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Abstract

With reference to the size of the informal sector, Stiglitz (2003) argues that border taxes are superior to VAT in certain developing countries. By way of a quantitative example this paper shows that, while Stiglitz' claim in the light of future empirical research probably will turn out to be correct, a large informal sector is. as shown by Keen (2006), not a sufficient condition for border taxes to be preferable to a VAT regime. Making the case for using border taxes also requires the plausible supplementary assumptions that (i) border taxes are associated with lower administrative costs, and (ii) that this difference is sufficiently large to justify the larger distortionary costs associated with border taxes compared to domestic taxes.

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Keywords: 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

The fierce attacks on the bastions of the established wisdom in the form of the "Washington consensus" by the distinguished economist, former Chief Economist in the World Bank and Nobel Price Laureate of Economics, Joe Stiglitz, have in recent years become common knowledge within the economic profession and beyond. A highly influential body of previous research, including prominently Keen and Ligthart (2002), has for provided academic support for the IMF recommendations to use VAT rather than border taxes to raise government revenue in developing countries. However, Emran and Stiglitz (2005) imply that substituting VAT for border taxes is likely to *reduce* rather than improve social welfare because developing countries have large informal sectors.

Since the desirability free trade is one of the few tenets which economists at large tend to agree upon, Stiglitz and Emran's attacks have been somewhat disconcerting to the profession. And yet the basis for the disagreement with Keen and Ligthart remains unclear. Emran and Stiglitz' (2005) contribution suggests that the key problem in the literature supporting the "Washington consensus" it neglects that developing countries have large informal sectors. However, in his (2006) repost, Keen posits that, given an optimal VAT system (and not the one defined in Emran and Stiglitz 2006), large informal sector provides no justification for diversions from free trade.

The question of whether developing countries benefit from the use of border taxes is important. This is true for policy-makers in developing countries themselves and generally in the context of global and regional trade negotiations. It is therefore important to resolve this controversy.

Building on the theoretical analysis in Munk (2006), the present paper agues that Joe Stiglitz may well be right that in certain developing countries border taxes are superior to a VAT. However, the argument for such superiority cannot be made only with reference to the fact that developing countries have large informal sectors.

We first add structure to the general equilibrium model used in Munk (2006), by adopting a CES-UT utility function with the informal sector embedded in the representation of household preferences. We then show that the partial equilibrium model in Keen (2006) may be interpreted as a special case of the general model, and that the results obtained based on the general model therefore also are valid for the model used by Keen. Based on stylised assumptions about an economy in a prototype developing country, we then calculate the optimal tax systems for different tax structures. As it is generally recognized that border taxes are associated with lower administrative costs than a VAT, we finally conclude that the onus is now on empirical research to provide the evidence on the relative magnitude of distortionary and administrative costs of border taxes and domestic taxes in developing countries to be able to settle the dispute.

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2. General equilibrium model

Following Munk (2006), consider a small open economy with one representative household incorporating the representation of the informal sector, three perfectly competitive production sectors representing the formal sector, and a government. In the economy there is one domestically traded primary factor, indexed *0*, and three internationally tradable commodities, indexed (*1*,*2*,*3*). The government imposes border taxes, $\mathbf{t}^W \equiv \left(t_1^W, t_2^W, t_3^W\right)$, 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 $\mathbf{q} \equiv \left(q_0, q_1, q_2, q_3\right) = \left(p_0 + t_0, p_1 + t_1, p_2 + t_2, p_3 + t_3\right)$.

The economy is assumed to have the potential to produce any of the three commodities using only the primary factor as input. The production structure exhibits constant returns to scale. Hence, the economy will specialise in the production of one commodity, which thus becomes the export good, while the two other commodities become the import goods. The output of the export sector is y_k, and the use of the primary factor for its production is y_0 [1]. 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

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

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 $\omega_0 + x_0$.[2] 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[3]

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

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 constrained to be an element in the tax structures $\Xi^j, j \in \mathbb{F}$, where each tax structure j is defined by restrictions imposed on tax systems available to the government and where $\mathbb{F}$ is a set with a finite number of elements.

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

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

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

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[1] The sign conventions are: $y_0 < 0$ and $y_1 > 0$; $x_0 < 0$ and $x_i > 0$ $\left(\text{i}=1,2,3\right)$; $y_1^W < 0$ 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.

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

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

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

Material balance requires

$$y_0 = x_0 + x_0^G \quad (7)$$

$$y_k + y_k^W = x_k + x_k^G \quad (8)$$

$$y_i^W = x_i + x_i^G \qquad i \neq k \in (1,2,3) \quad (9)$$

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

Within this framework Munk (2006) proves the following four propositions

1) Disregarding administrative costs, the second best tax-tariff system involves no use of border taxes. Instead the optimal tax system involves differentiating domestic taxes on commodities according to their complementarity with the use the primary factor in the informal sector (the Diamond and Mirrlees productive efficiency theorem). Supplementing a uniform VAT with taxes and subsidies on commodities, which are, respectively, complements to, and substitutes for, the use of the primary factor in the informal sector, will therefore improve social welfare. However, such a differentiation will increase the costs of tax collection. For a differentiation of commodity taxes to actually be welfare improving compared to a uniform VAT, the allocative benefits would have to exceed the extra administrative costs.

2) A uniform VAT supplemented by border taxes can also be used to discourage the untaxed use of the primary factor in the informal sector. This implies a loss in productive efficiency compared with the domestic tax solution, but a gain in terms of administrative costs as the collection of border taxes is less costly than the collection of domestic taxes.

3) Further substituting the use of border taxes for a uniform VAT will eliminate the costs associated with VAT administration, but will involve a further loss of economic efficiency.

4) Which of the four tax structures, a VAT at a uniform rate, a VAT with differentiated domestic taxes, a VAT with border taxes or only border taxes, is the best therefore depends on the particular characteristics of the economy, in particular the size of the informal sector and the efficiency of its tax administration.

3. Adding structure to the general equilibrium model

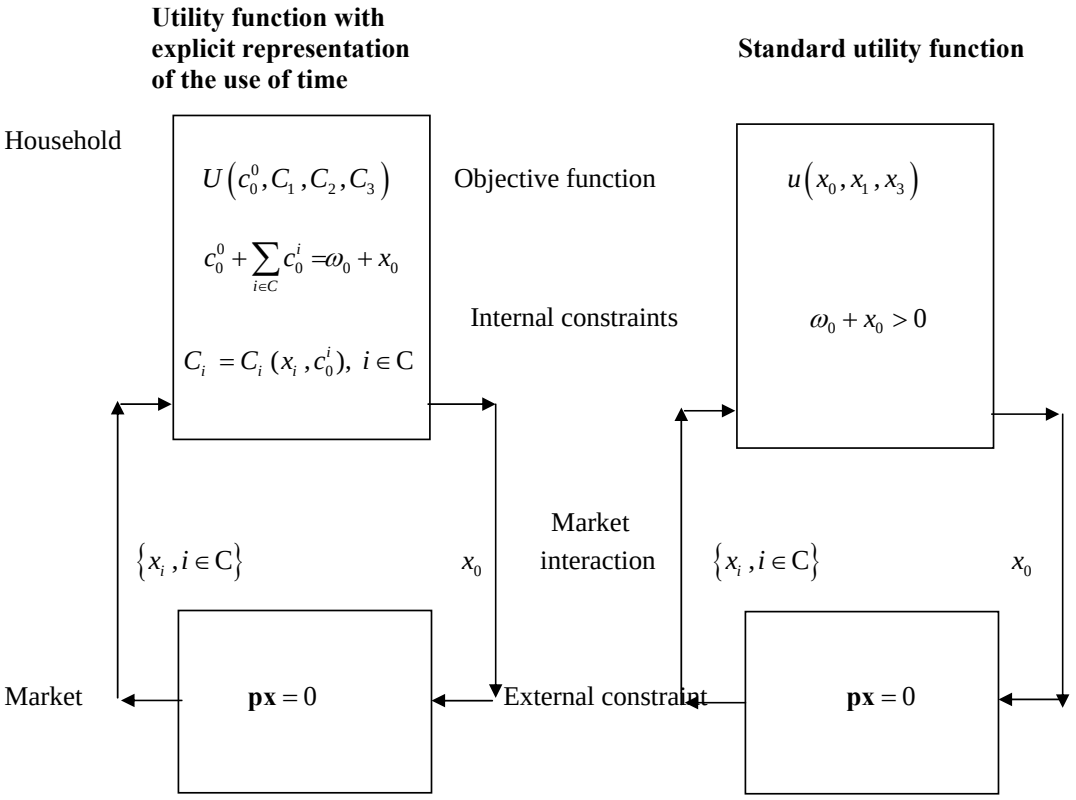
In order to illustrate the insight obtained through theoretical analysis based on the general equilibrium model, we add structure to the model and specify a stylized CGE model to provide quantitative results. We consider an economy with a large informal sector with three traded commodities: *Manufacturing (1), Cash crop (2)* and *Food (3)*. The consumption of *Manufacturing* is assumed complementary to its untaxed use of *Labour (0)*, and the consumption of *Food* is assumed to be a substitute (as the "home production" of food is competing with *Food* produced in the formal sector using *Manufacturing* as input).

In order to represent these stylised facts, we adopt a utility function with full representation of the household preferences which imbed the informal sector (see Munk 1998 and 2002)

$$u(\mathbf{x}) = U\left(C_1(x_1, c_0^1), C_2(x_2, c_0^2), C_3(x_3, c_0^3), \left(\omega_0^h - \sum_{i\in(1,2,3)} c_0^{i.h} - c_0^0 \right) \right) \tag{10}$$

where $C_i = C_i(x_i, c_0^i)$, i=1,2,3 represent how the amounts purchased of the commodities, x_i^h, i=1,2,3, respectively are combined with the time used for their consumption, c_0^i. C_i, i=1,2,3 indicate the consumption of commodities which may either be interpreted as composite commodities or results of production in the informal sector (see *Figure 1*). The household has a fixed time endowment denoted by ω_0. The total time used for the consumption of purchased commodities is $\sum_{i\in(1,2,3)} c_0^i$. Pure leisure, c_0^0, is the amount of time used on activities that do not involve the consumption of purchased commodities; therefore $c_0^0 = \omega - \sum_{i\in(1,2,3)} c_0^i - x_0$. The functions, $U\left(C_1, C_2, C_3, c_0^0\right)$, expresses household utility as a function of the consumption of the three composite commodities and pure leisure.

Figure 1: Representation of household behaviour with utility function with explicit representation of the use of time, and with standard utility function



Assuming $C_i = C_i(x_i, c_0^i)$, $i \in C$, to be homogenous of degree 1, we have

$$\tilde{E}\left(q_0,Q_1,Q_2,..,Q_{\mathrm{N}},u\right)\equiv \underset{c_0^i,C_1,C_2,..,C_{\mathrm{N}}}{\mathrm{Min}}\ q_0c_0^0+\sum_{\mathrm{i}\in\mathrm{C}}\mathrm{Q}_iC_i\quad \text{s.t. } u=U\left(c_0^0,C_1,C_2,..,C_{\mathrm{N}}\right) \tag{11}$$

where

$$Q_i=Q_i\left(q_0,q_i\right)\equiv\left(\underset{c_0^i,x_i}{\mathrm{Min}}\ q_0c_0^i+q_i\,x_i\ \text{ s.t. } C_i\left(c_0^i,x_i\right)\right)/C_i\qquad i\in C \tag{12}$$

Since $\tilde{E}\left(q_0,Q_1,Q_2,Q_3,u\right)$ and $Q_i\left(q_0,q_i\right)C_i$, $i\in$C are expenditure functions we have that

$$E(q_0,q_1,q_3,u)\equiv\tilde{E}\left(q_0,Q_1\left(q_0,q_1\right),Q_2\left(q_0,q_2\right),..,Q_3\left(q_0,q_3\right),u\right)\ -\ q_0\ \omega_0 \tag{13}$$

which may be taken to represent household behaviour according to the standard theory of demand (see Atkinson and Stern 1981 and Munk 2002).

We interpret $C_1\left(c_0^1,x_1\right)$ as the food production function in the informal sector with *Manufacturing* as the only input. Unit cost of food produced in the informal sector is

$$Q_1=Q_1\left(q_0,q_1\right)\equiv\left(\underset{c_0^i,x_1}{\mathrm{Min}}\ q_0c_0^1+q_1\,x_1\ \text{ s.t. } C_1\left(c_0^1,x_1\right)\right)/C_1 \tag{14}$$

and the corresponding cost function is thus

$$C\left(q_0,q_1,C_1\right)\equiv Q_1\left(q_0,q_1\right)C_1 \tag{15}$$

We therefore can define the profit function for food produced in the informal sector as

$$\Pi\left(q_1,Q_1;c_0^1\right)\equiv Q_1C_1-\tilde{C}\left(q_1,C_1;c_0^1\right) \tag{16}$$

where $\tilde{C}\left(q_1,C_1;c_0^1\right)\equiv q_1x_1$ for $C_1=C_1\left(c_0^1,x_1\right)$ is the *Labour* restricted cost function. Since $C_1\left(c_0^1,x_1\right)$ is assumed linearly homogenous, $\tilde{C}\left(q_i,C_1;c_0^1\right)$ must be strictly concave in C_1 .

$\Pi=\Pi\left(q_1,Q_1;c_0^1\right)$ represents a shadow remuneration of the primary factor used. As follows from Munk (2002) the shadow profit associated with "home production" may be neglected in the calculation of the optimal tax system.

We assume that the parameterised utility function takes the form (see Munk 1998)

$$U\left(c_0^0,C\left(C_1\left(x_1,c_0^1;\sigma^{11}\right),C_2\left(x_2,c_0^2;\sigma^{12}\right),..,C_{\mathrm{N}}\left(x_3,c_0^3;\sigma^{13}\right);\sigma^2\right);\sigma^3\right) \tag{17}$$

where $C_i\left(x_i,c_{0:}^i\sigma^{1i}\right)$, $i\in$C, $C\left(C_1,C_2,..,C_{\mathrm{N}};\sigma^2\right)$ and $U\left(C,c_0^0;\sigma^3\right)$ are CES functions characterised by elasticities of substitution σ^{1i}, $i\in C$, σ^2 and σ^3, respectively. The parameter values used for the tax simulations are provided in *Table 1*

Table 1 Parameter values of the CES-UT

Elasticity of substitution between pure leisure and consumption, σ^3		1
Elasticity of substitution between composite commodities, σ^2		2
Elasticity of substitution within composite: σ^{11}	*Manufacturing*	0.2
Elasticity of substitution within composite: σ^{12}	*Cash crop*	0.2
Elasticity of substitution within composite: σ^{13}	*Food*	0.2
Use of the primary factor in the informal sector as share of use in the formal sector		3
Cost of use of the primary factor as share of consumption	*Manufacturing*	3
Cost of use of the primary factor as share of consumption	*Cash crop*	0.5
Cost of use of the primary factor as share of consumption	*Food*	0

Assuming $x_1 = 10, x_2 = 1,\ \ x_3 = 9$ and $x_0 = -20$ the corresponding matrix of consolidated, compensated demand elasticities is as provided in *Table 2*.

Table 2 Compensated price elasticities for the CES-UT utility function employed

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

Details on the elasticity formulae employed may be found in Munk 2002. Notice that $\varepsilon_{10} < \varepsilon_{20} < \varepsilon_{30}$, and that compensated cross price elasticity with respect to the untaxed use of *Labour* in the informal sector is clearly smaller for *Manufacturing* than for *Food*.

4. Comparison with Keen's partial equilibrium model

In the partial equilibrium model employed by Keen (2006), two commodities are represented explicitly but the use of the primary factor in the informal sector and formal sectors is not explicitly represented. Assuming that the first commodity corresponds to *Manufacturing* and the other to *Food* in the general equilibrium model, Keen's partial equilibrium model explicitly represents *Manufacturing* imports and the domestic production of *Food* in the formal sector and the competing production in the informal sector. Keen (2006) assumes the production in the informal sector (C_1 in our notation and *Y* in Keen's notation) to be a perfect substitute to *Food* produced in the formal sector (y_3 in our notation and *y* in Keen's notation).

The consumer price of manufacturing, q_1 in our notation, is in Keen's notation

$$\rho \equiv \left(\frac{P + T_M + T_W}{1 - T_V} \right) \tag{18}$$

with P being the world market price of *Manufacturing*, and T_M and T_W the tariff rate and the VAT rate applied to *Manufacturing* import, respectively, (the latter, T_W, by Keen called a withholding tax) and with T_V being the VAT rate applied to sales of domestically produced goods, including *Food*. When ρ $T_V = T_W$ such that the tax-inclusive import price of *Manufacturing* faced by informal producers is $\rho = P + T_M$, this corresponds in a VAT at uniform rate, in our notation defined as a a consumer tax vector, $\left(t_1, t_2, t_3\right)$, where[4]

$$\left(t_i + p_i\right) / p_i = \overline{T} \qquad (i = 1,2,3) \tag{19}$$

The unit cost of food produced in the formal sector (in Keen's notation Q) is equal to the (tax inclusive) consumer price of food produced in the formal sector, as food produced in the informal and the formal sectors in his model are perfect substitutes. In Keen's notation the cost function $C(\rho, Y)$ corresponds to $C\left(q_i, C_1; c_0^1\right)$ in our notation. As long as the informal sector does not deliver input to the formal sector, the optimal tax system can be derived disregarding the shadow profit in the informal sector.

It thus follows from the analysis based on the general equilibrium model that a VAT at uniform rate (involving VAT on import of *Manufacturing* (the withholding tax) and VAT on *Food*) will not be optimal except in the unlikely case of all commodities being equally complementary with the untaxed used of *Labour* (for example by consumption being separable from the use of *Labour* in the informal sector). Optimality will in general require a differentiated VAT or in Keen's terminology a VAT supplemented with a withholding tax. Keen's result that for an optimal T_V and T_W there is no justification for the use of tariff follows from the results obtained for the optimal tax system when no restrictions are imposed on the set of feasible tax instruments, which again follows from the Diamond and Mirrlees production efficiency theorem (see Munk 2006). Supplementing a VAT at a uniform rate with a tariff on the import of *Manufacturing* will in general create production inefficiency, the cost of which to be justified has to be balanced by lower administrative costs. In Keen's terminology replacing the withholding tax by a tariff would therefore have to be justified with reference to savings in administrative costs.

4 It is thus not correct, as Keen (2006) seems to suggest, that imports is not assumed subject to VAT in Munk (2006,).

5. Quantitative illustration

To illustrate the insights presented in the two previous sections we provide simulation results derived from a stylized CGE model based on the values for the parameters of the CES-UT utility function listed in *Table 1* and the assumption that at world market prices the returns to the primary factor in the production of *Cash crop* is 2% lower than in the production of *Food* in the formal sector, whereas the country is far from competitive in *Manufacturing*.

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

		Lump sum' (1)	VAT only (2)	τ^{*1} (3)	τ^{*2} (4)	τ^{*3} (5)
Domestic tax rates						
Manufacturing	t_1	0.000	0.000	0.845	0.000	0.000
Cash crop	t_2	0.000	0.000	0.141	0.000	0.000
Food	t_3	0.000	0.000	0.000	0.000	0.000
Labour	t_0	0.000	-0.565	-0.294	-0.352	0.000
Border tax rates						
Manufacturing good	t_1^W	0.000	0.000	0.000	0.681	2.722
Cash crop	t_2^W	0.000	0.000	0.000	0.000	0.980
Food	t_3^W	0.000	0.000	0.000	-0.078	0.000
Production						
Manufacturing	y_1	0.000	0.000	0.000	0.000	0.000
Cash crop	y_2	0.000	0.000	0.000	14.649	0.000
Food	y_3	20.000	11.566	14.918	0.000	20.544
Labour supply	x_0	-35.000	-26.566	-29.918	-29.942	-35.544
Net trade						
Manufacturing	y_1^W	10.000	8.391	7.219	7.183	5.288
Cash crop	y_2^W	1.000	0.450	0.762	-13.847	0.618
Food	y_3^W	-11.000	-8.842	-7.981	6.664	-5.906
Change in real income relative to the benchmark situation disregarding administrative costs (EV)		0	-4.137	-2.413	-2,844	-5.220

Note: In the case of τ^{*3} we assume that there is an export ban for cash crop preventing the switching of production to cash crop.

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 $\boldsymbol{\tau}^{*1}$, when domestic taxation is constrained to be a VAT at uniform rate but border taxes are feasible by $\boldsymbol{\tau}^{*2}$, and when only border taxes are available to the governments by $\boldsymbol{\tau}^{*3}$.

According to the simulation results, *if* the supplementary administrative costs of using border taxes is smaller than 4,3% of GNP[5], this would justify supplementing a VAT at a uniform rate with border taxes, Moreover, savings in administrative costs of 1.3%[6] of GNP or more would justify using differentiated border taxes rather than differentiated domestic taxes to discourage the untaxed use of the primary factor in the informal sector. Finally it requires a difference in administrative costs of more than 3.7%[7] of GNP to justify raising government revenue only using border taxes rather than by a VAT at uniform rate.

6. Conclusion

Stiglitz' (2003) claim that border taxes are a better instrument than a VAT for developing countries cannot be made only with reference to the size of the informal sector. Theoretical analysis implies that whether border taxes are desirable for any given country or not is ultimately an empirical question which hinges on the distortionary and administrative costs of various tax arrangements for that country. While the question thus has to be resolved through further empirical research, the quantitative illustration provided in this paper makes it appear likely that border taxes will be more desirable than VAT in certain developing countries with a very weak administrative infrastructure and a large informal sector.

[5] Calculated as (4.1-2,8)/30 where 30 is the GNP in the formal sector. Including the value of the use of the primary sector is the GNP is almost 60 and the percentages corresponding smaller.
[6] (2.8-2.4)/30
[7] (5.2- 4.1)/30

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