] > 0,$$

and the result from equation (17) has been substituted. Equation (19) shows that a change in t^A induces three separate effects on tax revenues and public good supply in country A.

- (1) The *domestic public goods effect* gives the isolated consequences of a change in the tax rate on domestic public good supply. The discounting factor incorporates the domestic repercussions on the tax base as taxable private consumption in country A is replaced by the untaxed consumption of public goods. This effect will always tend to increase tax revenues and public good supply for an increase in t^A .
- (2) The *international tax base effect* gives the consequences on country A's tax revenues which result from a change in country B's import demand for good 1. For $dp_1^B/dt^A > 0$, foreign demand for good 1 falls in country A, inducing a decrease in country A's production of good 1 and a rise in the output of good 2. This adjustment of production reduces country A's tax base under the restricted destination principle.
- (3) The *terms of trade effect* gives the consequences of an international redistribution of purchasing power on the supply of public goods in country A. For $dp_1^B/dt^A > 0$, there will be a gain in real income in country A iff country A is an exporter of good 1 so that $m_1^B > 0$. The change in private purchasing power

²⁰The derivation uses the property of uncompensated demand functions that marginal propensities to consume sum to one.

alters domestic tax collections through the change in the private consumption of the numeraire good.

National Welfare: The effect of a change in t^A on welfare in country A is given by

$$\begin{aligned} \frac{\partial e^A}{\partial u^A} \frac{du^A}{dt^A} = & \underbrace{\left[\frac{q_z}{(1+t)} - 1 \right]}_{(1) (+-)} \psi + \underbrace{q_z t p_1 \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} t x_1^B \right)}_{(2) (-)} \frac{dp_1^B}{dt^A} \\ & + \underbrace{(1+t)m_1^B \left(1 + q_z t \frac{\partial c_2}{\partial y} \right)}_{(3) (+-)} \frac{dp_1^B}{dt^A}, \end{aligned} \quad (20)$$

where ψ is given in (19).

The effects in equation (20) correspond to those in equation (19), but they are evaluated here with the costs and benefits of changes in domestic public good supply.

- (1) The welfare consequences from the *domestic public goods effect* are given by evaluating the costs and benefits of increased tax revenues in country A and correspond to the first term in equation (9). The marginal benefit is given by the shadow price of the public use of the numeraire good while the (opportunity) costs lie in the forgone private consumption of this good. The discounting factor ensures that the public and the private use of good 2 are compared on a common net-of-tax basis. Thus, while the corresponding effect in equation (19) is unambiguously positive for an increase in t^A , the welfare implications of a tax rise depend on the level of public good supply in the initial equilibrium.
- (2) The *international tax base effect* tends to lower welfare in country A for an increase in t^A because the tax-induced changes in international trade flows reduce country A's tax base under the restricted destination principle. The welfare costs of this loss in the tax base are evaluated with the shadow price of public goods in country A.
- (3) The welfare consequences of the *terms of trade effect* are seen to be twofold. First, there is a change in private purchasing power which did not appear in

the corresponding effect of equation (19). Second, changes in the real value of private income in country A alter domestic tax revenues to the extent that private income is spent on the numeraire good. This change in tax revenues is again evaluated with the shadow price of public goods in country A.

The effect of a change in t^A on welfare in country B is similarly given by

$$\begin{aligned} \frac{de^B}{du^B} \frac{du^B}{dt^A} &= \underbrace{\left[\frac{q_z}{(1+t)} - 1 \right] tx_1^B \frac{dp_1^B}{dt^A}}_{(1) (+)} - \underbrace{q_z t p_1 \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} tx_1^B \right) \frac{dp_1^B}{dt^A}}_{(2) (+)} \\ &\quad - \underbrace{(1+t)m_1^B \left(1 + q_z t \frac{\partial c_2}{\partial y} \right) \frac{dp_1^B}{dt^A}}_{(3) (+)}. \end{aligned} \quad (21)$$

Equation (21) can be interpreted as follows: by altering p_1^B , a change in country A's tax rate leads to a *public goods effect* (1) in country B. If p_1^B is raised, the real value of tax revenues increases in country B. This effect is beneficial for country B iff its marginal valuation of the public good exceeds the valuation of the numeraire good on a net-of-tax base. The *international tax base effect* (2) and the *terms of trade effect* (3) in country B are the negative of the respective effects in country A, demonstrating that both of these effects are purely redistributive.

To summarize these results, four cases are distinguished in Table 2. National welfare effects depend on the common marginal valuation of the public good on the one hand and the pattern of trade flows in the initial equilibrium on the other. The public goods effect has the same sign in countries A and B because an increase in t^A raises the real value of government revenues in both countries. Turning to the redistributive effects, terms of trade changes in each country depend on the pattern of trade in the initial equilibrium. In contrast, the international tax base effect is negative for the country that increases its tax rate for any given initial equilibrium.

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

country A	public goods effect	international tax base effect	terms of trade effect
case 1: $q_z(1+t)^{-1} > 1, m_1^B > 0$	positive	negative	positive
case 2: $q_z(1+t)^{-1} > 1, m_1^B < 0$	positive	negative	negative
case 3: $q_z(1+t)^{-1} < 1, m_1^B > 0$	negative	negative	positive
case 4: $q_z(1+t)^{-1} < 1, m_1^B < 0$	negative	negative	negative

country B	public goods effect	international tax base effect	terms of trade effect
case 1: $q_z(1+t)^{-1} > 1, m_1^B > 0$	positive	positive	negative
case 2: $q_z(1+t)^{-1} > 1, m_1^B < 0$	positive	positive	positive
case 3: $q_z(1+t)^{-1} < 1, m_1^B > 0$	negative	positive	negative
case 4: $q_z(1+t)^{-1} < 1, m_1^B < 0$	negative	positive	positive

Global Welfare: The change in overall welfare induced by a change in t^A is obtained by aggregating equations (20) and (21). This yields²¹

$$\frac{de^A}{du^A} \frac{du^A}{dt^A} + \frac{de^B}{du^B} \frac{du^B}{dt^A} = \left[\frac{q_z}{(1+t)} - 1 \right] \omega, \quad (22)$$

where

$$\omega = \frac{1}{|\Gamma|} \left[\left(px_1^A + c_2^A + \frac{tp_1x_1^B}{(1+t)} \right) \frac{\partial m_1^A}{\partial p^A} + \left(\frac{px_1^A}{(1+t)} + c_2^A \right) \frac{\partial m_1^B}{\partial p^B} \right] > 0.$$

It is seen that the global welfare effect induced by a change in t^A depends only on the common, discounted shadow price of the public good in the initial equilibrium. A comparison with equation (9) of the previous section demonstrates that equation (22) is largely comparable to the positive tax rate effect (1A) in (9) whereas

²¹Note that the conditions for aggregating national income changes are fulfilled because consumers in both countries face identical price vectors initially and preferences are homothetic in both countries.

the negative tax base effect (1B) is absent in the present analysis²². With fixed factor supplies in each country, the *global* tax base does not change following an increase in the tax rate of one country. Furthermore, redistributive changes in *national* tax bases have no effect on the global efficiency of public good supply because the marginal valuation of the tax loss in the tax-increasing country A equals the marginal valuation of the tax gain in country B by Assumption 3.

This completes the analysis of an isolated change in t^A . A change in t^B can be analyzed by setting $dt^A = 0$ in equation (15) and applying Cramer's rule to the new problem. It is intuitive that this analysis is completely symmetric to the case discussed here.

4.2 Alternative Views of Government Behavior

In the following, the above results are used to discuss the implications of decentralized versus centralized tax policy on the efficiency of domestic public good supply under alternative assumptions with respect to government behavior²³. For this purpose, we 'switch' from a tax reform approach to an optimal taxation framework by assuming that successive small tax reforms are carried out until the change in the target variable induced by a further change in the tax rate becomes zero²⁴. It is emphasized that our discussion in this subsection – while being based on a formal model – is illustrative rather than rigorous in at least two respects:

1. The Assumptions 1–3 used for the derivation of our comparative statics results exclude distortions of international trade and differences in preferences for both private and public goods in the trading countries. The consequences of omitting these effects will, in general, be more important the larger the tax change analyzed. For this reason, the limitations of the analysis require special

²²Recall that the international trade effect (2) in equation (9) is eliminated in the analysis of this section through Assumption 1.

²³The discussion in this section is inspired by the treatment in Frey (1990).

²⁴The inference from the comparative statics results of a small tax reform to the characterization of a global optimum relies on the continuity of demand and supply functions; cf. Keen (1989, p. 9).

emphasis when we 'switch' from the analysis of a small tax reform to the choice of an optimal tax rate. On the other hand, the analysis in section 3 has given some idea how results may be affected by a non-zero initial tax wedge ($t^A - t^B$), thus incorporating a change in the efficiency of international trade into the analysis.

2. The preceding analysis has demonstrated that there are two fiscal externalities associated with a domestic tax reform under the restricted destination principle. Of these effects, the international tax base effect always harms the country which raises its tax rate whereas the sign of the terms of trade depends on the trade pattern. Thus, the net effect of fiscal externalities will be ambiguous when the tax-increasing country is the exporter of the non-numeraire good (cf. the cases 1 and 3 in Table 2). Since the analysis below focuses on the relative importance of political externalities on the one hand and (net) fiscal externalities on the other, the discussion will be simplified by assuming that *international tax base effects always dominate terms of trade effects* in case of conflict.

The discussion is based on the decision-making process in country A. When tax base effects dominate terms of trade effects, the symmetry of the model can be invoked to argue that all qualitative results carry over to the fiscal choices made in country B. Finally, Definition 2 is introduced for ease of reference.

Definition 2: *We define a situation characterized by*

$$\left\{ \begin{array}{l} q_z(1+t)^{-1} - 1 > 0 \\ q_z(1+t)^{-1} - 1 = 0 \\ q_z(1+t)^{-1} - 1 < 0 \end{array} \right. \quad \text{as an} \quad \left\{ \begin{array}{l} \text{underprovision} \\ \text{efficient provision} \\ \text{overprovision} \end{array} \right.$$

of public goods in countries A and B.

The Government as a Benevolent Dictator: We first discuss the implications of the 'orthodox' assumption that governments maximize the utility of their citizens

and political externalities are absent. It is also assumed that the government of country A does not take into account the tax response in country B to a variation in the domestic tax rate (Cournot-Nash behavior). This implies that the results of the tax reform analysis in section 4.1 (which were derived for $dt^B = 0$) can be applied to the present discussion. The effects of a *small* change in t^A on national welfare in country A are given in equation (20). National welfare maximization implies that the government of country A sets the domestic tax rate such that

$$\frac{\partial e^A}{\partial u^A} \frac{du^A}{dt^A} = 0.$$

In the *absence* of all fiscal externalities, only the public goods effect (1) remains in equation (20). National welfare maximization then implies

$$\left[\frac{q_z}{(1+t)} - 1 \right] \psi = 0.$$

By Definition 2, welfare-maximizing governments chose an efficient level of public good supply in this case.

In the *presence* of fiscal externalities, governments which maximize national welfare take into account the redistributive international effects associated with a change in the domestic tax rate in addition to the domestic costs and benefits of increased public good supply. Neglecting terms of trade effects altogether, the maximization of national welfare in (20) yields

$$\underbrace{\left[\frac{q_z}{(1+t)} - 1 \right] \psi}_{(1) (+)} + \underbrace{q_z t p_1 \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} t x_1^B \right) \frac{dp_1^B}{dt^A}}_{(2) (-)} = 0. \quad (23)$$

The second effect in (23) is negative and gives the loss in the tax base associated with an increase in the domestic tax rate. This implies $q_z(1+t)^{-1} - 1 > 0$ and thus an *undersupply* of public goods in country A in the fiscal optimum. The welfare-maximizing level of t^A is reached when the domestic welfare gain from a further increase in t^A equals the marginal welfare cost imposed by fiscal externalities.

Since country B faces a symmetric optimization problem, it is intuitive that a Cournot-Nash equilibrium in taxes is characterized by an undersupply of public

goods in both countries. Given this initial equilibrium, it is straightforward to show that an *increase* in either t^A or t^B (or both) represents a global welfare improvement. This is given in equation (22) for an increase in t^A . Furthermore, it is possible to show that an increase t^A represents a strict Pareto improvement in this case. Since the initial equilibrium is characterized by national welfare maximization, a marginal change in country A's tax rate leaves national welfare in this country unaffected. On the other hand, it is seen from equation (21) that national welfare rises in country B when international tax base effects dominate terms of trade effects²⁵.

The Government as a Leviathan: The Leviathan model of government behavior serves to highlight the role of political externalities in fiscal decision-making. In its pure form, this behavioral assumption implies that governments are concerned with the maximization of their budget rather than consumer welfare. In a model with government budget balance, this is equivalent to maximizing the supply of public goods²⁶ so that the effects of a tax reform on domestic public good supply in equation (19) are the starting point for this analysis. The Leviathan assumption implies that governments choose domestic tax rates such that

$$\frac{dz^A}{dt^A} = 0$$

in equation (19). In the present context, the problem with this behavioral assumption is that the maximization problem has no interior solution in the *absence* of fiscal externalities. More specifically, the optimal commodity tax rate from a perspective of revenue maximization will be 100 percent because, with fixed factor supplies and a *general* destination principle in place, consumers in both countries cannot avoid ever rising tax rates in their home country.

²⁵In essence, these results correspond to those derived from rigorous game-theoretic analyses of tax competition. Cf. de Crombrughe/Tulkens (1990, p. 346, Proposition 1) and Kanbur/Keen (1991, p. 17, Proposition 8).

²⁶It is assumed here that governments use the full amount of tax revenues to increase the supply of public goods. In contrast, Brennan/Buchanan (1980, pp. 27–28) argue that tax revenues partly accrue to the government for "discretionary use". The basic argument of Brennan/Buchanan remains unchanged, however, if no 'government waste' occurs.

Instead, an interior solution is guaranteed in this model when the government maximizes an objective function which contains both tax revenues and consumer welfare as separate arguments (Oates/Schwab, 1988, p. 344). This behavioral assumption is rationalized as follows:

”We thus envision a government which must balance its desire to realize the benefits of higher taxes today against the possibility that the voters will ‘turn the rascals out’ tomorrow.”

Oates/Schwab (1988), p. 344

In the following, we take advantage of the similar structure of equations (19) and (20) and assume a linear government objective function of the form

$$G^A = w_1^A z^A + w_2^A \frac{\partial e^A}{\partial u^A} u^A \quad \forall \quad w_1^A, w_2^A > 0. \quad (24)$$

The government thus maximizes a weighted sum of domestic public good supply and the (monetarized) welfare of the representative consumer where the weights w_1^A, w_2^A can take on any positive value. Totally differentiating (24) and introducing optimizing behavior yields

$$\frac{dG^A}{dt^A} = w_1^A \frac{dz^A}{dt^A} + w_2^A \frac{\partial e^A}{\partial u^A} \frac{du^A}{dt^A} = 0.$$

In the *absence* of fiscal externalities, it is seen from equations (19) and (20) that the maximization of G^A implies

$$\underbrace{w_1^A \frac{1}{(1+t)} \psi}_{(1) (+)} + \underbrace{w_2^A \left[\frac{q_z}{(1+t)} - 1 \right] \psi}_{(2) (-)} = 0. \quad (25)$$

Since the first effect of this expression is positive for any interior solution $t < 1$, equation (25) indicates an *oversupply* of public goods in country A by Definition 2. Intuitively, G^A is maximized when the (weighted) marginal gain in tax revenues from a further increase in t^A equals the (weighted) marginal loss in consumer welfare.

Since country B faces a symmetric optimization problem, the absence of fiscal externalities will lead to an oversupply of public goods in both countries when elements of tax revenue maximization enter the government objective functions; this

case underlies the analysis of Brennan/Buchanan. Given this initial equilibrium, equation (22) demonstrates that a *small* reduction in t^A increases global efficiency.

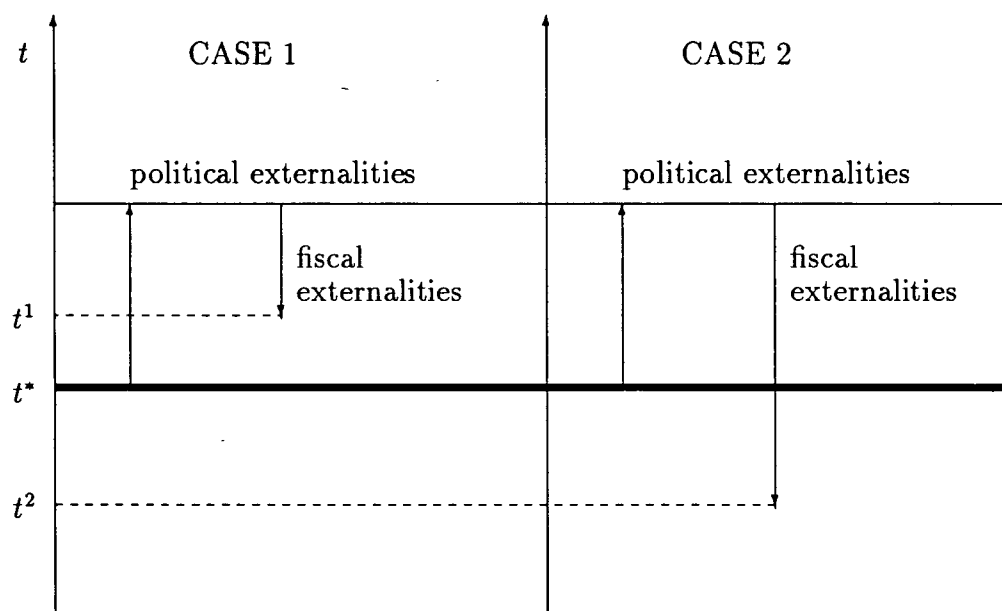
In the *presence* of fiscal externalities, governments face an additional constraint on their taxing power through international competition for a mobile tax base. Combining equations (19) and (20) and leaving out terms of trade effects yields the following implications of maximizing G^A :

$$\underbrace{w_1^A \frac{1}{(1+t)} \psi}_{(1) (+)} + \underbrace{(w_1^A + w_2^A q_z) t p_1 \left(\frac{\partial m_1^B}{\partial p_1^B} - \frac{\partial c_1}{\partial y} t x_1^B \right) \frac{d p_1^B}{d t^A}}_{(2) (-)} + \underbrace{w_2^A \left[\frac{q_z}{(1+t)} - 1 \right] \psi}_{(3) (+-)} = 0. \quad (26)$$

It is seen from equation (26) that positive political externalities (1) and negative fiscal externalities (2) are counteracting in this case so that it is unclear whether the maximization of G^A leads to an over- or undersupply of public goods (3) in country A. The reason for this ambiguity is that the tax rate reduction induced by tax competition is not a *small* downward adjustment of country A's tax rate. Instead, the reduction in t^A induced by the opening of the national economy to tax competition may under- or overcompensate for the externality introduced by revenue-maximizing governments. A complete neutralization of the first two effects – implying that the third effect becomes zero and an efficient level of public good supply is chosen – will occur only by coincidence.

The two possible cases are shown in Figure 3 where t^* represents the tax rate that finances an efficient level of public good supply in each of the two (identical) countries. In case 1, the political externality dominates the fiscal externality. Tax competition then represents a corrective step in the right direction but the tax rate (t^1) – and the accompanying level of public good supply – will still be too high in the final equilibrium from the perspective of consumers. In this case, tax harmonization can only be harmful, restricting the desired move towards more efficiency. In contrast, case 2 describes a situation where unrestricted tax competition leads to 'tax rate undershooting' (tax level t^2) despite the presence of political externalities in the initial equilibrium. In this case, tax harmonization may help to constrain the downward movement of tax rates, thus bringing public good supply in the final

Figure 3: Fiscal vs. Political Externalities and Public Good Supply



equilibrium closer to the desired level.

This discussion shows that the desirability of tax rate harmonization depends on the relative importance of political externalities on the one hand and fiscal externalities on the other. If there are reasons to believe that both types of externalities are relevant in the context of EC tax policy in the internal market, and if a true second-best setting applies²⁷, it is necessary to draw on the results of empirical studies which assess the quantitative effects of the different externalities discussed here.

²⁷Obviously, the conflict between tax competition and tax rate harmonization disappears if a further (domestic) policy tool is introduced. This first-best view is taken by Musgrave/Musgrave (1990, p. 79) who conclude: "Fiscal competition, it appears, is a clumsy and costly means by which to remedy inefficiencies in domestic budget determination, but it is not the only remedy. Remedies may be applied also at the domestic level (...)". However, the interest in international tax competition as a second-best way of reducing overexpanded government sectors arises precisely because it has proved difficult to enact effective domestic constraints on the governments' taxing power.

4.3 A Brief Survey of Empirical Results

In this section, we collect some of the existing empirical evidence on the issues raised above. The presentation does not intend to carry out a comprehensive survey of relevant results nor to discuss methodological issues in more detail. Rather, the purpose of this brief review is to give a first idea on how empirical work in this area has proceeded, and to outline some of the more general findings.

Government Behavior and Political Externalities: A first strand in the empirical literature explicitly addresses the issue of discriminating between competing assumptions with respect to government behavior. Most of this literature has been organized around the distinction between supply-side vs. demand-side factors determining government growth in developed countries²⁸. In general, demand-side theories explain government growth either as a response to the wishes of the general public or by the presence of strong interest groups. In contrast, supply-side theories look for the causes of government growth within the government sector itself (Lybeck, 1988, pp. 29–30). Therefore, empirical support for supply-side theories of government growth indicates the existence of political externalities while evidence for demand-side theories can –but need not – imply efficiency in public good supply in industrialized countries.

Lybeck (1986, pp. 73–106) compares the determinants of government growth in 12 OECD countries²⁹ in an econometric time-series analysis for the period 1960–1982. In each country, the size of the public sector as a percentage of GDP is regressed on alternative sets of independent variables associated with demand-side theories of government growth on the one hand and supply-side theories on the other³⁰.

²⁸Cf. Kirchgässner/Pommerehne (1991) for an overview of supply-side vs. demand-side approaches to explain government growth.

²⁹These countries are Australia, Austria, Belgium, Canada, France, Germany, Italy, The Netherlands, Norway, Sweden, the United Kingdom, and the United States.

³⁰Lybeck (1986) alternatively uses government expenditures proper and government expenditures plus transfer payments to define the size of government. The explanatory variables of the demand and the supply model, respectively, are summarized in Lybeck (1986, p. 90).

The performance of the demand and supply models are compared on the basis of both summary statistics and the number of significant coefficients. Lybeck's results indicate that the demand model of government growth dominates for Sweden and the United Kingdom while the supply model is superior for the United States, Canada, and France. For the remaining seven OECD countries, no clear-cut decision between the two models can be made (Lybeck, 1986, pp. 100-101).

From a multi-country perspective, no general conclusions are possible with respect to alternative models of government growth. Instead, the regression results for most countries are dominated by country-specific institutional factors. Lybeck (1988, p. 44) concludes that "obviously, and perhaps inevitably, we are still a long way from deriving a common model that can explain the growth of the government sector in several countries". While this conclusion establishes a need for further empirical work, especially with respect to the European Community, it does not allow to assess the overall role of political externalities in the current process of fiscal decision-making in EC member states.

Fiscal Externalities and Tax Competition: A second question relevant to the above debate is whether there is empirical evidence that the existence of fiscal externalities effectively lowers real-world tax rates through inter-jurisdictional tax competition. Simulation studies (York, 1991) indicate that the opening of national economies to tax competition may substantially reduce tax rates on an internationally mobile tax base and lead to a narrowing of international tax differentials³¹.

These results contrast, however, with empirical evidence on subfederal tax auton-

³¹York (1991) uses an applied general equilibrium model of capital tax competition between the Group of Seven Countries. His results (pp. 15-22) show that the average corporate income tax rate in the Group of Seven countries falls from 31.2 % to 23.2 % when the policy change is given by the opening of international capital markets and net-of-tax rate of returns to capital must be equalized worldwide under the source principle of taxation. Welfare in all countries declines as governments increasingly rely on distorting taxes on labor to raise a given level of tax revenues. Finally, the coefficient of variation in tax rates on both labor and capital declines, indicating that international tax structures become more alike as a result of tax competition.

omy in industrialized federal states. Genser (1992, pp. 213–219) finds that substantial tax differentials persist between jurisdictions for both direct and indirect taxes. As an example, general subfederal sales taxes vary by a maximal span of 12 % in Canada and 9.5 % in the United States when local sales taxes are included in the picture. Nevertheless, a "marked tendency towards strategic reduction of subfederal taxation [...] is not detectable in the intertemporal pattern of subfederal tax rates" (p. 218). For commodity taxes, this finding is primarily explained by the information and transport costs of tax arbitrage.

Oates (1985) applies an econometric cross-section analysis to isolate the role of fiscal centralization measures on the size of the government sector, using an international and a United States sample, respectively. In the U.S. sample, the dependent variable is given by aggregate state-local tax receipts as a fraction of personal income. This variable is alternatively regressed on the state share of overall tax revenues (expenditures), and on the absolute number of local government units in the state. In the world sample, total public revenue as a fraction of GDP is regressed on the central government's share of total tax revenues (expenditures). Oates (1985, p. 756) concludes that "overall, the results of this study suggest that there does not exist a strong, systematic relationship between the size of government and the degree of centralization of the public sector".

Following up on Oates' analysis, other authors have extended his empirical model, focusing on tax competition between local government units in the United States. In contrast to Oates (1985), some of these articles find evidence for a systematic relationship between indicators of centralization and the size of state-local government³². However, as is emphasized by Oates (1989, p. 582), there still exists no econometric evidence that inter-jurisdictional tax competition occurs above the local level of government.

As a summary of these contributions, it can be concluded that frictionless models of general equilibrium are likely to overstate the danger of ruinous tax competition induced by the presence of fiscal externalities. Most of the empirical evidence avail-

³²See Oates (1989) for a summary and further references.

able so far gives little – if any – indication that downward tax competition occurs beyond the local level of government. On the other hand, experience with interstate commodity tax differentials has so far been restricted to the North American continent. Proponents of tax rate harmonization tend to stress geographical and institutional differences between North American and European conditions, arguing that the opening of borders in the European Community would entail a more intense competition between member states as compared to the United States or Canada (e.g., Sinn, 1990b, pp. 12–13). If this argument is correct, the available evidence on tax competition is of little help for the policy question whether tax rates should be harmonized in the EC internal market.

5 Summary and Conclusions

The discussion in this paper has tried to integrate the arguments for centralized versus decentralized decision-making in fiscal policy in a common analytical framework, and to discuss the fundamental trade-offs involved in an exclusive reliance on either tax rate harmonization or tax rate competition. For this purpose, the analysis has incorporated a public good which allows an analytical description of the costs of harmonization as against its benefits.

Two distinct issues have been isolated in the analysis: the discussion in section 3 focused on the optimal tax *differential* between EC member states when preferences for public goods differ across countries and non-distorting taxes are not available. The analysis has shown that a full equalization of tax rates cannot be optimal in this setting, but a (small) harmonizing tax reform improves global welfare when countries are exclusively concerned with the efficiency of domestic public good supply in the initial equilibrium. In more general cases, however, the costs and benefits of tax rate harmonization cannot be weighed against each other by means of theoretical analysis alone.

In principle, it would be possible to quantify the costs and benefits of tax rate harmonization in the EC internal market, for example by means of a computable

general equilibrium analysis. There are, however, some specific difficulties with the application of this technique in the present context. First, intra-Community differences in current levels of public spending must be attributed to differences in preferences for public goods (as opposed to, for example, different degrees of political externalities), and such an assumption should itself be tested empirically. Second, the policy question to which extent member states' tax rates should be aligned in the internal market is inherently a quantitative rather than a qualitative decision. It is widely acknowledged that computable general equilibrium results should not be interpreted in a way that they allow precise calculations of an 'optimal degree of tax rate harmonization'. Instead, the most that can be expected from such simulations is to get a rough idea on the relative welfare costs of trade distortions on the one hand and the violation of domestic preferences on the other.

A second aspect of tax rate harmonization, discussed in section 4, focuses on the optimal *level* of public good supply when preferences for public goods are identical across member states-but both fiscal and political externalities exist. If political externalities dominate fiscal externalities, tax competition helps to reduce the oversupply of public goods that prevails in a closed economy. This case is stressed by the Leviathan view of government. If fiscal externalities dominate political externalities, however, tax competition leads to an undersupply of public goods, as is emphasized in game-theoretic models that assume benevolent dictator governments. In the first case, tax rate harmonization can only be harmful while it may improve welfare in the second scenario. Again, empirical studies are needed to overcome these theoretical ambiguities.

The existing evidence on tax competition is confined to the experience of federal economies because international tax differences have been neutralized in the past by the general application of the destination principle. Empirical studies have found some evidence of tax competition at the local government level, but there is no indication that the existence of fiscal externalities effectively lowers the level of taxes levied by state governments. If this observation carries over to the EC internal market, tax rate competition may not be an important feature in practice despite

the considerable theoretical interest in this issue. However, one controversial issue is precisely whether evidence from federal economies can be used to anticipate the behavior of EC member states after the abolition of border controls.

In view of the theoretical ambiguities and the lack of conclusive empirical evidence, the Community's decisions in the field of tax rate harmonization cannot be evaluated in detail. The following observations can be made, however: first, a Community-wide lower bound on the value-added tax rate, which is binding for some member states, implies some convergence of tax rates in the internal market while allowing most EC members to maintain their current tax levels. This policy choice strikes a balance between the welfare costs of trade distortions on the one hand and the welfare costs of domestic inefficiencies in public good supply on the other. Second, the minimum rate level chosen by the Community is at the lower end of the spectrum of member states' current tax rates. This precludes the possibility that a process of competitive tax undercutting takes place in *all* member states, but it still exposes high-tax countries to the forces of tax competition. Therefore, it is possible to draw the 'negative' conclusion that the decisions on tax rate harmonization made by the European Community do not violate any of the welfare-theoretic results derived in this chapter.

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University of Konstanz
Sonderforschungsbereich 178
"Internationalization of the Economy"

**Workshop on
International Political Economics of Taxation**

July 2-3, 1992
University of Konstanz
Großer Sitzungssaal, V 1001

Thursday, July 2, 1992

- 10.00 Opening Address
Hans-Jürgen Vosgerau (Speaker of the SFB 178)
Introduction
Bernd Genser (SFB 178)
- 10.30 *Chair: Bernd Genser (SFB 178)*
"Intergovernmental Tax Competition"
Bruno S. Frey (University of Zürich)
- 11.30 "International Tax Competition and Public Goods Supply:
Alternative Views of Government Behaviour"
Andreas Haufler (University of Konstanz)
- 12.30-14.00 Lunch (IBZ, University of Konstanz)
- 14.00 *Chair: Gebhard Kirchgässner (University of St.Gallen)*
"Explaining the Use of Related Tax Instruments"
Stanley L. Winer (Carleton University/Ottawa) and Walter
Hettich (California State University/Fullerton)
- 15.00 "Intertemporal Commitment Problems and Voting on
Redistributive Taxation"
Amihai Glazer (Carnegie Mellon University/Pittsburgh)
and Kai A. Konrad (University of München)
- 16.00-16.30 Coffee Break
- 16.30 *Chair: Friedrich Breyer (University of Konstanz)*
"The Effects of Tax Administration on Tax Morale"
Werner W. Pommerehne (University of Saarbrücken)
and Bruno S. Frey (University of Zürich)
- 17.30 "Fuel Taxation in EC Countries: A Political-Economy
Approach"
Bernd Genser and Hannelore Weck-Hannemann (SFB 178)
- 19.30 Dinner (Schwedenschenke, Insel Mainau)

Friday, July 3, 1992:

- 08.30 *Chair: Heinrich Ursprung (SFB 178)*
"Fiscal Policy During the Transition in Eastern Europe"
Roger H. Gordon (University of Michigan/Ann Arbor)
- 09.30 "Corporate Income Tax Competition, Double Taxation
Treaties, and Foreign Direct Investment"
Eckhard Janeba (University of Bonn)
- 10.30-11.00 Coffee Break
- 11.00 *Chair: Hannelore Weck-Hannemann (SFB 178)*
"The Development of the Shadow Economy under Changing Tax
Systems and Structures: Some Theoretical and Empirical
Results for Austria"
Friedrich Schneider (University of Linz) and Reinhard Neck
(University of Bielefeld)
- 12.00 Closing Address
Bernd Genser (SFB 178)
- 12.30 End of Workshop
- 13.00 Lunch (Hotel Mainaublick, Egg)

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