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Tax-tariff reform with costs of tax administration

by

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Abstract

As is broadly recognized, the straightforward application of the Diamond-Mirrlees (1971) production efficiency theorem implies that when lump-sum taxation is not available, then it is optimal for the government in a small open economy to rely on taxes on the net demand of households rather than on border taxes to finance its resource requirements. However, for production efficiency, and by implication for free trade to be desirable, it must be possible to tax all market transactions at no costs. However, it is not likely for this condition to be satisfied, especially not in developing countries. There is thus a need to provide guidance to the design and reform of tax-tariff systems taking into account that due to the costs of tax administration, production efficiency and free trade may not be desirable. The paper addresses this challenge by characterising the optimal tax-tariff systems for different tax-tariff structures associated with different levels of administrative costs. In doing so, it establishes a theoretical framework for identifying tax-tariff reforms that are desirable when the adoption of free trade is not.

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1. Introduction

In a famous paper, Diamond and Mirrlees (1971) established that even when lump-sum taxation is not available, production efficiency is desirable. However, as Stiglitz and Dasgupta (1971) pointed out at the outset, the Diamond-Mirrlees' efficiency theorem is not very robust because if certain tax instruments cannot be used, then production efficiency will not necessarily be desirable.

Under the assumption that all market transactions and profit can be taxed, the conditions for a tax-tariff system to be optimal are fairly well understood. It follows as a corollary to the Diamond-Mirrlees (1971) production efficiency theorem that it is optimal in a small open economy for the government to rely on taxes on the net demand of households rather than to use border taxes (see Dixit and Norman 1980, Dixit 1985). However, the implication of the Stiglitz and Dasgupta insight, that free trade is not desirable if all tax instruments cannot be set at their optimal level at no costs, has been explored very little, except for the polar case when only border taxes are feasible. The optimal tariff structure, when tariff revenue is the only source of government revenue, has been considered by Dasgupta and Stiglitz (1974) and recently by Hatta and Ogawa (2003) who draw attention to the fact that, as one would expect from the Stiglitz and Dasgupta (1971) analysis, a proportional tariff system in general is not desirable, and that productive efficiency is thus not optimal.

There is also a considerable literature within the Diamond-Mirrlees framework on desirable tariff reform. Hatta (1977) made a seminal contribution to the analysis of the welfare effects of tariff reform when changes in government tax revenue are balanced by changes in lump-sum transfers. Although important in opening up the area for theoretical investigation, the assumption that the government's revenue requirement is financed by lump-sum taxes clearly limits the policy relevance of the results. Subsequent contributions (see for example Diewert, Turunen-Red, and Woodland 1989) have taken into account that the revenue forgone by tariff reductions has to be replaced by tax revenue generated by other distortionary taxes, but in general within a framework where free trade would be the ultimate aim of such reform, thus of limited relevance for identifying desirable directions of tax-tariff reforms when the set of feasible tax instruments are restricted (see Keen and Ligthart 2002 on this point).

There is convincing empirical evidence to suggest that different tax structures are associated with different amounts of administrative costs, and that the associated administrative costs relative to the distortionary costs are more important at low, rather than at high levels of economic development (see World Bank Report 1988). The conditions for production efficiency and free trade to be desirable are thus far from satisfied in developing countries and in economies in transition. This point of view has been argued forcefully by Stiglitz at numerous occasions and recently by Emran and Stiglitz (2002, 2003). More specifically, they suggest that with a large informal sector, the IMF and the World Bank recommendation to reduce trade taxes and increase consumption taxes like VAT, is likely to decrease welfare.

However, although several of those who have contributed to the analysis of piecemeal tax-tariff reform have recognised the importance of taking administrative costs into account (for example Emran and Stiglitz 2002, 2003) administrative costs are in general not integrated into the models on which the analyses have been based. There is thus a need to develop a framework that can be used as a basis for providing guidance to governments on how, in response to changes in costs of tax

administration, to reform both the *tax structure,* i.e. the set of tax instruments used, and the *tax system,* i.e. the actual tax rates, for given tax structures.

The purpose of this paper is to contribute to this endeavour. It has a limited scope. We analyse the optimal tax systems for alternative tax structures associated with different levels of administrative costs, and we focus only on the trade-off between administrative costs and allocational efficiency. However, although the characterisation of the optimal tax systems under alternative assumptions about the administrative costs involved may be of limited practical interest in itself, it clearly helps to understand what characterise desirable directions of tax reform, in particular with respect to changes in administrative costs. The paper is structured as follows. In Section 2, we set out the model framework. In Section 3 the optimal tax systems for three different tax structures are characterised. On this basis, in Section 4, we identify desirable directions of coordinated tax-tariff reforms at various stages of economic development. Section 5 concludes.

2. The model

We consider a small open economy comprising of one representative household[1], three perfectly competitive production sectors, and a government. There are one primary factor, indexed 0, and three tradable commodities, indexed (1,2,3). The government imposes border taxes, $\mathbf{t}^{\mathrm{W}} \equiv \left(t_1^W, t_2^W, t_3^W\right)$, and household taxes $\mathbf{t} = \left(t_0, t_1, t_2, t_3\right)$. World market prices are $\mathbf{p}^W \equiv \left(p_1^W, p_2^W, p_3^W\right)$, producer prices are $\mathbf{p} \equiv \left(p_0, p_1, p_2, p_3\right) = \left(p_0, p_1^W + t_1^W, p_2^W + t_2^W, p_3^W + t_3^W\right)$, and household prices are $\mathbf{q} \equiv \left(q_0, q_1, q_2, q_3\right) = \left(p_0 + t_0, p_1 + t_1, p_2 + t_2, p_3 + t_3\right)$.

Production takes place under constant returns to scale, each sector using only the primary factor as input. For each tax-tariff structure, the sector producing commodity 1 is assumed always to be the most productive, such that the economy will specialise in the production of that commodity, which thus becomes the export good, while commodity 2 and 3 become the import goods. The output of the export sector is y_1 and the use of the primary factor for its production is y_0.[2] The production function for the export sector is

$$y_1 = -a_0 y_0 \tag{1}$$

and by the zero profit condition the producer price of the primary factor is

$$p_0 = a_0 p_1 \tag{2}$$

[1] The analysis thus ignores distributional consideration. This facilitates the exposition. Such considerations would naturally have to be taken into account in order to provide policy recommendations.

[2] The sign convention are: $y_0 < 0$ and $y_1 > 0$; $x_0 < 0$ and $x_1 > 0$ $(\mathrm{i}=1,2,3)$; $y_1^{\mathrm{W}} < 0$ and $y_i^W > 0$, $(i = 2,3)$. Thus for the primary factor tax and the export tax, respectively, to generate a positive tax revenue the tax rates must be negative.

The household's endowment of the primary factor is ω_0 and its net demand vector is $\left(x_0, x_1, x_2, x_3\right)$. The household's untaxed consumption of the primary factor, representing the use of resources in the informal sector of the economy, is thus $\omega_0 + x_0$. The preferences of the household are represented by the expenditure function, $E\left(\mathbf{q}, u\right)$, defined over household prices, $\mathbf{q}$, and utility, u. The households' net demands are given by[3]

$$x_j = E_j\left(\mathbf{q}, u\right) \qquad j \in \left(0,1,2,3\right) \tag{3}$$

Foreign trade is $\left(y_1^W, y_2^W, y_3^W\right)$. The balance of trade constraint is thus

$$\sum_{i\in(1,2,3)} p_i^W y_i^W = 0 \tag{4}$$

The government's choice of tax- and tariff rates is subject to *tax-tariff restrictions*. We express restrictions on domestic tax rates as[4]

$$T_j \equiv \left(t_j + p_j\right)/\, p_j = \overline{T}_{\mathrm{j}}\ , \qquad j \in (0,1,2,3)$$

and on tariffs as

$$T_j^W \equiv \left(t_j^w + p_j^w\right)/\, p_j^w = \overline{T}_{\mathrm{j}}^W\ , \qquad j \in (1,2,3)$$

We define a *tax-tariff system* as $\left(\mathbf{t}, \mathbf{t}^W\right)$ and a *tax-tariff structure j,* $\mathbf{\Xi}^j$, as the set of tax systems, where the same restrictions are imposed on the set of tax instruments. The administrative costs associated with tax-tariff systems belonging to the tax-tariff structure j are assumed to be the same, $B\left(\mathbf{\Xi}^j\right)$. The set of tax-tariff structures is assumed finite. We assume that the government considers only three different tax structures:

$\mathbf{\Xi}^1$: no tax-tariff restrictions;
$\mathbf{\Xi}^2$: only border taxes and a tax on the primary factor are feasible , i.e. $\overline{T}_{\mathrm{i}} = 1,\ i \in (1,2,3)$ [5], and
$\mathbf{\Xi}^3$: only border taxes are feasible, i.e. $\overline{T}_{\mathrm{i}} = 1, i \in (0,1,2,3)$.

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[3] We utilize the derivative notation writing $E_j \equiv \dfrac{\partial E}{\partial q_j},\ j \in \left(0,1,2,3\right)$, and $E_{ij} \equiv \dfrac{\partial^2 E}{\partial q_i\, \partial q_j},\ i, j \in \left(0,1,2,3\right)$

[4] For example $\overline{T}_0 = 1$ indicates that it is not possible to tax the primary factor, $\{\overline{T}_{\mathrm{i}} = 1, \mathrm{i}\ \hat{\mathrm{I}}\ (0,1,2,3)\}$ that domestic commodity taxes are not feasible, and $\{\overline{T}_{\mathrm{i}}^W = 1, \mathrm{i}\ \hat{\mathrm{I}}\ (1,2,3)\}$ that border taxes cannot be used.

[5] Notice that within the model framework a tax on the market supply of the primary factor is equivalent to a uniform tax on the final consumption of the commodities produced in the formal sector, i.e. a VAT.

The government's resource requirement, other than for tax administration, is exogenously given. For the tax-tariff structure *j,* the government's total resource requirements are

$$x_i^G = x_i^G\left(\Xi^j\right) \qquad i \in (0,1,2,3) \tag{5}$$

For a *tax-tariff system,* $\left(\mathbf{t},\mathbf{t}^W\right) \in \Xi^j$, the government's budget constraint is

$$\sum_{i\in(0,1,2,3)} t_i\, x_i + \sum_{i\in(1,2,3)} t_i^W x_i^W - \sum_{i\in(0,1,2,3)} p_i\, x_i^G\left(\Xi^j\right) = 0 \tag{6}$$

Material balance requires

$$\begin{aligned} y_0 &= x_0 + x_0^G \\ y_1 + y_1^W &= x_1 + x_1^G \\ y_i^W &= x_i + x_i^G \qquad i \in (2,3) \end{aligned} \tag{7}$$

Substituting by (1), (3) and (5) into the material balance conditions (7), and subsequently substituting for y_0 we obtain

$$y_1^W = a_0\left[E_0\left(q_0,\mathbf{q},u\right) + x_0^G\left(\Xi^j\right)\right] + E_1\left(q_0,\mathbf{q},u\right) + x_1^G\left(\Xi^j\right) \tag{8}$$

$$y_i^W = E_i\left(q_0,\mathbf{q},u\right) + x_i^G\left(\Xi^j\right) \qquad i \in (2,3) \tag{9}$$

We assume as a matter of normalisation that the producer price of the primary factor, p_0, is fixed, and that the world market prices, $\mathbf{p}^W \equiv \left(p_1^W, p_2^W, p_3^W\right)$, are exogenously determined.

Substituting into the balance of trade constraint and into the government's budget constraint, we obtain using the *expenditure function approach* the following conditions for a tax system, $\left(\mathbf{t},\mathbf{t}^W\right) \in \Xi^j$, to be feasible (see Diamond and McFadden 1974 and Dixit and Munk 1977)[6]

$$\mathrm{E}(\mathbf{q},u) = 0 \tag{10}$$

$$p_1^{\mathrm{W}}\left[a_0\left[E_0\left(\mathbf{q},u\right) + x_0^G\left(\Xi^j\right)\right] + E_1\left(\mathbf{q},u\right) + x_1^G\left(\Xi^j\right)\right] + \sum_{i\in 2,3} p_i^{\mathrm{W}}\left[E_i\left(\mathbf{q},u\right) + x_i^G\left(\Xi^j\right)\right] = 0 \tag{11}$$

[6] The first equation, (10), assures the value of compensated demand is consistent with household's lump-sum income, the second equation, (11), represents the balance of trade constraint, and the third, (12), the government's budget constraint. The conditions for utility maximisation, profit maximisation and material balance are represented by these three equations.

$$\sum_{\mathrm{i}\in(0,1,2,3)} t_i E_{\mathrm{i}}\left(\mathbf{q},u\right)+t_1^{\mathrm{W}}\left[a_0\left(E_0\left(\mathbf{q},u\right)+x_0^G\left(\boldsymbol{\Xi}^j\right)\right)+E_1\left(\mathbf{q},u\right)+x_1^G\left(\boldsymbol{\Xi}^j\right)\right]$$
$$+\sum_{i\in 2,3} t_{\mathrm{i}}^{\mathrm{W}}\left[E_i\left(\mathbf{q},u\right)+x_i^G\left(\boldsymbol{\Xi}^j\right)\right]-p_0x_0^G\left(\boldsymbol{\Xi}^j\right)-\sum_{i\in(1,2,3)} p_i x_i^G\left(\boldsymbol{\Xi}^j\right)=0 \qquad (12)$$

where $p_{\mathrm{i}}=p_{\mathrm{i}}^W+t_{\mathrm{i}}^W$, $\mathrm{i}\in(1,2,3)$ and $\mathbf{q}\equiv\left(q_0,q_1,q_2,q_3\right)=\left(p_0+t_0,p_1+t_1,p_2+t_2,p_3+t_3\right)$.

By Walras' law, an equilibrium solution can be found from two of the three equations, disregarding either (11) or (12). Looking at (10) and (11) we see that under $\boldsymbol{\Xi}^2$ and $\boldsymbol{\Xi}^3$, we can without loss of generality assume that exports are untaxed, and under $\boldsymbol{\Xi}^1$ in addition that the domestic consumption of the export good is untaxed.[7]

The government is assumed to maximise social welfare in a two-step procedure: First, it calculates for each tax structure the optimal tax system; then, in the second step, based on the results of the first step, it chooses the optimal tax structure, $\boldsymbol{\Xi}^*$, i.e. the tax structure which allows the highest level of social welfare to be attained, and concomitantly the overall optimal tax system, $\left(\mathbf{t}^*,\mathbf{t}^{W*}\right)$. Administrative costs are thus exogenous to the choice of the optimal solution for a given tax-tariff structure, but endogenous to the government's overall maximisation problem.

3. Characterisation of the optimal tax-tariff system for different tax structures

3.1 No restrictions

We first characterise the optimal tax-tariff system under the unconstrained tax-tariff structure, $\boldsymbol{\Xi}^1$. Assuming, as a matter normalisation, that both the domestic consumption and the export of commodity 1 are untaxed, i.e. $t_1=0$ and $t_1^{\mathrm{W}}=0$, the Lagrangian expression corresponding to the government's problem of finding the optimal solution may (leaving out arguments of functions for readability) be formulated as

$$L=u+\mu\left(-E\right)+\lambda\left(\sum_{\mathrm{i}\in(0,2,3)} t_i E_{\mathrm{i}}+\sum_{\mathrm{i}\in(2,3)} t_{\mathrm{i}}^{\mathrm{W}}\left(E_{\mathrm{i}}+x_i^G\right)-p_0x_0^G-\sum_{i\in(1,2,3)}\left(p_i^W+t_{\mathrm{i}}^{\mathrm{W}}\right)x_i^G\right) \qquad (13)$$

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[7] Substituting by $q_0=a_0T_0\,T_1^W p_1^W$ and $q_i=T_iT_i^W p_i^W, i\in(1,2,3)$, (10) and (11) may be rewritten

$$E\left(a_0T_0T_1^W p_1^W,\left\{TT_i^W p_i^W,i\in(1,2,3)\right\},u\right)=0$$
$$p_1^W\left[a_0\left[E_0\left(a_0T_0T_1^W p_1^W,\left\{TT_i^W p_i^W,i\in(1,2,3)\right\},u\right)+x_0^G\left(\Xi^j\right)\right]+E_1\left(a_0T_0T_1^W p_1^W,\left\{TT_i^W p_i^W,i\in(1,2,3)\right\},u\right)+x_1^G\left(\Xi^j\right)\right]$$
$$+\sum_{i\in 2,3} p_i^W\left[E_i\left(a_0T_0T_1^W p_1^W,\left\{TT_i^W p_i^W,i\in(1,2,3)\right\},u\right)+x_i^G\left(\Xi^j\right)\right]=0$$

Multiplying T_i, i=0,1,2,3 by the same constant and similarly multiplying T_1^W, i=1,2,3 by the same constant will not change demands and will thus leave the equilibrium conditions unaffected.

The first order conditions for an optimal tax-tariff system thus become

$$\frac{\partial L}{\partial t_k} = -\mu E_k + \lambda\left(\sum_{i\in(0,2,3)} t_i E_{ik} + E_k + \sum_{i\in(2,3)} t_i^W E_{ik}\right) = 0 \qquad k=0,2,3 \text{ (14)}$$

$$\frac{\partial L}{\partial t_k^w} = -\mu E_k + \lambda\left(\sum_{i\in(0,2,3)} t_i E_{ik} + E_k + x_k^G + \sum_{i\in(2,3)} t_i^W E_{ik}^h - x_k^G\right) = 0 \qquad k=2,3 \text{ (15)}$$

From the first order conditions with respect to domestic taxes, t_k, we have

$$-\mu E_k + \lambda\left(\sum_{i\in(0,2,3)} t_i E_{ik} + E_k + \sum_{i\in(2,3)} t_i^W E_{ik}\right)=0 \qquad k=0,2,3 \text{ (16)}$$

and from the first order conditions with respect to tariff rates, t_k^w, we have

$$-\mu E_k + \lambda\left(\sum_{i\in(0,2,3)} t_i E_{ik} + E_k + \sum_{i\in(2,3)} t_i^W E_{ik}\right)=0 \qquad k=2,3 \text{ (17)}$$

If $t_i^w = 0,\ i = 2,3$, and if domestic taxes are set optimally such that (16) is satisfied, then also (17) is satisfied. The optimal solution may thus be achieved only using domestic taxes, as may indeed, interpreting the foreign sector as a production sector, be deduced directly from the Diamond and Mirrlees production efficiency theorem.

Compared with the first-best allocation, any tax system including the optimal tax system involves an encouragement of the household's (untaxed) consumption of the primary factor, or in other words a discouragement of the household's supply of the primary factor to the market. This implies that starting with an equal proportional tax system in terms of the produced goods it is possible, in general, to alleviate the discouragement of the supply of the primary factor by differentiating the tax rates for the produced commodities. The optimal tax system may thus be interpreted as determined by two objectives (see Munk 2002):

> *Objective 1:* to maintain the first-best pattern of consumption of the produced commodities,
> *Objective 2:* to discourage the untaxed consumption of the primary factor.

The optimal tax system will therefore, generally speaking, be characterised by (see Corlett and Hague 1953, Harberger 1974 and Munk 2002) [8]

> 1) high tax rates on commodities which are most complementary with the untaxed use of the primary factor, and
> 2) greater diversion from proportionality, a) the greater the complementarity with the untaxed use of the primary factor; and b) the more the degree of complementarity differ between produced commodities.

[8] Notice that the model encompasses three produced commodities where the Corlett and Hague model encompasses only two produced commodities. Thus only the intuition of the Corlett and Hague results applies here, not the optimal tax formulae.

Distorting producer prices by using border taxes does not contribute to either of the two objectives, as household prices can be determined by the choice of domestic taxes whatever the level of border taxes, thus providing an intuitive explanation why border taxes from an allocative point of view are not relevant to solving the government's maximization problem.

From an allocative point of view, i.e. disregarding administrative costs, the tax structure, Ξ^1, is clearly the optimal tax structure, as it allows for most choice. However, the tax structure requires monitoring of domestic market transactions for each commodity separately. The administrative costs associated with the unconstrained tax-tariff structure, $B\left(\Xi^1\right)$, are therefore likely to be significantly larger than for the other tax structures, in particular in countries with a weak administrative infrastructure. Thus, when both administrative and distortionary costs are taken into account, then Ξ^1 may not be the optimal tax structure.

3.2 Only border taxes and VAT

We now characterise the optimal tax-tariff system when the government's revenue requirement can only be financed by tariffs and by a tax on the market supply of the primary factor (corresponding to a VAT), i.e. when the tax-tariff system belongs to Ξ^2. The use of tariffs involves monitoring far fewer market transactions than the use of differentiated consumer taxes; the administrative costs associated with Ξ^2, $B\left(\Xi^2\right)$, are therefore likely to be smaller than those associated with Ξ^1, $B\left(\Xi^1\right)$. However, the optimal tax system associated with Ξ^2 may involve a loss in allocative efficiency compared with that associated with Ξ^1.

The first order conditions for $\left(\mathbf{t},\mathbf{t}^W\right)$ to be an optimal solution to the government's maximisation problem under Ξ^2, are

$$\frac{\partial L}{\partial t_0} = -\mu E_0 + \lambda\left(t_0 E_{00} + E_0 + \sum_{i\in(2,3)} t_i^W E_{i0}\right) = 0 \qquad (18)$$

$$\frac{\partial L}{\partial t_j^w} = -\mu E_j + \lambda\left(t_0 E_{0k} + E_k + x_k^G + \sum_{i\in(2,3)} t_i^W E_{ik} - x_k^G\right) = 0 \qquad k=2,3 \quad (19)$$

For t_0 chosen such that (18) is satisfied, in order also for (19) to be satisfied we need in general $t_i^W \neq 0$, i=2,3, i.e. to levy tariffs. As the domestic taxes under Ξ^2 cannot be manipulated to discourage the untaxed consumption of the primary factor, instead tariffs are used to achieve this objective. Under the assumptions made, the economy is specialised in the production of one good. If this good is the same when the production sectors face world market prices as when they face consumer prices, then Ξ^2 is associated with no loss in allocative efficiency compared with Ξ^1. However, if the economy specialises in the production of different goods under the two different tax structures, then choosing between Ξ^1 and Ξ^2 involves a trade-off between administrative costs and

allocative efficiency, where which tax structure is the optimal cannot be determined on theoretical grounds alone.

3.3 Only tariffs

Finally, we consider the optimal solution when the government's revenue requirement has to be financed only by tariffs, i.e. under the tax structure, Ξ^3. The first order conditions for an optimal tax-tariff system now become

$$\frac{\partial L}{\partial t_j^w} = -\mu E_j + \lambda\left(E_k + \sum_{i\in(2,3)} t_i^W E_{ik}^h\right) = 0 \qquad k=2,3 \quad (20)$$

Solving for the optimal tariffs we have

$$t_2^W = \theta\frac{\left(-E_{33}E_2 + E_{21}E_3\right)}{D} \quad (21)$$

$$t_3^W = \theta\frac{\left(-E_{22}E_3 + E_{32}E_3\right)}{D} \quad (22)$$

where $D = E_{22}E_{33} - E_{32}E_{23}$, and $\theta = \frac{\lambda-\mu}{\lambda}$, or

$$t_2^W = \theta\frac{\left(\varepsilon_{23} - \varepsilon_{33}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} > 0 \quad (23)$$

$$t_3^W = \theta\frac{\left(\varepsilon_{32} - \varepsilon_{22}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} > 0 \quad (24)$$

where $\varepsilon_{ij} \equiv E_{ij} \Big/ \frac{x_i}{q_j}$.

By the homogeneity of degree zero of the compensated demand functions, $E_i(\mathbf{q},u), i\in(0,1,2,3)$, we have that $\sum_{j\in(0,1,2,3)} \varepsilon_{ij}$, $i\in(0,1,2,3)$, and therefore that $\varepsilon_{12} = -\varepsilon_{11} - \varepsilon_{10}$ and $\varepsilon_{21} = -\varepsilon_{22} - \varepsilon_{20}$. The optimal tariff system may therefore also be expressed as (see Munk and Rasmussen 2003)

$$\frac{t_2^W \Big/ q_2}{t_3^W \Big/ q_3} = \frac{-\varepsilon_{22} - \varepsilon_{33} - \varepsilon_{21} - \varepsilon_{20}}{-\varepsilon_{22} - \varepsilon_{33} - \varepsilon_{31} - \varepsilon_{30}} \quad (25)$$

or since $\varepsilon_{ij} = s_j \sigma_{ij}$ where σ_{ij} is the Allan elasticity of substitution, and s_j the share of the consumption of j in full income, as

$$\frac{t_2^W / q_2}{t_3^W / q_3} = \frac{(s_2 + s_3)\sigma_{23} + s_1\sigma_{31} + s_0\sigma_{30}}{(s_2 + s_3)\sigma_{23} + s_1\sigma_{21} + s_0\sigma_{20}} \tag{26}$$

With the tax structure, Ξ^3, both the non-market use of the primary factor and the domestic consumption of the export good will be encouraged compared with the first-best allocation. In the absence of domestic consumer taxes, the government uses tariffs to discourage the consumption of the export good. The optimal tariff system may thus be interpreted as a compromise between achieving the following three objectives:

Objective 1: to maintain the first-best pattern of consumption of the import goods,
Objective 2: to discourage the untaxed consumption of the primary factors, and
Objective 3: to discourage the untaxed consumption of the export good.

The optimal tariff system reflects the desire to discourage both the untaxed consumption of the primary factor and the untaxed domestic consumption of the export good. Which commodity will be taxed at the highest rate depends entirely on the sign of $(s_1\sigma_{31} + s_0\sigma_{30})$ - $(s_1\sigma_{21} + s_0\sigma_{20})$ (Objective 2 and 3). For a given value of σ_{23}, the difference in the tax rates will be the greater, the greater the numerical value of $(s_1\sigma_{31} + s_0\sigma_{30})$ - $(s_1\sigma_{21} + s_0\sigma_{20})$; and for given value of $(s_1\sigma_{31} + s_0\sigma_{30})$ - $(s_1\sigma_{21} + s_0\sigma_{20})$ the difference will be the smaller the greater is σ_{23} (Objective 1). Objective 2 and Objective 3 may be conflicting, but if the consumption of the same import good is both more complementary to the untaxed consumption of the export good, and to the untaxed consumption of the primary factor, then it will be taxed at a higher rate than the other import good. (see Munk and Rasmussen 2003).

The optimal tariff system represents, compared with the optimal tax-tariff system obtained under the two previous tax structures, increased distortionary costs because domestic taxes cannot be used to discourage the domestic consumption of the export good and the untaxed consumption of the primary factor. On the other hand, the administrative costs of raising government revenue only by tariffs, $B(\Xi^3)$, is likely to be significantly smaller than for the two other tax-tariff structures, because under Ξ^3 domestic market transactions are not taxed. Therefore, that a tax system belonging to Ξ^3, is the overall optimal tax system cannot be ruled out on theoretical grounds.

4. Tax-tariffs reform

Inherent in the framework presented here is a representation of a trade-off between administrative costs and allocative efficiency. Based on allocative efficiency considerations, the tax-tariff structure

1 is socially preferred to 2, which again is socially preferred to 3[9], whereas according to the assumption that a more complex tax structure is associated with greater administrative costs, the ranking based on administrative costs is the opposite.

There is solid empirical evidence to support the hypothesis that the administrative costs of tax administration are relatively more important at low, than at high levels of economic development (see World Bank Report 1988). Therefore, in the process of economic development the trade-off between distortionary costs and administrative costs will change in favour of more allocative efficient, but administratively more costly tax structures.

It is therefore a plausible hypothesis that Ξ^1 is the optimal tax structure for *mature market economies*, Ξ^3 for *the least developed economies,* whereas Ξ^2 is the optimal tax structure for *middle-income developing countries*. This hypothesis implies that countries in the process of their economic development go through two transitional phases where changes of their tax-tariff system involves changes of the tax-tariff structure and thus involve large changes in tax-tariff rates, whereas during the periods between these phases their tax-tariff systems are changed without the tax-tariff structure being changed, thus only incrementally. The initial tax-tariff system is after the change in tax-tariff structure likely to differ significantly from the tax-tariff system, which is optimal under a new tax-structure, as our analysis indicates. Gradual change of tax and tariff rates based on learning by doing approach is therefore likely to be associated with big costs. It will therefore be desirable after the introduction of a new tax-tariff structure during a relative short period to change the tax system to that, which is optimal under the new tax-tariff structure, creating a particular need for technical advice on how to implement the appropriate tax-tariff reform.

The two transitional phases are

- when it becomes desirable to supplement border taxes by a simple domestic tax system in the form of a VAT, and

- when it becomes desirable to adopt a complex domestic tax system and adopt free trade

The recommendations in the latter case are well known, and we will therefore only consider the former case, which we see as of particular relevance for middle-income developing countries and for transition countries.

The IMF and the World Bank have advocated that developing countries, in fact even the least developed countries, should reduce border taxes in favour of increasing consumption taxes like VAT. These recommendations have been supported by Keen and Ligthart (2002), but have been strongly criticised by Emran and Stiglitz (2002, 2003). They point out that Keen and Ligthart's analytical results critically depend on their (implicit) assumption that there is no informal sector in the economy, where in fact in developing countries and transition countries the informal sector, in general, is large.

The results of our analysis are largely consistent with Emran and Stiglitz's criticism. The least developed countries may not benefit from the introduction of domestic taxes, as the administrative

[9] This follows simply from the fact that the first tax-tariff structure allows more choice in terms of tax instruments than the second, and the second more than the third.

costs may outweigh the allocational benefits. Even when developing countries benefit from the introduction of a VAT, they should not give up the use of border taxes entirely; if the degree of complementarity between the import goods and the untaxed use of the primary factor in the informal sector differs, then levying tariffs makes it possible to tax these resources indirectly, thus alleviating the distortion implied by the partial coverage of the VAT. However, our analysis also provides some support to the proposition by Keen and Ligthart. Although it may not be desirable entirely to replace border taxes, developing countries are likely, as their administrative infrastructure improves, at a certain stage of their development to benefit from a tax-tariff reform that reduces border taxes and introduces a broad-based consumer tax system such as a VAT.

5. Concluding remarks

That different tax structures are associated with differences in administrative costs are seldom explicitly represented in optimal tax models. However, as the present analysis demonstrates, taking these costs into account may justify policies, notably trade policies, which governments in transition and less developed countries typically want to pursue, and which all developed countries have pursued at earlier stages of their development, although they create productive inefficiencies.

The analysis also has important bearing on the discussion of the fairness of symmetric commitments in international trade negotiations. Whereas the analysis suggests that for highly developed countries adopting free trade is likely to enhance social welfare, the analysis also suggests that for countries in transition, and in particular for less developed countries to be obliged to adopt free trade may be associated with a loss of social welfare. Extending the scope of the analysis to take into account also distributional considerations is likely to reinforce this conclusion. Highly developed countries, in general, are much better equipped than less developed countries to deal with the income distributional problems created when in the process of economic development, or because of opening up to international trade, industries, such as agriculture, coal, steel and textile, come under pressure. They in general dispose over transfer instruments which are far more efficient in achieving distributional objectives, but which on the other hand requires such administrative sophistication, that they are not relevant for developing countries.

In order in practice to establish desirable direction of tax-tariff reform a complex trade-off between at least the three main objectives that in general guide government policies need to be taken into account: i.e. to minimise the costs of raising government revenue, to redistribute income, and to limit administrative costs. There is therefore, a limited scope for what advice can be deduced only based on theoretical analysis. A more promising avenue for providing advice on coordinated tax-tariff reform in practice is to use CGE models, taking into consideration the insight, which may be obtained through theoretical analysis. It is an approach advocated and already pursues by Anderson (1999, 2002) and others. It is, however, important in this context to emphasise that these models should be based not only on the data normally required to their calibration, but also on data on the administrative costs of alternative tax structures.

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