1.9. 2004

Tax-tariff reform with costs of tax administration

by

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Introduction

In a seminal 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 considering that production efficiency will not necessarily be desirable if certain tax instruments cannot be used.

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. As a corollary to the Diamond-Mirrlees (1971) production efficiency theorem it follows 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), but equally it follows from the Stiglitz and Dasgupta (1971) analysis that free trade in general is not desirable if all tax instruments cannot costlessly be set at their optimal level. However, this latter implication has been explored very little, except for the polar case when only border taxes are feasible, may be partly because Dasgupta and Stiglitz provided no rationale why certain taxes could not be used. 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, in general a proportional tariff system, and thus productive efficiency, is not desirable.

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 this work has been done within a framework where free trade would be the ultimate aim of such reform. As Keen and Ligthart (2002) has pointed out, this literature is thus of limited relevance for identifying desirable directions of tax-tariff reforms when the set of feasible tax instruments are restricted. In the same vein, Emran and Stiglitz (2002, 2003) has argued that traditional theory - with its implication that free trade is always desirable - cannot be used as the basis for providing policy advice to developing and transition countries on tax-tariff reform. In particular, they have criticised the IMF and the World Bank recommendation to reduce trade taxes and increase consumption taxes like VAT, as likely to decrease welfare in developing countries with large informal sectors. At the IIPF conference in Prague 2003, Stiglitz in his key note speech called for the development of optimal tax theory more relevant for developing countries than the existing theory.

The present paper addresses this challenge by analysing the optimal tax-tariff system under different assumptions about the costs of tax administration and desirable directions of tax-tariff reform in response to changes in the relative importance of these costs. It provides an intuitive interpretation of what determines the optimal tax system under alternative assumptions about which tax instruments are feasible and identifies desirable directions of tax reform for countries at different stages of development based on the assumption that the relative importance of administrative costs for the design of tax-tariff systems declines with increasing level of economic development.

The paper is structured as follows. In Section 2, we set out the model framework. In Section 3 the optimal tax systems for four different tax structures are characterised. On this basis, in Section 4, we identify desirable directions of coordinated tax-tariff reforms in response to improvement in administrative infrastructure and consider the merits of the Emran-Stiglitz criticism of the IMF and World Bank recommendation with respect tax-tariff reform in developing countries. Section 5 concludes.

1. The model

We consider a small open economy comprising one representative household[1], three perfectly competitive production sectors, and a government. There is 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. Hence, the economy will specialise in the production of commodity 1, which thus becomes the export good, while commodities 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

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

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

[1] The analysis thus ignores distributional considerations. This facilitates the exposition, but naturally distributional considerations would have to be taken into account in order to make the analysis relevant as a basis for providing specific policy recommendations.

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

informal sector of the economy, is thus $\omega_0 + x_0$.[3] The preferences of the household are represented by the expenditure function, $E(\mathbf{q},u)$, defined over household prices, $\mathbf{q}$, and utility, u. The household's net demands are given by[4]

$$x_i = E_i(\mathbf{q},u) \qquad i = 0,1,2,3 \tag{3}$$

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[5]

$$T_i \equiv \left(t_i + p_i\right)/p_i = \overline{T}_i\ , \qquad i = 0,1,2,3$$

and on tariffs as

$$T_i^W \equiv \left(t_i^w + p_i^w\right)/p_i^w = \overline{T}_i^W, \qquad i = 1,2,3$$

We define a *tax-tariff system* as $\left(\mathbf{t},\mathbf{t}^W\right)$ and a *tax-tariff structure j,* Ξ^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, $B\left(\Xi^j\right)$. The set of tax-tariff structures is assumed finite. We assume for the sake of exposition that the government considers only four different tax structures:

Ξ^1: no tax-tariff restrictions;
Ξ^2: only border taxes and a tax on the primary factor are feasible , i.e. $\overline{T}_i = 1, i = 1,2,3$[6];
Ξ^3: only border taxes are feasible, i.e. $\overline{T}_i = 1, i = 0,1,2,3$;
and
Ξ^4: only border taxes at uniform rate are feasible, i.e. $\overline{T}_i = 1, i = 0,1,2,3, T_1^W = 1$, $T_i^W = \overline{T}_i^W\ i = 2,3$.

[3] We disregard the possibility of intermediate consumption, in particular that the goods produced in the informal sector are used as input in the formal sector.

[4] We utilize the derivative notation writing $E_i \equiv \dfrac{\partial E}{\partial q_i}$, $i = 0,1,2,3$, and $E_{ij} \equiv \dfrac{\partial^2 E}{\partial q_i\, \partial q_j}$, $i, j = 0,1,2,3$

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

[6] 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 requirement is

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

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

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

Material balance requires

$$y_0 \;=\; x_0 + x_0^G \tag{7}$$

$$y_1 + y_1^W \;=\; x_1 \;\; + x_1^G \tag{8}$$

$$y_i^W \;=\; x_i \;+ x_i^G \qquad i = 2,3 \tag{9}$$

Substituting by (1) in (8), and by (3) and (5) in (7),(8) and (9), and subsequently substituting for y_0 by (7) in (8), we obtain

$$y_1^W \;=\; a_0\left[E_0\left(\mathbf{q},u\right) + x_0^G\left(\Xi^j\right)\right] + E_1\left(\mathbf{q},u\right) + x_1^G\left(\Xi^j\right) \tag{10}$$

$$y_i^W \;=\; E_i\left(\mathbf{q},u\right) + x_i^G\left(\Xi^j\right) \qquad i = 2,3 \tag{11}$$

As a matter of normalisation, we assume 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.

Finally, we substitute (10) and (11) into the balance of trade constraint (4) and into the government's budget constraint (6). 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 may then be expressed as follows (see Dixit and Munk 1977).[7]

$$\mathrm{E}(\mathbf{q},u) \le 0 \tag{12}$$

$$p_1^{\mathrm{W}}\left[a_0\left[E_0\left(\mathbf{q},u\right) + x_0^G\left(\Xi^j\right)\right] + E_1\left(\mathbf{q},u\right) + x_1^G\left(\Xi^j\right)\right] + \sum_{i\in 2,3} p_{\mathrm{i}}^{\mathrm{W}}\left[E_i\left(\mathbf{q},u\right) + x_i^G\left(\Xi^j\right)\right] \ge 0 \tag{13}$$

[7] The first equation (12) assures the value of compensated demand is consistent with the household's lump-sum income, the second equation (13) represents the balance of trade constraint, and the third (14) the government's budget constraint. The conditions for utility maximisation, profit maximisation and material balance are represented by these three equations (see also Diamond and McFadden 1974).

$$\sum_{\mathrm{i}=0,1,2,3} t_i E_{\mathrm{i}}\left(\mathbf{q},u\right)+t_1^{\mathrm{W}}\left[a_0\left(E_0\left(\mathbf{q},u\right)+x_0^G\left(\Xi^j\right)\right)+E_1\left(\mathbf{q},u\right)+x_1^G\left(\Xi^j\right)\right]\geq 0$$
$$+\sum_{i=2,3} t_{\mathrm{i}}^{\mathrm{W}}\left[E_i\left(\mathbf{q},u\right)+x_i^G\left(\Xi^j\right)\right]-p_0 x_0^G\left(\Xi^j\right)-\sum_{i=1,2,3} p_i x_i^G\left(\Xi^j\right)\geq 0 \qquad (14)$$

where $p_{\mathrm{i}}=p_{\mathrm{i}}^W+t_{\mathrm{i}}^W$, (i=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 (13) or (14). Looking at (12) and (13) we see that under Ξ^2 and Ξ^3, we can without loss of generality assume that exports are untaxed, and under Ξ^1 in addition that the domestic consumption of the export good is untaxed.[8]

The government is assumed to maximise social welfare, u, subject to (12) and (14) in a two-step procedure: First, it calculates the *optimal tax system* for each tax structure; then, in the second step, based on the results of the first step, it chooses the *optimal tax structure*, Ξ^*, 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 in that different tax structures are associated with different administrative costs.

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

No restrictions

We first characterise the optimal tax-tariff system under the unconstrained tax-tariff structure, Ξ^1. Assuming, as a matter of 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 expressed as

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[8] Substituting by $q_0=a_0T_0\,T_1^W p_1^W$ and $q_i=T_iT_i^W p_i^W,\left(i=1,2,3\right)$, (12) and (13) may be rewritten

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

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.

$$L = u + \mu(-E) + \lambda\left(\sum_{i=0,2,3} t_i E_i + \sum_{i=2,3} t_i^W \left(E_i + x_i^G\right) - p_0 x_0^G - \sum_{i=1,2,3} \left(p_i^W + t_i^W\right) x_i^G \right) \quad (15)$$

The first order conditions with respect to domestic taxes, t_k, are

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

and with respect to tariff rates, t_k^w,

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

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

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 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 :

Objective 1: maintaining the first-best pattern of consumption of the produced commodities,
Objective 2: discouraging 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) [9] by

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

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. This is an intuitive explanation why border taxes are not relevant to the solution of the government's maximization problem.

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

From an allocative point of view, i.e. disregarding administrative costs, the tax structure, Ξ^1, is clearly the optimal tax structure, as the optimal tax system associated with this tax structure is subject to fewer constraints than the other tax structures. However, the tax structure Ξ^1 requires monitoring of the 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 Ξ^1 may not be the optimal tax structure when both administrative and distortionary costs are taken into account.

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.

As in the case of unconstrained taxation, Ξ^1, we assume , as a matter of normalisation, that the export of commodity 1 is untaxed, i.e. $t_1^{\mathrm{W}} = 0$. 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

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

$$-\mu E_j + \lambda\left(t_0 E_{0j} + E_j + \sum_{i\in(2,3)} t_i^W E_{ij}\right) = 0 \qquad j = 2,3 \tag{19}$$

Although it is feasible for the government to finance its resource requirement using only the domestic tax and thus maintaining production efficiency, this is not the optimal solution. The government can increase welfare by using tariffs to discourage the untaxed use of the primary factor in the informal sector. The optimal tariff structure will thus be determined as a compromise between the same two objectives, which in the previous case determine the optimal commodity tax structure. As the domestic taxes under Ξ^2 cannot be manipulated to discourage the use of the primary factor in the formal sector, tariffs are instead used to achieve this objective, however potentially at larger costs because also production decisions may be distorted.

The use of tariffs involves monitoring far fewer market transactions than the use of differentiated consumer taxes; the administrative costs associated with the tax-tariff structure, Ξ^2, $B\left(\Xi^2\right)$, are therefore likely to be smaller than those associated with the unconstrained tax-tariff structure, 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. 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. On the other hand, 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. In this case, which tax structure is the optimal cannot be determined on theoretical grounds alone.

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.

A proportional tariff structure

$$T_i^W \equiv \left(t_i^w + p_i^w\right) / \, p_i^w = T^W , \qquad i = 1,2,3$$

generates no revenue. We may therefore as a matter of normalisation assume that exports are untaxed. With the tariff structure, Ξ^3, both the non-market use of the primary factor and the domestic consumption of the export good[10] will thus be encouraged compared with the first-best allocation. In the absence of domestic taxes, the government uses tariffs not only to generate tax revenue, but also to discourage the consumption of the export good and the use of the primary factor in the informal sector. The optimal tariff system may thus be interpreted as a compromise between 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.

i.e. in addition to the two objectives considered in the previous cases also the *Objective 3*

Transforming the first order conditions, we may derive tax formulae which clearly bring out these trade-offs.

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

$$-\mu E_j + \lambda\left(E_j + \sum_{i=2,3} t_i^W E_{ij}^h\right) = 0 \qquad j = 2,3 \qquad (20)$$

Solving for the optimal tariffs using the symmetry of the Slutsky matrix we have

[10] As pointed out by Hatta and Ogawa (2003), there is an analogy to the rationale to tax commodities at a higher rate the more they are complementary to leisure.

$$t_2^W = \theta \frac{\left(-E_{33}E_2 + E_{23}E_3\right)}{D} \tag{21}$$

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

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

Defining compensated price elasticities as $\varepsilon_{ij} \equiv E_{ij} \Big/ \frac{x_i}{q_j}$, $(i, j = 0,1,2,3)$, (21) and (22) may be transformed into

$$\frac{t_2^W}{q_2} = \theta \frac{\left(\varepsilon_{23} - \varepsilon_{33}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} \tag{23}$$

$$\frac{t_3^W}{q_3} = \theta \frac{\left(\varepsilon_{32} - \varepsilon_{22}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} \tag{24}$$

By the homogeneity of degree zero of the compensated demand functions, $E_i(\mathbf{q}, u)$, $(i = 0,1,2,3)$, we have that $\sum_{j=0,1,2,3} \varepsilon_{ij}$,$(i = 0,1,2,3)$, 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)

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

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

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

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 $\left(s_1\sigma_{31} + s_0\sigma_{30}\right)$- $\left(s_1\sigma_{21} + s_0\sigma_{20}\right)$ (Objective 2 and 3). For a given value of σ_{23}, the difference in the tax rates will be greater, the greater the numerical value of $\left(s_1\sigma_{31} + s_0\sigma_{30}\right)$- $\left(s_1\sigma_{21} + s_0\sigma_{20}\right)$; and for a given value of $\left(s_1\sigma_{31} + s_0\sigma_{30}\right)$- $\left(s_1\sigma_{21} + s_0\sigma_{20}\right)$ the difference will be the smaller the greater σ_{23} is (Objective 1).

Objective 2 and 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).

Compared with the optimal tax-tariff system obtained under the two previous tax structures, the optimal solution for this tax structure represents 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, $B\left(\Xi^3\right)$, 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.

Only uniform tariff

Under Ξ^4, assuming as a matter of normalisation that exports are untaxed, only one tax-tariff system is feasible. This tax-tariff structure implies greater distortionary costs than for the other tax-tariff structures, in particular than a differentiated tariff system. However, by the same token this tax-tariff structure is like to be associated with the smallest administrative costs since only foreign transactions are taxed and at a the same rate.

Ranking of tax-tariff systems disregarding administrative costs

Writing $W\left(\Xi^j\right)$ as the maximum social welfare associated with the tax-tariff structure j disregarding administrative costs, we have

$$W\left(\Xi^1\right) \geq W\left(\Xi^2\right) \geq W\left(\Xi^3\right) \geq W\left(\Xi^4\right)$$

since $W\left(\Xi^j\right)$ is by general rules of optimisation non-increasing in the number of tax-tariff instruments available to the government.

3. Tax-tariffs reform in the process of economic development

In the previous section, we considered what constitutes the optimal tax-tariff system for different tax-tariff structures. We now turn to the question of what constitutes desirable directions of tax-tariff reform at different levels of economic development. We combine the results derived so far with three hypotheses:

Hypothesis 1: The administrative costs are increasing with the differentiation of the tax-tariff structure i.e.

$$B\left(\Xi^1\right) \geq B\left(\Xi^2\right) \geq B\left(\Xi^3\right) \geq B\left(\Xi^4\right)$$

Hypothesis 2: The relative costs of tax administration decrease with increasing levels of economic development.

Hypothesis 3: The relative size of the informal sector decreases with increasing levels of economic development

The first hypothesis is based on the assumption that the more transactions have to be monitored separately for tax purposes the larger the administrative costs. In general, in any given country, more domestic transactions than foreign transactions take place. Hence, taxing all domestic transactions is generally more costly than taxing all foreign transactions. Furthermore, taxing all transactions at the same rate is less costly than taxing transactions in different commodities at different rates.

The last two hypotheses are linked to the more basic assumption that developed countries have a comparative advantage in public administration compared to developing countries. Empirical evidence seem to support this assumption (see for example the World Bank Report 1988).

From Hypothesis 1 it follows that there is a trade-off between allocative efficiency and administrative costs: the more efficient the tax-tariff structure in terms of social welfare, the greater the administrative cost. Hypothesis 2 implies that, in the process of economic development, this trade-off shifts in favour of more efficient tax-tariff structures. Hypothesis 3 implies that the benefit from a differentiating tax or tariff rates in order indirectly to tax the (otherwise untaxed) use of primary factors in the informal sector will decrease with economic development.

One may expect the development of the optimal tax-tariff system to be a continuous process reflecting that economic development is also a continuous process. However, an important implication of our analysis is that even if the underlying process of economic development is continuous, then the optimal tax-tariff system will go through transition phases with discrete and significant changes in tax rates, and only between these phases will the development of tax and tariff rates be incremental. An important implication of this is that during these periods of transition where drastic adjustment of the tax system is required, there will be a particularly strong need for technical advice on how to implement the appropriate tax-tariff reform.

It follows from Hypotheses 1 and 2 that the optimal tax-tariff structure will shift from Ξ^4 to Ξ^3, and then to Ξ^2 and finally to Ξ^1 in the process of economic development (assuming that Ξ^4 will be the optimal tax-tariff structure at the lowest level of development and Ξ^1 at the highest level of development). We now identify desirable directions of tax-tariff reform in each of these transitional phases.

The first transition takes place as the administrative infrastructure improves in developing countries to the point where the differentiation of the tariff rates become desirable in order to discourage the

consumption of those commodities which are complementary with the use of resources in the informal sector and the domestic consumption of the export good.

The second transition takes place when it becomes desirable to finance government expenditures by an uniform domestic tax leaving the role of border taxes to discourage the use of resources in the informal sector.

The third transition involves the adoption of free trade as it becomes desirable to differentiate domestic tax rates to balance the objective of maintaining the pattern of first best consumption of produced commodities with the objective of discouraging the use of resources in the informal sector (leisure).

Table 1 below summarises optimal tax-tariff structures for countries at different levels of economic development. For the sake of exposition we have defined *least developed countries, other developing countries, middle income countries* and *mature market economies* as countries where Ξ^4, Ξ^3, Ξ^2 Ξ^1, respectively, constitute the optimal tax structure.

Table 1: Level of development and optimal tax-tariff system

	Share of informal sector	**Efficiency of tax administration**	**Objective determining the optimal tariff system**	**Optimal tax-tariff structure**
Least developed countries	Very high	Very low	None	Uniform tariff rate: Ξ^4
Other developing countries	High	Low	Reduce the use of resources in informal sector Reduce the consumption of the export commodity	Border taxes: Ξ^3
Middle income countries	Medium	Medium	Reduce the use of resources in informal sector	Border taxes +VAT: Ξ^2
Mature market economies	Small	High	None*	Differentiated domestic taxes Ξ^1

*The objective of reducing the untaxed use of primary factors is achieved through the domestic tax system.

The IMF and the World Bank have advocated that developing countries, in fact even the least developed countries, should adopt tax-tariff reforms that 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 developing countries are characterised by having relatively large informal sectors.

The results of our analysis are largely consistent with Emran and Stiglitz's criticism. First, the least developed countries may not benefit from the introduction of domestic taxes, as the administrative costs may outweigh the allocational benefits. Second, it is unlikely to be in the interest of developing and transition countries to give up the use of border taxes entirely. This is true even though, at a certain stage of their development, they will benefit from a tax-tariff reform that reduces border taxes and introduces a broad-based tax system such as a VAT. If the degree of complementarity between the import goods and the untaxed use of the primary factors in the informal sector differs, then levying tariffs makes it possible to tax the use of resources in the informal sector indirectly, thus alleviating the distortion implied by the partial coverage of the VAT.

Finally, taking into account distributional considerations, which we otherwise in this paper as Keen and Ligthart (2002) as Emran and Stiglitz (2002, 2003), has disregarded further reinforces the rationale for using border taxes to supplement a VAT system, as they make it possible to achieve distributional objectives that cannot be achieved by a VAT system.

4. Concluding remarks

In optimal tax models, that different tax structures are associated with differences in administrative costs is seldom explicitly represented. 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 interfere with free trade.

Furthermore, the analysis has important implications for the discussion of the fairness of symmetric commitments in international trade negotiations. Although free trade is likely to enhance social welfare for highly developed countries, obliging countries in transition, and in particular less developed countries, to adopt free trade may be associated with a significant loss of social welfare. Extending the scope of the analysis to take into account also distributional considerations reinforces this conclusion. When industries, such as agriculture, coal, steel and textile, come under pressure in the process of economic development, or because of opening up to international trade, this creates important income distributional problems. In general, highly developed countries are much better equipped to deal with these problems than less developed countries. Precisely due to their higher level of development, they are able to put in place and enforce tax systems, which are typically far more efficient at achieving distributional objectives.

In order to establish desirable directions of tax-tariff reform in practice, a complex trade-off between at different objectives need to be taken into account. This paper has highlighted the trade-off between the objective to achieve allocative efficiency, and the objective to limit administrative costs. The paper has also highlighted the limited scope for basing advice on theoretical analysis only. A more promising avenue for providing advice on coordinated tax-tariff reform in practice is to use Computable General Equilibrium (CGE) models, taking into consideration the insights which may be obtained through theoretical analysis. It is an approach advocated and already pursued by Anderson (1999, 2002) and others. However, in this context it is important to emphasise that these models should be based not only on the data on production and consumer behaviour normally required to their calibration, but also on data on the administrative costs of alternative tax structures.

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