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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, the theorem does not hold when taxation is associated with administrative costs. The present paper explores the implications of taking into account the costs of tax administration for optimal taxation and for desirable directions of tax-tariff reform in countries at different levels of economic development. The paper clarifies the reasons for, and lends support to, the criticism by Stiglitz (2003) of the IMF and the World Bank's recommendation to developing countries to adopt VAT to replace border taxes.

Keywords: Optimal taxation, optimal trade policy, VAT, tax-tariff reform, costs of tax administration, informal sector, developing countries

JEL classification codes: F11, F13, H21

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1. 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. It is a corollary to the Diamond-Mirrlees (1971) production efficiency theorem that, in a small open economy, it is optimal 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). On the other hand, it also follows from Stiglitz and Dasgupta's analysis that free trade is in general not desirable if all tax instruments cannot be set costlessly at their optimal level. This latter implication was explored by Dasgupta and Stiglitz (1974) and by Heady and Mitra (1982, 1987). Heady and Mitra identified the assumption that tax restrictions are exogenously given (as in Stiglitz and Dasgupta 1971 and Munk 1980) as unattractive, and already in 1982 suggested as a priority for future research the development of a theory of costly administration, which would permit an endogenous choice of tax restrictions. However, although the importance of administrative costs has been widely recognised, little progress has been made to incorporate administrative costs into the theory of optimal taxation.

There is a considerable literature on desirable directions of tariff reform. Hatta (1977) analysed the welfare effects of tariff reform when changes in government tax revenue are balanced by changes in lump-sum transfers. Subsequent contributions (see for example Diewert, Turunen-Red, and Woodland 1989) took into account that the revenue forgone by tariff reductions has to be replaced by tax revenue generated by other distortionary taxes. However, in general, this work has been done within a framework where free trade would be the ultimate aim of tax reform. As Keen and Ligthart (2002) have pointed out, this literature is thus of limited relevance for identifying desirable directions of tax-tariff reforms when the conditions for free trade to be desirable are not satisfied. In the same vein, Emran and Stiglitz (2005) have argued that traditional theory - with its assumption that all market transactions can be taxed at no cost - cannot be used as the basis for providing policy advice on tax-tariff reform in developing and transition countries. In particular, they have criticised the IMF and the World Bank recommendation to reduce trade taxes and increase consumption taxes, such as VAT, as likely to decrease rather than increase welfare in developing countries with large informal sectors.

The present paper addresses the challenge of developing a theory of optimal taxation which permits the government's choice of tax restriction to be endogenously determined. A critical element in this endeavour is the formulation of assumptions that associate different tax structures with different administrative costs. The analysis thereby provides a framework for gaining insight into how the optimal tax-tariff system in the course of economic development changes in response to reductions in the relative costs of tax administration. [1] This, in turn, provides the basis for evaluating tax-tariff reform in general and, more specifically, the above mentioned criticism by Emran and Stiglitz (2005). They emphasise the importance of administrative costs, but employ a model without the representation of these costs. The present analysis may thus be seen as an articulation of the assumptions on which their analysis is implicitly based.

[1] The paper thus responds to the challenge to develop optimal tax theory to be of greater relevance for developing countries, addressed to the profession by Joe Stiglitz in 2003 at the IIPF Congress in Prague.

The paper is structured as follows. Section 2 briefly reviews the empirical evidence on costs of tax administration and specifies simplifying assumptions for the subsequent analysis. In Section 3, the government's maximisation problem is formulated taking administrative costs into account, and in Section 4, the optimal tax system is derived and characterised for four different tax structures. On this basis, in Section 5, desirable directions of coordinated tax-tariff reforms in response to improvement in administrative infrastructure are identified, and the policy implications discussed. Section 6 summarises and concludes.

2. Administrative costs of tax administration

Empirical research on the existence and impact of the operating costs of taxation has flourished in recent years. Although still lacking in a number of respects this research makes it possible to draw some definite conclusions. Evans (2003) reports, based on a review of a large number of studies, government costs of tax collection and enforcement in the order of 1%, and private costs of tax compliance of 3-10% of the tax revenue. Furthermore, he finds that taxing domestic transactions in general is more costly than taxing border transactions. The OECD (2004) has undertaken a major study of the costs of tax administration in the OECD countries which also suggests that tax administration is associated with significant costs. Bird (2005) has reviewed the lessons from the experience with VAT in developing and transition countries. Overall, he finds that there is surprisingly little solid empirical knowledge of some critical factors, and that the relevant economic theory remains sketchy[2], but based on case studies he identifies a number of particular problems facing developing countries with respect to VAT design and administration which suggest that the costs of tax administration are of relative greater importance in developing than in developed countries. This is consistent with conclusions reached in a previous study by the World Bank (1988).

In order to incorporate the basic insights from the empirical studies into the theory of optimal taxation, we employ the following conceptual framework: a *tax-tariff system,* $\boldsymbol{\tau}$, is defined as the values of all tax instruments, and a *tax-tariff structure j,* is defined as the set of tax-tariff systems, $\boldsymbol{\tau} \in \boldsymbol{\Xi}^j$, which are subjected to the same restrictions. Governments are assumed to consider four different tax structures:

$\boldsymbol{\Xi}^1$: no tax-tariff restrictions;
$\boldsymbol{\Xi}^2$: only a primary factor tax and border taxes are feasible;
$\boldsymbol{\Xi}^3$: only border taxes are feasible; and
$\boldsymbol{\Xi}^4$: only import tariffs at a uniform rate are feasible.

Using this conceptual framework, we make the following simplifying assumptions:

A1: The costs of tax administration associated with a tax-tariff system, $\boldsymbol{\tau}$, belonging to the tax structure j, i.e. $\boldsymbol{\tau} \in \boldsymbol{\Xi}^j$, at the level of economic development d, are equal to $B(j,d)$.

The administrative costs thus only depend of the *tax structure* and *the level of development*, and not on the *level* of *taxation*. This assumption is crucial in order to simplify the analysis. It implies that the cost of increasing tax revenue is only due to increasing distortionary costs, except in the rare

[2] Bird quotes Laffont (2004) for making similar observations with respect to public utility regulation in developing and transition countries.

cases where such changes produce a shift in the optimal tax-tariff structure and thus change the administrative costs.[3]

A2: The costs of tax administration for the tax structure *j*, $B(j,d)$, decrease in relative importance with increasing levels of economic development, d.

Economic development improves the comparative advantage of information processing such as tax administration. It also increases the relative size of the public sector, thus increasing the marginal distortionary costs of raising government revenue. For both reasons, the administrative costs of taxation decrease in importance relative to the distortionary costs.

A3: The costs of tax administration at the level of economic development *d*, $B(j,d)$, increase with the number of transactions subject to taxation and with the number of different tax rates allowed under the tax-tariff structure *j*.[4]

The administrative costs associated with collecting the same revenue using border taxes will in general be smaller than when using domestic taxes because the size of each transaction is larger and the number of transactions thus smaller, and because the number of collection points is smaller. Furthermore, for a given set of transactions subjected to taxation, different tax rates complicate compliance by firms, and also tax collection and enforcement by the government. Both domestic taxes and border taxes at uniform rates will therefore in general be associated with smaller administrative costs than a corresponding tax structure with different rates.

3. The model

Adopting a simplified version of the theoretical framework of Dasgupta and Stiglitz (1974) and Heady and Mitra (1982, 1987) [5], we consider the problem of optimal taxation in a small open economy with one representative household, three perfectly competitive production sectors, and a government. In the economy there is one primary factor, indexed *0*, and three tradable commodities, indexed (*1,2,3*). The government imposes border taxes, $\mathbf{t}^{W} \equiv (t_1^W, t_2^W, t_3^W)$, and household taxes $\mathbf{t} = (t_0, t_1, t_2, t_3)$. World market prices are $\mathbf{p}^W \equiv (p_1^W, p_2^W, p_3^W)$, producer prices are $\mathbf{p} \equiv (p_0, p_1, p_2, p_3) = (p_0, p_1^W + t_1^W, p_2^W + t_2^W, p_3^W + t_3^W)$, and household prices are $\mathbf{q} \equiv (q_0, q_1, q_2, q_3) = (p_0 + t_0, p_1 + t_1, p_2 + t_2, p_3 + t_3)$.

[3] We recognise that this assumption represents a gross simplification of reality. Increasing the level of taxation will strengthen households' incentive to cheat and thus the justification of the government to use resources to discourage such cheating. In the concluding section, where we discuss the policy implications of our theoretical results, we therefore consider how taking tax evasion into account would modify our conclusions. However, it represents an increase in realisme compared with the standard theory of optimal taxation which also abstracts from tax evasion.

[4] A2 and A3 are key assumptions in the analysis of Kimbrough and Gardner (1992), who use a public finance model to explain the change in the relative role of tariffs and other taxes in the history of the US (see also Section 5).

[5] Dasgupta and Stiglitz (1974) and Heady and Mitra (1982, 1987) consider an economy with more than one primary factor. The reason why we adopt the rather restrictive assumption of only one primary factor is to be able to interpret our results drawing on the insight provided by the standard theory of optimal taxation. Expanding the model to represent more than one primary factor would make producer prices endogenous. With tax restrictions the trade-off between differential factor taxes (creating production inefficiency) and administrative costs would also have to be considered. We have analysed this trade-off elsewhere (see Munk 1980 and 1998), and incorporating it here would complicate the exposition without contributing much to achieving the objectives of the paper as formulated in Section 1.

The economy has the potential to produce any of the three commodities using only the primary factor as input. However, as the production structure exhibits constant returns to scale the economy will specialise in the production of one commodity which thus become the export good. The output of the export sector is y_k, and the use of the primary factor for its production is y_0.[6] The production function for the export sector is

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

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

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

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 informal sector of the economy, is thus $\omega_0 + x_0$.[7] 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 household's net demands are given by[8]

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

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 systems, $\boldsymbol{\tau} \equiv \left(\mathbf{t}, \mathbf{t}^W\right)$, is, as mentioned above, constrained to be element in the tax structures $\boldsymbol{\Xi}^j$, $j = 1,2,3,4$. We can now define these tax structures by *tax-tariff restrictions*, for domestic tax rates as $T_i \equiv \left(t_i + p_i\right)/\, p_i = \overline{T}_i$, $(i = 0,1,2,3)$ and for border taxes as $T_i^W \equiv \left(t_i^w + p_i^w\right)/\, p_i^w = \overline{T}_i^W$, $(i = 1,2,3)$.[9]

Since the administrative costs for all tax-tariff systems belonging to the tax-tariff structure *j* at the level of development *j* are $B\left(j,d\right)$, and the government's resource requirement for other expenditures than tax administration is assumed exogenously given, the government's total resource requirement is

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

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[6] The sign conventions are: $y_0 < 0$ and $y_i > 0$; $x_0 < 0$ and $x_i > 0$ $\left(\text{i}=1,2,3\right)$; $y_i^W < 0$ if i is an export and $y_i^W > 0$ if it is an import. Thus for the primary factor tax and the export tax, respectively, to generate a positive tax revenue, the tax rates must be negative. Thus if $t_i^W > 0$ (< 0) and $y_1^W > 0$ then commodity i is subject to an import tax (subsidy), and if $y_1^W < 0$ then it is subject to a export subsidy (tax).

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

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

[9] 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.

We assume that $x_i^G(j,d)$ is not influenced by changes in producer and consumer prices.[10]

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

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

Material balance requires

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

$$y_k + y_k^W = x_k + x_k^G \tag{8}$$

$$y_i^W = x_i + x_i^G \qquad i \neq 0,k \tag{9}$$

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), yields

$$y_k^W = a_0\left[E_0(\mathbf{q},u) + x_0^G(j,d)\right] + E_k(\mathbf{q},u) + x_k^G(j,d) \tag{10}$$

$$y_i^W = E_i(\mathbf{q},u) + x_i^G(j,d) \qquad i \neq 0,k \tag{11}$$

World market prices, $\mathbf{p}^W \equiv (p_1^W, p_2^W, p_3^W)$, are exogenously determined, and the producer price of the primary factor, p_0, is fixed as a matter normalisation without loss of generality.

Finally, we substitute (10) and (11) into the balance of trade constraint, (4), and into the government's budget constraint, (6). Adopting an approach similar to that used in Dixit and Munk (1977),[11] the conditions for a tax system, $(\mathbf{t},\mathbf{t}^W) \in \Xi^j$, to be feasible may then be expressed as

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

$$p_k^W\left[a_0\left[E_0(\mathbf{q},u) + x_0^G(j,d)\right] + E_k(\mathbf{q},u) + x_k^G(j,d)\right] + \sum_{i\neq k} p_i^W\left[E_i(\mathbf{q},u) + x_i^G(j,d)\right] \geq 0 \tag{13}$$

$$\sum_{i=0,1,2,3} t_i E_i(\mathbf{q},u) + t_k^W\left[a_0\left(E_0(\mathbf{q},u) + x_0^G(j,d)\right) + E_k(\mathbf{q},u) + x_k^G(j,d)\right]$$
$$+ \sum_{i\neq k} t_i^W\left[E_i(\mathbf{q},u) + x_i^G(j,d)\right] - p_0 x_0^G(j,d) - \sum_{i=0,1,2,3} p_i x_i^G(j,d) \geq 0 \tag{14}$$

where $\mathbf{p} = \mathbf{t}^W + \mathbf{p}^W$ and $\mathbf{q} = \mathbf{t} + \mathbf{p}$, and where *k* is the export good.

As the question of which trade flows can be assumed untaxed without loss of generality is more complex as it may seem, we spell out the normalisation rules we adopt[12]. By Walras' law, an equilibrium solution can be found disregarding either (13) or (14), and the condition for equilibrium

[10] This is not an entirely innocent assumption, as it implies that a renormalisation, which makes one commodity rather than another untaxed, does not change the amount of resources required for tax administration.

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

[12] See also footnote 15.

can thus be represented by (12) and (13). Substituting in (12) and (13) by $q_0 = a_0 T_0 T_k^W p_k^W$ and $q_i = T_i T_i^W p_i^W, (i = 1,2,3)$, the equilibrium conditions may thus be expressed as

$$E\left(a_0 T_0 T_k^W p_k^W, \left\{T_i T_i^W p_i^W, i \in (1,2,3)\right\}, u\right) \leq 0 \tag{15}$$

$$p_k^W \left[a_0 \left[E_0 \left(a_0 T_0 T_k^W p_k^W, \left\{T_i T_i^W p_i^W, i \in (1,2,3)\right\}, u\right) + x_0^G(j) \right] + E_k \left(a_0 T_0 T_k^W p_k^W, \left\{T_i T_i^W p_i^W, i \in (1,2,3)\right\}, u\right) + x_k^G(j) \right]$$

$$+ \sum_{i \neq k} p_i^W \left[E_i \left(a_0 T_0 T_k^W p_k^W, \left\{T_i T_i^W p_i^W, i \in (1,2,3)\right\}, u\right) + x_i^G(j) \right] \geq 0 \tag{16}$$

Producer prices are $p_0 = a_0 T_k^W p_k^W$ and $p_i = T_i^W p_i^W, (i = 1,2,3)$, and consumer prices are $q_0 = T_0 p_0$ and $q_i = T_i p_i, i = 1,2,3$. Multiplying T_i, (i=0,1,2,3) by a constant and/or T_i^W, (i=1,2,3) by another constant will not change demands and will thus leave the equilibrium conditions unaffected. In the case of the tax structure with no tax restriction, Ξ^1, both the vector of consumer prices, $\mathbf{q}$, and the vector of producer prices, $\mathbf{p}$, can therefore be normalised independently without loss of generality. In the case of tax structures where only VAT and border taxes are available, Ξ^2, the producer prices can be normalised independently of world market prices which is also the case when only border taxes are available, Ξ^3. For the proportional tariff structure, Ξ^4, the tax on the export good need to be fixed as a matter of normalisation. In all cases we assumed as a matter of normalisation without loss of generality that exports are untaxed, i.e. $t_k^W = 0$.

The government maximises social welfare, u, subject to the general equilibrium conditions as expressed by (12) and (14). The maximisation takes place in a two steps: First, the government for each tax structure Ξ^i, (i=1,2,..,4) identifies the optimal tax systems, $\boldsymbol{\tau}^{*i}$, and on basis of the corresponding values of social welfare chooses the optimal tax structure Ξ^*; then as the overall optimal tax system, $\boldsymbol{\tau}^*$, it chooses the tax system which is optimal for this tax structure. Administrative costs are thus exogenous to the choice of tax system for a given tax-tariff structure, but endogenous to the government's overall choice of tax system. The optimal tax structure may therefore change in response to changes in technology including the technology of tax administration.

4. 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. As a matter of normalisation both domestic consumption and the export of commodity *k* are assumed untaxed, i.e. $t_k = 0$ and $t_k^W = 0$ [13]. Hence, the Lagrangian expression corresponding to the

[13] Alternatively, the supply of the primary factor to the market may be assumed untaxed as a matter of normalisation without loss of generality. However, we assume exports untaxed as a matter of normalisation for two reasons. Firstly, because to assume the export good as untaxed both internally and at the border, is analytical convenient as otherwise two commodities would be affected by the normalisation, secondly, to make clear that the normalisation of consumer

government's optimization problem may be expressed as follows (leaving out arguments of functions for readability):

$$\mathrm{L} = u + \mu\left(-E\right) + \lambda\left(\sum_{\mathrm{i}=0,2,3} t_i E_{\mathrm{i}} + \sum_{\mathrm{i}\neq k} t_{\mathrm{i}}^{\mathrm{W}} \left(E_{\mathrm{i}} + x_i^G\right) - p_0 x_0^G - \sum_{\mathrm{i}=1,2,3} \left(p_i^W + t_{\mathrm{i}}^{\mathrm{W}}\right) x_i^G \right) \tag{17}$$

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

$$-\mu E_j + \lambda\left(\sum_{\mathrm{i}=0,2,3} t_i E_{ij} + E_j + \sum_{\mathrm{i}\neq k} t_i^W E_{ij} \right) = 0 \qquad i \neq k \tag{18}$$

and with respect to border taxes , t_j^w ,

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

If $t_i^w = 0,\ i = 1,2,3$, and if domestic taxes are set so that (18) is satisfied, then also (19) is satisfied. The optimal solution may thus be achieved using only domestic taxes, as may indeed be deduced directly from the Diamond and Mirrlees production efficiency theorem, interpreting the foreign sector as a production sector.

In order to illustrate how restrictions on the tax instruments available to the government may justify diversions from production efficiency, we provide in Appendix a quantitative example of the optimal tax system for a prototype developing country with a large informal sector (the share of the primary factor used in the informal sector, s_0, being ca 70%) and with three traded commodities: *Manufacturing, Cash crop* and *Food*, where manufacturing is the most and the consumption of food the least complementary with the use of *Labour* in the informal sector, as *Manufacturing* is used in the informal sector to produce food products which compete with *Food* produced in the formal sector At world market prices the economy is assumed to have a comparative advantage in *Food* production, but to be almost as competitive in the production of *Cash crop*.

Compared with the first-best allocation, any tax system implies that the untaxed use of the primary factor in the informal sector[14] is encouraged or, in other words, that the household's supply of the primary factor to the market is discouraged. Starting from a proportional tax system in terms of goods being produced or imported, it is therefore in general possible to alleviate the discouragement of the supply of the primary factor by differentiating the tax rates for the produced commodities (compare in Appendix, *Table 2, Column 2 and Column 3*). The optimal tax system may thus be interpreted as representing a trade-off between two objectives:

> ***Objective 1:*** To maintain the first-best pattern of consumption of produced and imported goods
>
> ***Objective 2:*** To discourage the untaxed use of the primary factor in the informal sector

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prices is not related to the behavioural assumption that the household's consumption of its endowment of the primary factor cannot be taxed.

[14] As we have assumed that the output from the informal sector is consumed only in the household sector, the untaxed use of the primary factor is equivalent to "leisure" in the standard optimal tax model.

Generally speaking, the optimal tax system (see Corlett and Hague 1953, Harberger 1974) will therefore be characterised by[15],

> 1) high rates of tax 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 in the informal sector; and b) the more the degree of complementarity differs between commodities being produced or being imported.

With the unconstrained tax-tariff structure, Ξ^1, household prices can be determined by the choice of domestic taxes irrespective of the level of border taxes. Distorting producer prices by using border taxes does therefore contribute to neither Objective 1 nor Objective 2. This provides an intuitive explanation of why border taxes are not relevant to the solution of the government's maximization problem. For the hypothetical economy considered, under the tax structure Ξ^1, the optimal tax system, $\boldsymbol{\tau}^{*1}$ involves $T_1 > T_2 > T_3$ whatever the normalisation rule adopted. Assuming the export good, food, to be untaxed as a matter of normalisation, domestic producer prices become the same as when government revenue is financed by lump sum taxation, i.e. $\left(p_1, p_2, p_3\right) = (1,1,1)$ (see Appendix, *Table 3, Column 3*).

As $\boldsymbol{\tau}^{*1} \in \Xi^j$, is subject to fewer constraints than the other tax structures, from a purely allocative point of view, i.e. disregarding administrative costs, it is clearly the overall optimal tax system. However, it requires monitoring domestic market transactions for each commodity separately. The administrative costs associated with Ξ^1 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 be financed only by border taxes 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 where $\overline{T_i} = 1, i = 1,2,3$ because we, as a matter of normalisation, have assumed $t_k = 0$. We also as a matter of

[15] There has in the literature been a considerable confusion with respect to the interpretation of the Corlett and Hague rule. The rule has been interpreted to imply that the commodity most complementary with the numeraire should be taxed at the highest rate which is only correct if the numeraire happens to be the commodity of which the household has an initial endowment. The confusion has arisen because of assumptions such as "labour is the untaxed numeraire" has been adopted without further justification. This has given rise to confusion between the assumption that the "market transactions of the primary factor (labour) is untaxed" (which may be considered a normalisation rule involving no loss of generality), and the assumption that "the household consumption of its primary factor endowment (of labour) cannot be taxed", (which imposes a restriction on the government's optimisation problem). Understanding the implication of this latter assumption is the key to the correct interpretation of the Corlett and Hague rule. That the optimal tax system involves higher taxes on those commodities which are complementary with the household consumption of "leisure" is thus not a consequence of the normalisation rule adopted (as claimed for example by Myles 1995, pp 123-124), but due to the fact that "leisure" (or in the terminology adopted in this paper the use of the primary factor within the informal sector) cannot be observed and therefore cannot be subjected to taxation directly.

normalisation assume $t_k^W = 0$ [16]. This problem is similar to that analysed by Heady and Mitra (1982).

Disregarding corner solutions, 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

$$-\mu E_0 + \lambda\left(t_0 E_{00} + E_0 + \sum_{i\neq 0,k} t_i^W E_{i0}\right) = 0 \tag{20}$$

$$-\mu E_j + \lambda\left(t_0 E_{0j} + E_j + \sum_{i\neq 0,k} t_i^W E_{ij}\right) = 0 \qquad j \neq 0,k \tag{21}$$

Although it is feasible for the government to finance its resource requirements only using a VAT at a uniform rate (see Appendix, *Table 2, Column 2*), this is not the optimal solution. As we have seen the government can increase welfare by discouraging the untaxed use of the primary factor in the informal sector. As the domestic taxes on produced and imported goods under Ξ^2 cannot be manipulated to discourage the use of the primary factor in the informal sector, border taxes are instead used to achieve this objective. However, as producer prices for the produced and imported goods must now be equal to consumer prices, they will differ from world market prices. With the optimal tax system, $\boldsymbol{\tau}^{*2} \in \Xi^2$, production will either take place in the same sector as under Ξ^1, or it will switch to another sector. In the first case, the allocation remains unchanged, as the same consumer prices will be sustained by border taxes as by consumer taxes under Ξ^1. However, in the second case, there will be a loss of productive efficiency. In the example with crop production being almost as competitive as food production at world market prices, production switches from *Food* under Ξ^1 to *Cash crop* under Ξ^2 as the producer price of *Cash crop* increases relative to that of *Food*. The optimal tax system under Ξ^2 thus implies a loss of allocative efficiency compared to that under Ξ^1. With the exports of cash crop assumed untaxed as a matter of normalisation, in the example $\left(p_1, p_2, p_3\right) = \left(1.7, 1, 0.9\right)$, and $\boldsymbol{\tau}^{*2}$ thus involves imports of *Manufacturing* being taxed and *Food* imports being subsidised (see Appendix, *Table 2*).

In general the optimal tax-tariff system under Ξ^2 is thus determined as a compromise between the two objectives which determine the optimal tax system under Ξ^1, and the objective of limiting the loss of productive efficiency. Disregarding administrative costs, the social welfare for $\boldsymbol{\tau}^{*2}$ is thus in general lower than for $\boldsymbol{\tau}^{*1}$. However, the administrative costs associated with the tax-tariff structure Ξ^2 is smaller than for Ξ^1. Which tax structure is the optimal cannot therefore be determined on theoretical grounds alone. In our example Ξ^2 will be the optimal tax structure, if the administrative costs associated with Ξ^1 in terms of the value added of the formal sector (ca 30) is ca 1.5% greater than that associated with Ξ^2, as the Equivalent Variation of moving from $\boldsymbol{\tau}^{*1}$ to $\boldsymbol{\tau}^{*2}$ is ca -0.45, disregarding administrative costs (see Appendix, *Table 2*).

[16] 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.

Only tariffs

We now consider the optimal solution when the government's revenue requirement has to be financed only by border taxes, i.e. under the tax structure Ξ^3 with $\bar{T}_i = 1,\ (i = 0,1,2,3)$.[17] As the household by the assumption of a linear production technology receives no profit income, a proportional tariff structure $T_i^W \equiv \left(t_i^w + p_i^w\right)/\, p_i^w = T^W, (i = 1,2,3)$ generates no revenue. Without loss of generality, we can therefore as explained above assume the exports to be untaxed as a matter of normalisation, i.e. $t_k^W = 0$. Any system of border taxes will therefore in order to generate a positive revenue necessarily encourage the consumption of the export good[18]. With the tariff structure, Ξ^3, both the non-market use of the primary factor and the domestic consumption of the export good will therefore be encouraged compared with the first-best allocation. 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 produced and imported goods

Objective 2: To discourage the untaxed consumption of the primary factors.

Objective 3: To discourage the untaxed consumption of the export good[19].

In other words, in addition to the two objectives considered in the previous cases, also *Objective 3* needs to be taken into account.

Assuming, as a matter of normalisation without loss of generality, that commodity 1 is the untaxed export good, we derive optimal tariff formulae which clearly bring out these trade-offs. The first order conditions for an optimal tax-tariff system now become

$$-\mu E_j + \lambda\left(E_j + \sum_{i=2,3} t_i^W E_{ij}^h\right) = 0 \qquad j = 2,3 \tag{22}$$

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

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

$$t_3^W = \theta\frac{\left(-E_{22}E_3 + E_{32}E_3\right)}{D} \tag{24}$$

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[17] This corresponds to the situation analysed for example by Hatta and Ogawa (2003). However, they base their analysis on more general assumptions about the production structure, which complicates the interpretation of results.

[18] This is analogous to the fact that under Ξ^1 the untaxed use of the primary factor is always encouraged.

[19] As pointed out by Hatta and Ogawa (2003), this is analogous to the Corlett and Hague rule. However, by the same token it is important to guard against a similar confusion as has arisen in the interpretation of that rule. A clear distinction should be made between on the one hand the assumption that "the domestic consumption of the export good cannot be taxed" (because of the administrative costs involved), and on the other hand the assumption that "exports cannot be taxed" which in the absence of other restrictions on border taxes may be considered a rule of normalisation, which involves no loss in generality. We have assumed that exports cannot be taxed, but an alternative normalisation assuming one of the import goods as untaxed or taxed at a given rate is equally valid. As indicated in Footnote 10, assuming that tax systems corresponding to different normalisation rules are equivalent with respect to the associated administrative costs is not an entirely innocent assumption.

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

Defining compensated price elasticities as $\varepsilon_{ij} \equiv E_{ij} \Big/ \dfrac{x_i}{q_j}$, $(i, j = 0,1,2,3)$, (23) and (24) may be transformed into

$$\frac{t_2^W}{q_2} = \theta \frac{\left(\varepsilon_{23} - \varepsilon_{33}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} \tag{25}$$

$$\frac{t_3^W}{q_3} = \theta \frac{\left(\varepsilon_{32} - \varepsilon_{22}\right)}{\varepsilon_{22}\varepsilon_{33} - \varepsilon_{32}\varepsilon_{23}} \tag{26}$$

By homogeneity of degree zero of the compensated demand functions, $E_i(\mathbf{q}, u)$, $(i = 0,1,2,3)$, we have that $\sum_{j=0,1,2,3} \varepsilon_{ij} = 0$,$(i = 0,1,2,3)$, and 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, the optimal tariff system may be expressed as (see Munk and Rasmussen 2005)

$$\frac{t_2^W \Big/ q_2}{t_3^W \Big/ q_3} = \frac{\left(s_2 + s_3\right)\sigma_{23} + s_1\sigma_{31} + s_0\sigma_{30}}{\left(s_2 + s_3\right)\sigma_{23} + s_1\sigma_{21} + s_0\sigma_{20}} \tag{27}$$

The optimal tariff system reflects the objectives of discouraging 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 $\varphi \equiv s_0\left(\sigma_{30} - \sigma_{20}\right) + s_1\left(\sigma_{31} - \sigma_{21}\right)$ where $s_0\left(\sigma_{30} - \sigma_{20}\right)$ is a measure of the importance of Objective 2 and $s_1\left(\sigma_{31} - \sigma_{21}\right)$ of Objective 3. For a given value of σ_{23} (which may be taken as a measure of the importance of Objective 1), the difference in the tax rates will be greater, the greater the numerical value of φ; and for a given value of φ, the difference will be smaller the greater is σ_{23}. Objectives 2 and 3 may be conflicting, but if Objective 2 is more important than Objective 3, or if Objective 3 draws the tariff system in the same direction as Objective 2, a relatively large informal sector (as measured by s_0) and a large difference in the complementarity of the imported commodities with the use of the primary factor in the informal sector (as measured by $\sigma_{30} - \sigma_{20}$), imply that a country will derive relatively large benefits from a differentiated tariff structure.

Compared with the optimal tax-tariff systems Ξ^1 and Ξ^2, the optimal tax system, τ^{*3}, under the Ξ^3 involves 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 border taxes are likely to be significantly smaller than for the two other tax-tariff structures, because under Ξ^3 domestic market transactions are not taxed. Therefore, on theoretical grounds alone, it cannot be ruled out that the overall optimal tax system belongs to Ξ^3.

Only uniform import tariff

Finally, under Ξ^4, where $\overline{T_i} = 1, (i = 0,1,2,3)$, and $T_i^W \equiv \left(t_i^w + p_i^w\right) / p_i^w = T^W, i \neq k$, assuming exports untaxed as a matter of normalisation, i.e. $t_k^w = 0$, only one tariff system is feasible. The tax-tariff structure Ξ^4 is associated with greater distortionary costs than the other tax-tariff structures. However, it is likely to be associated with the smallest administrative costs, since only imports are taxed, and at the same rate (see assumption ***A3***).

The trade-off between allocative efficiency and administrative costs

Writing $W(j,d)$ for the maximum social welfare (real income) for the tax structure *j* at the level of economic development *d*, we have, disregarding administrative costs,

$$W(1,d) \geq W(2,d) \geq W(3,d) \geq W(4,d)$$

since $W(j,d)$ is by general rules of optimisation is non-decreasing in the number of tax-tariff instruments available to the government.

Since by assumption ***A3*** the costs of tax administration are increasing with the differentiation of the tax-tariff structure and with the number of transactions which are subject to taxation, we have

$$B(1,d) \geq B(2,d) \geq B(3,d) \geq B(4,d)$$

The social ranking of tax structures based on administrative costs is thus the opposite of that based only on allocative considerations. There is, therefore, a trade-off between allocative efficiency and administrative costs, which does not allow the optimal tax-tariff structure to be identified without empirical evidence on both the structure of the economy and the costs of tax administration for the country in question.

5. The evolution of the optimal tax-tariff structure and desirable directions of tax-tariff reform

In this section, we consider the implications of the theoretical analysis for the evolution of the optimal tax structure over time, and for desirable directions of tax-tariff reform.

Assuming that the political system behaves as if the government maximises the utility of a representative household, the analysis may be interpreted as a positive theory of taxation in an open economy. Given this interpretation, the theory provides an explanation of the evolution of the tax-tariff system consistent with that of Kimbrough and Gardner (1992). On the basis of assumptions similar to assumptions ***A2-A3*** Kimbrough and Gardner (1992) explain why the importance of tariff revenue in the US has diminished over time. But, as they assume a fixed factor supply and only one import good, their analysis does not capture the importance of the interaction of the consumption of the import goods neither with the use of the primary factor in the informal sector nor with the consumption of the export good.

The main objective of this paper is, however, not to explain policy, but to identify desirable directions of tax-tariff reform. In this context, the relative economic importance of the informal sector in the economy plays an important role. In order to bring this out, we make one further

assumption, which is amply supported by empirical evidence (see for example Schneider and Enste 2002):

A4: The size of the informal sector measured by the share in full income of the consumption of the primary factor in the informal sector, s_0, decreases with increasing levels of economic development.

This assumption in combination with assumptions ***A1-A3*** implies that the benefits which can be derived from the use of border taxes decrease with economic development. Based on the assumptions made the optimal tax-tariff structure will evolve through three transitional phases, each characterised by different directions of a desirable tax-tariff reform, as illustrated in *Table 1*. The first transition from Ξ^4 to Ξ^3 corresponds to the situation where the administrative infrastructure has improved to the point where the differentiation of the tariff rates has become preferable to a uniform tax structure. The second transition from Ξ^3 to Ξ^2 corresponds to the situation where it has become desirable to finance government expenditures by domestic taxes at a uniform rate, maintaining border taxes only to discourage the use of resources in the informal sector. Finally, the third transition from Ξ^2 to Ξ^1 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.

Table 1: The level of development and the optimal tax-tariff system

Optimal tax-tariff structure	**Level of economic development**	**The purpose served by the optimal border taxes**
Uniform tariff rate: Ξ^4	Low	The uniform tariff serves no other purpose than to finance the government's resource requirement.
Border taxes: Ξ^3	Lower-middle	The optimal border taxes 1) reduces the use of resources in the informal sector, and 2) reduces the consumption of the export commodity
Border taxes +VAT: Ξ^2	Upper-middle	The optimal border taxes reduces the use of resources in the informal sector
Differentiated domestic taxes: Ξ^1	High	B order taxes serve no purpose. The reduction of the untaxed use of primary factors is achieved by differentiating domestic commodity taxes.

Thus, important implications of our analysis are, *first*, that although the process of economic development is continuous, the development of the optimal tax system is not, and, *second*, that investments in the administrative infrastructure in a developing country will result in liberalisation of trade at an earlier stage than would otherwise be the case. These implications have important consequences for the type of assistance to be given to developing countries. Due to the associated fixed costs, the tax structure should change only after the trade-off between administrative costs and

distortionary costs has changed sufficiently to justify the transition. However, when a change of *tax structure* has been decided, the *tax system* will need to undergo a substantial transformation, because all tax rates - not only those which have previously been constrained - will need to change as the purpose which the tax system has to serve has changed (see *Table 1*). Consider, for example, the situation where the government in a lower-middle income country has to decide whether or not to implement a tax reform which involve replacing Ξ^3 with Ξ^2. In this situation the government must assess the implications of such a tax-tariff reform, not only in terms of the administrative and distortionary costs of implementing a VAT system, but also in terms of the adjustment of the border taxes in response to the reduced need for border taxes to generate government revenue. Furthermore, it must take into account that border taxes no longer should be used to discourage the domestic consumption of the export commodity, but only the untaxed use of resources in the informal sector. This means that during these transitional phases, there will be a particularly strong need for advice on how to change the tax system.

The IMF and the World Bank have advocated that developing countries, in fact even the least developed countries, should abolish border taxes in favour a VAT. These recommendations have been supported by Keen and Ligthart (2002), but have been strongly criticised by Emran and Stiglitz (2005). 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 in general have relatively large informal sectors. As our example illustrates, taking administrative costs into account may justify diversions from free trade and explain why many developing countries have resisted the pressure to eliminate border taxes. 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 allocational benefits may be limited and outweighed by increasing administrative costs. *Second*, even when it is in the interest of a developing or a transition country to adopt a VAT regime, it may not be in its interest to give up the use of border taxes entirely. It may still be desirable to impose border taxes in order to discourage the use of resources in the informal sector, alleviating the distortion implied by the partial coverage of the VAT. A recent paper by Baunsgaard and Keen (2005) implicitly provides support to these conclusions. Based on convincing empirical evidence, the paper finds that the replacement of border taxes with a VAT has resulted in a reduction in government revenue for low income countries. They consider the reduction in government revenue as troubling. However, what is indeed troubling is that this response may be considered as a rational response by the poorest countries of the world to an increase in the marginal costs of government funds due to the suppression of border taxes, and thus reflecting a decrease in social welfare. This is disconcerting, not the least considering the massive pressure these countries have been subjected to by the international community to undertake such reform.[20]

However, when attempting to draw policy conclusions, it is important to take into account that the analysis has been based on highly simplifying assumptions. In particular, the production structure has been assumed to be linear and the effects of the choice of tax structure on the possibilities for income redistribution, tax evasion and rent seeking have been disregarded. The question is therefore if basing the analysis on more realistic assumptions will compromise the conclusions reached so far. First, generalisation of the assumption with respect to the production technology to allow for more than one primary factor, restrictions on the set of feasible taxes will always result in a loss in productive efficiency. Assuming a more general production technology will therefore just reinforces the idea of a trade-off between allocative and administrative efficiency.

[20] Our analysis thus also has important implications for the discussion of the fairness of symmetric commitments in regional and international trade agreements. Obliging countries in transition, and in particular the least developed countries, to adopt free trade may force them to accept a significant loss of social welfare, whereas for developed countries the adoption of free trade is likely not to represent any sacrifice.

Taking into account distributional considerations seems to further reinforce the rationale for using border taxes in developing countries, as border taxes make it possible to achieve distributional objectives that cannot be achieved by a VAT at a uniform rate. When industries, such as agriculture, coal, steel, and textile, come under pressure in the process of economic development, or because of the opening up of domestic markets to international competition in response to foreign pressure, this often causes severe social hardship. In general, highly developed countries are well equipped to deal with such problems. Due to their higher level of development, they are able to establish and enforce tax and transfer systems which are typically far more efficient in achieving distributional objectives than border taxes. However, for less developed countries, not being allowed to use border taxes may imply that they are unable to achieve revenue and distributional objectives, which they could otherwise have achieved.

Another important consideration regarding the choice of tax structure is, as mentioned in Section 2, the scope it creates for tax evasion. The effect of tax evasion on the administrative costs and the distortionary effect of taxation have been considered in the tradition started by Allingham and Sandmo (1972), and have been summarised in Andreoni et al. (1998). For example, taking tax evasion into account, the scope for substitution between the consumption of different commodities and the use of resources in the informal sector, σ_{i0}, would increase, potentially creating a greater allocative benefit of a differentiated tax-tariff structure. As high administrative costs prevent the implementation of a differentiated domestic tax system, taking tax evasion into account thus seems to provide an additional reason for developing countries to use tariffs to raise revenue. However, a full assessment of the implication for the choice of tax-tariff structure of taking tax evasion into account goes beyond the scope of this paper. [21]

A final concern is the importance of political economy considerations. Rent seeking behaviour and corruption are major problems in many developing countries. This, however, does not automatically imply a preference for domestic taxes over border taxes. First, as is the case of domestic taxes, tariffs can be levied at the same rate to limit the scope for rent seeking, and, as pointed out by Bird (2005), the lobbying pressure for exemptions from VAT in developing countries is no less acute than for differentiated tariff rates. Second, even if border taxes are more susceptible to distortion due to rent seeking and corruption than domestic taxes, the difference may not be sufficiently important to justify significant modifications to recommendations based only on public economic considerations with respect to the choice of tax-tariff structure. The so-called 'Washington consensus', is based on the belief that the type of tax system which is desirable for developed countries is also the best for developing countries. It is therefore not surprising that this believe has resulted in the widespread use of tariffs in developing countries to be interpreted as a result of rent seeking and corruption. However, as our analysis suggests, imposing high and differentiated tariff rates may in fact for a poor country with a large informal sector and difficulties in monitoring

[21] Gordon and Li (2005), who also reach the conclusion that in developing countries the use of border taxes is likely to improve social welfare, represent tax evasion by assuming that firms have the incentive to avoid taxation by not using financial intermediation. As firms' need for capital and their scale of operation depends on the type of sector to which they belong, firms in different sectors have different needs for financial intermediation, and thus different incentive to opt out of the formal sector. A tax-tariff system with relatively high tariffs on manufactured goods used as inputs in the informal sector is thus likely, as in our example, to be welfare improving compared with a VAT system, as it will discourage the use of resources in the informal sector. Formulated within the framework of our model, tax evasion of this type means that in developing countries not only is the size of the informal sector, s_0, greater than in developed countries, but the elasticities of substitution, σ_{0i}, between the untaxed use of the primary factor and goods produced in sectors not using financial intermediation is also relatively larger with the implication , as we have seen in the example, that significant increases in social welfare can be achieved by differentiated commodity taxation, implemented by border taxes when differentiation of domestic taxes is not administratively feasible.

activities for tax purposes be a rational response to the problem of raising government revenue at minimum economic costs. It is therefore possible that distortions of the resource allocation due to rent seeking activities are smaller than has previously been thought. This is actually the conclusion reached by Gordon and Li (2005). They demonstrate that a political economy model in the tradition of Grossman and Helpman (1994) poorly reconciles many aspects of the data on tax-tariff structures in developing countries compared with their own model which, as the model adopted in this paper, recognises (although it does not formally represent) the importance of administrative costs and the size of informal sector for the optimal tax-tariff system.[22] Their results suggest that taking political economy considerations into account does not substantially alter the policy conclusions reached within a public economics framework. This does not detract from the importance of political economy approaches in a number of other respects, such as for the understanding how the differentiation of both border taxes and domestic taxes may provide special interest groups with the opportunity to corrupt the political process.

6. Concluding remarks

In this paper, we have added structure to the standard theory of optimal taxation to allow the representation of the trade-off between the objectives of limiting distortionary and administrative costs of taxation. This has resulted in an optimal tax theory which permits the endogenous choice of tax restrictions. Interpreted as a positive theory, it explains why the tax-tariff system evolves through transitional phases characterised by significant changes in tax rates and with the role of border taxes in generating government revenue declining over time. The main achievement of the paper is, however, to have established a framework for identifying desirable directions of tax-tariff reform taking administrative costs into consideration. This helps clarify the reasons for, and lends support to, the criticism by Stiglitz (2003) of the IMF and the World Bank's recommendation to developing countries to adopt VAT to replace border taxes. The analysis also provides a rationale for the international community to provide technical assistance to the improvement of the administrative infrastructure in developing countries in order to stimulate trade liberalisation, and for developed countries to provide free access to their own markets without requiring developing countries to implement free trade.

The analysis highlights the importance of taking administrative costs into account when providing recommendations on tax-tariff reform and that such recommendations cannot be based on theoretical considerations alone. A priority for future research must therefore be to gather further empirical evidence on the administrative costs of taxation. There is clearly also a need for further theoretical work to improve the micro foundation for understanding of how administrative costs, tax evasion, and rent seeking influence the choices and enforcement of tax structures in developing countries. In this context, the work of Gordon and Li (2005) and the framework established in this paper may prove useful. Furthermore, with improved theoretical insight and better empirical knowledge, the construction of Computable General Equilibrium (CGE) models constitutes a promising avenue for in practice to identify desirable directions of tax-tariff reform, an approach forcefully advocated and already pursued by Anderson (2002) and others.

[22] As in our analysis of the optimal tax-tariff system under a tax structure allowing the use of VAT and border taxes $,\Xi^2$, the rationale in Gordon and Li ‘s model for the use of border taxes is the inability of governments in developing countries, due to poor administrative infrastructure, to set domestic commodity taxes at their optimal level. Gordon and Li assume domestic taxation in the form of a uniform domestic sales tax. In the absence of intermediate consumption this is equivalent to assuming domestic taxes to be in the form of a VAT at uniform rate; the optimal border tax rates are therefore the same whether domestic taxation is in the form of a proportional tax on consumption or on income.

References

Allingham, M. and A. Sandmo (1972), "Income tax evasion: a theoretical analysis", *Journal of Public Economics*, **1**, 323-338.

Andreoni, J., B. Erard, and J. Feinstein (1998), "Tax compliance", *Journal of Economic Literature*, **96**, 818-860.

Anderson, J.E., (2002), "Trade reform diagnostics with many households, quotas and tariffs", *Review of International Economics*, **10,** (2), 215-36.

Baunsgaard, T. and M. Keen (2005), "Tax revenue and (or) trade liberalisation, *Working Paper, IMF*.

Bird, R.M. (2005), "Value added taxes in developing and transitional countries", *Working Paper, Andrew Young School of Policy Studies, Georgia State University.*

Corlett, W.J. and D.C. Hague (1953), "Complementarity and excess burden of taxation", *Review of Economic Studies*, **21**, 21-30.

Dasgupta, P. and J. E. Stiglitz (1974), "Benefit-cost analysis and trade policies", *Journal of Political Economy*, **82**, 1-33.

Diamond, P.A. and D.L. McFadden (1974), "Some uses of the expenditure function in public finance", *Journal of Public Economics*, **3**, 3-21.

Diewert, W. E., A.H. Turunen-Red, and A.D. Woodland (1989), "Productivity and Pareto-improving changes in taxes and tariffs", *Review of Economic Studies*, **56**, 199-216.

Dixit, A. K. (1985), "Tax policy in open economies," in *Handbook of Public Economics*, Vol. I, eds. A.J. Auerbach and M. Feldstein (Amsterdam: North-Holland).

Dixit, A.K. and V. Norman (1980), *The theory of international trade*, Cambridge University Press.

Dixit, A and K. J. Munk (1977), "Welfare effects of tax and price changes. Correction", *Journal of Public Economics*, **8**, 103-107.

Evans, C. (2003) , "Studying the studies: An overview of recent research into taxation operating costs, *eJournal of Tax Research*, **1**, 64-92.

Emran, M. S. and J. Stiglitz (2005), "On selective indirect tax reform in developing countries", *Journal of Public Economics*, **89**, 599-623.

Gordon, R. and W. Li (2005), "Puzzling tax structures in developing countries: A comparison of two alternative explanation", *NBER Working Paper.*

Grossman, G. and E. Helpman (1994), "Protection for sale", *American Economic Review*, **84**, 833-50.

Harberger, A. C. (1974), *"Taxation and welfare"*, Chicago University Press.

Hatta, T. (1977), “A recommendation for a better tariff structure”, *Econometrica*, **45**, 1869-69.

Hatta, T. and Y. Ogawa (2003), “A theory of optimal tariffs under a revenue constraint”, *CSIS Discussion Paper*.

Heady, C. and P. Mitra (1982*)*, "Restricted redistributive taxation, shadow prices and trade policy", *Journal of Public Economics*, **17**, 1-22.

Heady, C. and P. Mitra (1987), "Distributional and revenue raising arguments for tariffs", *Journal of Development Economics*, **26**, 77-101.

Keen, M. and J. E. Ligthart (2002), “Coordinating tariff reduction and domestic tax reform”, *Journal of International Economics*, **56**, 489-507.

Kimbrough, K.P. and G. W. Gardner (1992), "Tax Regimes, Tariff Revenues, and Government Spending", *Economica*, **59**, 75-92.

Laffont, J. J. (2004), “Management of public utilities in China”, *Annals of Economics and Finance*, **5**, 185-210.

Munk, K. J. (1980), "Optimal taxation with some none-taxable commodities", *Review of Economic Studies*, **47**, 755-765.

Munk, K. J. (1998), “Should Governments Create Production Inefficiency”, *EPRU Working Paper 1998-20, University of Copenhagen.*

Munk, K. J. (2002), “What Determines the Optimal Tax Structure from an Intuitive Point of View”, *EPRU Working Paper 2002-17, University of Copenhagen.*

Munk, K. J. and B. Rasmussen (2005), "On the determinants of optimal border taxes for a small open economy", *Working Paper, University of Aarhus.*

Munk, K. J. (2006), "On the rationale for the use of border taxes in developing countries", *Working Paper, University of Aarhus.*

Myles, G. D. (1995), *Public Economics*, Cambridge University Press.

OECD (2004), Tax administration in OECD countries: *Comparative Information Series.*

Schneider, F. and D. H. Enste (2002), “Shadow economies: Size, causes, and consequences”, *Journal of Economic Literature*, **38**, pp 77-114.

Stiglitz, J. E. and P.S. Dasgupta (1971), “Differential taxation, public goods and economic efficiency”, *Review of Economic Studies*, **38**, 151-174.

Stiglitz, J. E. (2003)., “Development oriented tax policy”, Presentation to Congress of International Institute of Public Finance, Prague

World Bank (1988), *World Development Report 1988*, Oxford University Press.

APPENDIX

In order to illustrate how the use of border taxes may result in production switching from one sector to another, we consider a quantitative example representing a prototype developing country with a large informal sector where three commodities, *Manufacturing*, *Cash crops* and *Food*, are traded in the formal economy. Household preferences are represented by a CES-UT utility function[23] generating a matrix of compensated price elasticities shown in *Table 1*. *Manufacturing* is assumed more complementary with the use of *Labour* in the inform sector than *Cash crop*, and in particular than *Food* (i.e. with $\varepsilon_{10} < \varepsilon_{20} < \varepsilon_{30}$). Furthermore, we assume that at world market prices the economy is most competitive in the production of *Food*, and that the returns to *Labour* in the production of *Cash crops* is 2% lower than in the production of *Food*, whereas the country is far from competitive in *Manufacturing*. For more detail on the model used to generate the results see Munk (2006).

Table 1 Compensated price elasticities based on CES-UT utility function

ε_{ij}	*Manufacturing*	*Cash crop*	*Food*	*Labour*
Manufacturing	-0,372	0,028	0,250	0,094
Cash crop	0,278	-1,372	0,250	0,844
Food	0,278	0,028	-1,750	1,444
Labour	-0,027	-0,024	-0,371	0,422

In *Table 2* the data for a situation where the governments revenue requirement is financed by a lump sum tax (the benchmark situation) is provided in *Column 1*, and when financed, by a VAT at uniform rate in *Column 2*. The optimal tax system without restrictions imposed on the set of feasible tax instruments is indicated by $\boldsymbol{\tau}^{*1}$, and when domestic taxation is constrained to be a VAT at uniform rate, but where border taxes are feasible, by $\boldsymbol{\tau}^{*2}$.

[23] See Munk 1998, Annex 1 and Munk 2002.

Table 2 The optimal tax-tariff systems under different tax structures

		Lump sum' (1)	VAT only (2)	τ^{*1} (3)	τ^{*2} (4)
Domestic tax rates					
Manufacturing	t_1	0.000	0.000	0.845	0.000
Cash crop	t_2	0.000	0.000	0.141	0.000
Food	t_3	0.000	0.000	0.000	0.000
Labour	t_0	0.000	-0.565	-0.294	-0.352
Border tax rates					
Manufacturing good	t_1^W	0.000	0.000	0.000	0.681
Cash crop	t_2^W	0.000	0.000	0.000	0.000
Food	t_3^W	0.000	0.000	0.000	-0.078
Production					
Manufacturing	y_1	0.000	0.000	0.000	0.000
Cash crop	y_2	0.000	0.000	0.000	14.649
Food	y_3	20.000	11.566	14.918	0.000
Labour supply	x_0	-35.000	-26.566	-29.918	-29.942
Net trade					
Manufacturing	y_1^W	10.000	8.391	7.219	7.183
Cash crop	y_2^W	1.000	0.450	0.762	-13.847
Food	y_3^W	-11.000	-8.842	-7.981	6.664
Change in real income relative to the benchmark situation disregarding administrative costs (EV)		0	-4.137	-2.413	-2,844

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