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Paul Collier and Anthony J. Venables

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Paul Collier, University of Oxford
Anthony J. Venables, University of Oxford and CEPR

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Illusory Revenues: Tariffs in Resource-Rich and Aid-Rich Economies*

Where imports are financed predominantly by rents from resource extraction or aid, the revenue generated by tariffs is illusory. Revenue earned by the tariff is offset by a reduction in the real value of aid and resource rents. Revenue is however moved between accounts in the government budget, which, in the case of aid, may reduce the burden of donor conditionality. We demonstrate this proposition and its qualifications analytically and by simulating the effects of tariffs on revenue, real income, and export diversification for a range of cases. Whereas countries in which tariff revenue is illusory should adopt more liberal trade regimes, we show that currently there is no such tendency.

JEL Classification: F1, F35 and Q3
Keywords: aid, import tariffs and natural resources

Paul Collier
CSAE
Economics Department
Manor Road
Oxford OX1 3UQ
Email:
paul.collier@economics.ox.ac.uk

Anthony J. Venables
Oxcarre
Department of Economics
Manor Road
Oxford
OX1 3UQ
Email:
tony.venables@economics.ox.ac.uk

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1. Introduction:

In this paper we analyze the true fiscal consequences of tariffs for those governments with large revenues from resource exports or aid. We show that in such countries the revenues generated by tariffs are offset by unrecorded reductions in the real values of resource rents and aid flows, so that the apparent revenues are illusory. Not only can tariffs even reduce true revenue, but in the process they have the usual negative effects on aggregate real income and can prevent export diversification. Why then do such countries employ import tariffs? One reason is that because the true consequences of tariffs are opaque, governments may resist trade liberalization due to misplaced fears of revenue losses. Another reason may be that, as tariffs transfer revenue between government accounts, they have the effect of converting aid flows into tariff revenues and thereby creating a revenue stream free of burdensome donor conditions.

The revenue argument for tariffs has become increasingly potent as old arguments for protection have been discredited. The general trend towards trade liberalization in developing countries has in part been due to the initial scope for the tariffication of quantitative restrictions which reconciles a degree of liberalization with the need for revenue. With the scope for revenue-neutral trade liberalization largely exhausted and with other arguments for protectionism on the wane, the perceived revenue losses may now be powerful impediments to further liberalization. In the new world of fiscal prudence, such losses would be seen as irresponsible. Indeed, tariff revenues might be seen by the government as disproportionately important. The IMF advises resource-rich economies to focus on the 'non-resource fiscal balance' (IMF 2007). Since tariffs transfer revenue from the resource account to the non-resource account the concept of the non-resource fiscal balance inadvertently and pointlessly encourages trade restrictions. Similarly, in measuring the fiscal deficit the IMF treats aid as a financing item whereas tariff revenue is classified as revenue. These practices have the unintended effect of making tariffs appear prudent even if their true effects are to be revenue-neutral and economically damaging. Hence, it may well matter for the balance of debate on trade policy if the apparent revenue losses from further trade liberalization are illusory. Further, several of these governments are concerned to promote non-resource exports. For example, the government of Nigeria is ambitious to diversify exports from the current exclusive dependence upon oil and

gas, and the government of Ethiopia is similarly ambitious to diversify away from coffee and foreign assistance. Such governments may not appreciate that whereas tariff-based revenue strategies do not generate revenue, they do have inadvertent side-effects that can foreclose the desired export diversification. Hence, tariffs are not merely redundant: they damage a core government objective.[1]

Additionally, in aid-dependent countries governments may use tariffs to transform aid into unrestricted revenues, this being a route for fungibility that has not previously been considered in the literature. Aid receipts usually come with conditions as to how the money should be spent. Traditionally, donor earmarking of money has been by means of projects. As donors came to realize that such earmarking was largely illusory due to fungibility, new earmarking technologies were introduced that tied aid to incremental expenditures in particular sectors, usually health and education. However, tariffs have the effect of shifting revenue from the budget head of aid, on which donors set such conditions, to a category which donors recognize as the government's 'own' revenues and which are thereby free of conditions. To the extent that they recognize this effect, governments with high aid receipts may choose higher tariff levels than they would otherwise see as desirable.

Why is the revenue effect of tariffs in resource-rich and aid-rich countries likely to be illusory? The central analytical idea is simple: resource exports and aid are rents which accrue to the government, and tariffs reduce the real value of these rents. Consider an economy that has an exogenously determined supply of foreign exchange coming from resource revenues or from aid. This determines the volume of imports that the economy can purchase. Demand for imports is a function of the price of imports relative to other goods, and the equality of import demand to the given supply determines this relative price. Import tariffs raise the price of imports but, since they cannot change their *relative* price, they must have the effect of increasing domestic prices proportionately. In the simplest case tariffs have no real effect on the economy. They do, however, have some nominal effects, including the transfer of revenue between budget heads in the government accounts. The import tariff raises revenue, but it also reduces the domestic purchasing power of the resource or aid revenues, effects that exactly net out. This means that while tariffs appear to be earning revenue for the government, they are in fact having no effect.

[1] Cross-country regressions by Arezki and van der Ploeg (2007) show that a restrictive policy worsens the impact of natural resources on both growth and per capita income.

Although the core of the paper is analytic, we first demonstrate that the issue is not arcane. In Section 2 we show that tariff revenues remain substantial in many developing countries that are natural resource exporters or aid-dependent. Indeed, among these countries there is some tendency for the height of tariffs to be *positively* related to the importance of resource revenues. We then test our analytical argument in a more rigorous framework. We show that the proposition that tariffs have a precisely zero real effect (while moving revenue between government accounts) requires strong assumptions. However, relaxing these assumptions does not in general rehabilitate the case for tariffs. Although there are cases in which tariffs generate net revenue, there are also cases in which net revenue is decreased. Thus, in the absence of the detailed knowledge necessary to determine the true outcome, zero net revenue combined with adverse side effects is reasonable working assumption for policy makers. We do this analysis in two stages. Sections 3 - 5 investigate a theoretical model, and Section 6 – assisted by numerical simulation – looks at some extensions, including the deleterious effects of tariffs on export diversification.

2. Evidence on Tariffs

We first investigate whether countries with large foreign exchange inflows from natural resource exports or aid have lower tariffs than other developing countries. Our subsequent analysis suggests that such countries have less reason to impose tariffs.

In Table 1 we report a regression which relates the weighted average height of the tariff to other characteristics of the country.[2] The regression controls for per capita income: countries with lower per capita have higher average tariffs than countries that are more developed. However, our key concern is whether the tariff is related to natural resource exports and aid. In column 1 the sample is all countries for which data are available. Neither resource exports nor aid as a share of GDP are close to statistical significance: resource-rich countries do not set their tariffs systematically lower than other countries at the same level of per capita income. Column 2 repeats

[2] Most empirical studies of the determinants of tariffs have concentrated on cross-sectoral variation within country, see Gawande and Krishna (2003) for a survey. Several cross-country studies have related country average tariffs to per capita income and to political economy measures. Banerji and Ghanem (1997) find that measures of authoritarianism are positively associated with trade protection. Hwang and Jung (2002) find democracy has a negative effect on average tariff rates. Dutt and Mitra (2002) show that left-wing ideology increases trade protection; they include an oil variable in their regressions, which turns out to be insignificant.

the exercise for countries with per capita income of less than $2000; the finding is unchanged.

In column 3 we repeat the regression confining the sample to 40 countries for which there is data on resource revenues (accruing to government) as opposed to resource exports. The share of resource revenues in GDP is statistically significant, but the coefficient is *positive*. Far from setting lower tariff rates if resource revenues are high, as the illusory nature of tariffs would suggest, governments tend to set higher tariffs. The most likely explanation for this relationship is that as the foreign exchange inflows from resource exports appreciate the real exchange rate this squeezes the profitability of the firms in the import substitute sector and they successfully lobby for tariff protection. The relationship between aid and the height of tariffs is negligible and insignificant: in effect, tariffs are unrelated to aid inflows. Both resource revenues and aid will augment imports, so resource-rich and high-aid economies will tend to have high tariff revenues, other things equal. Hence, in neither case do governments reduce tariffs despite the fact that their true revenue effects are weaker than in other countries.

Table 1: Explaining the Tariff Rate

	Weighted average tariff rate	Weighted average tariff rate	Weighted average tariff rate
Resource exports % GDP	0.0086 (0.04)	-0.0516 (0.058)	
Resource revenues % GDP			0.177 (0.079)
Aid % GDP	0.129 (0.085)	0.023 (0.105)	-0.116 (0.246)
GDP per capita	-0.0003 (0.00015)	-0.0035 (0.0018)	-0.00056 (0.00021)
Constant	9.67 (1.08)	13.35 (2.27)	8.85 (1.72)
N	131	76	40
Adjusted R^2	0.05	0.05	0.13

Notes: Data used are mean values of annual data from 2000 – 2005, with the exception of tariff rates, which are annual values for specific years between 2000 and 2005.
For data sources see appendix table A1.

Table 2: Trade taxes in resource and aid dependent countries:

Country	Resource exports (% GDP)	Aid (% GDP)	Trade Tax (% GDP)	Tariff Rates (% weighted mean)
Congo, Rep.	69.34	8.16	1.92	17.7
Angola	66.75	3.21	3.50[1]	6.0
Bahrain	63.26	0.66	1.94	5.2
Oman	51.21	0.16	0.64	3.2
Papua New Guinea	41.99	6.54	5.44	2.2
Kuwait	45.26	0.0	0.84	4.5
Nigeria	42.68	0.61	2.40[2]	10.8
Tajikistan	29.49	11.80	1.40	6.1
Congo, Dem. Rep.	9.45	31.46	1.13	13.0
Algeria	37.91	0.40	3.22	10.6
Mongolia	20.40	17.34	2.17	4.3
Kazakhstan	35.13	0.66	0.86	1.9
Trinidad and Tobago	34.80	-0.03	1.48	5.5
Venezuela, RB	26.30	0.05	1.29	12.7
Iran, Islamic Rep.	21.86	0.09	2.01	13.8
Nicaragua	0.39	18.83	1.12	5.4
Bolivia	10.90	8.24	0.86	5.5
Russian Federation	18.75	0.29	6.20	9.6
Kyrgyz Republic	5.11	11.91	0.35	4.3
Ethiopia	0.07	16.25	4.50	13.5
Belarus	14.87	0.24	2.32	8.9
Uganda	0.51	14.50	3.34	8.98

Notes: Countries for which (a) aid plus resource exports amount to more than 15% of GDP and (b) trade tax revenue as % GDP data is contained in WDI.
Data used are mean values of annual data from 2000 – 2005, with the exception of tariff rates, which are annual values for specific years between 2000 and 2005.
1: 2004, imports only. 2: 2003.
For data sources see appendix table A1.

Table 2 presents data on resource-exporting and aid-dependent developing countries. Tariff revenues as a share of GDP for these countries ranges up to 6.2%. Evidently, even at the lower end of this range revenues are sufficiently large for their potential loss as a result of trade liberalization to be a serious concern to ministries of finance, if indeed they are not illusory. Hence, in many resource-rich and aid-dependent countries tariffs *appear* to generate important revenues. Thus, governments of these countries may well be particularly cautious of trade liberalization when in fact the fiscal case against liberalization is much weaker.

3. A model:

The analytical model we develop has three goods, one non-tradable and two tradable, one of which may be a natural resource. There are private consumers and government. Government revenue can come from aid, from ownership of some fraction of the fixed factor in the resource sector, and from import tariffs.

The non-tradable good is produced by labour alone; we set the labour requirement per unit output at unity, so its price is equal to the wage rate, w. Both the tradable goods are, in general, produced and consumed domestically and the direction of trade is determined by domestic excess demand/ supply. The good that is imported we label M; it has fixed world price of unity and is subject to tariffs at tariff factor t, so the domestic price is t and free trade occurs if $t = 1$. The good that is exported is labelled X and is sold at fixed world price p. Technologies are described by revenue functions, $r^M(p,t,w)$, $r^X(p,t,w)$. These give revenues earned by the fixed factor in each sector, and their arguments indicate that each sector may use as inputs labour (and/or the non-traded good) and the other traded good. In the X-sector the fixed factor may be thought of as the natural resource endowment.

Private and public sector budget constraints are respectively

$$e(p,t,w)u = wL + r^M(p,t,w) + (1-\beta)r^X(p,t,w), \qquad (1)$$

$$e(p,t,w)g = A + \beta r^X(p,t,w) + (t-1)m(p,t,w;v). \qquad (2)$$

In the first of these u is utility and $e(p,t,w)u$ is the expenditure function defined over the prices of the X and M sector goods and the non-tradable. The private sector receives wage income (L is the fixed labour force), the whole of revenue accruing to the fixed factor in the M-sector, and fraction (1 - β) of revenue accruing to the fixed factor in the X-sector. Equation (2) is the public sector budget constraint. Real government consumption (or 'utility'), g, has the same unit cost function as private utility and it is simplest to think of g as lump sum transfer to households; we discuss the implications of relaxing this assumption in section 6. Government consumption is financed by an international transfer A, tariff revenue on imports, share β of revenue from the X-sector, this representing government resource revenue. Instead of writing imports in terms of underlying expenditure and revenue functions, we summarise

them in the import demand function $m(p,t,w;v) \equiv e_t(p,t,w)v - r_t^M(p,t,w)$, where v denotes total utility, $v \equiv u + g$, and subscripts denote partial derivatives.

We need one further equilibrium condition and the simplest to use is balance of payments balance (the alternative is labour market clearing[3]). Payments balance is

$$m(p,t,w;v) = px(p,t,w;v) + A, \tag{3}$$

where $x(p,t,w;v) \equiv r_p^X(p,t,w) - e_p(p,t,w)v$ is the export supply function. In general, exports depend on all the prices in the domestic economy and on total utility.

Equations (1) – (3) characterise equilibrium, implicitly defining values of endogenous variables w, u and g. Before using the model to investigate the impact of tariffs, we note alternative ways in which the model can be interpreted. In addition to tariff revenue, there are two sources of rent accruing to government. One is A, and the other is share β of the returns to the fixed factor in the X-sector. Aid is captured in the term A, and resource rents could be modelled either as part of A or as the X-sector, in which case the fixed factor is the natural resource endowment. The fundamental difference between the two is that while A is a pure lump sum transfer, the X-sector may use other inputs (as the revenue function depends on w and t) and X-output may be used in the domestic economy (since p enters the expenditure function and the M-sector revenue function). Carrying these two alternative ways of representing government rents gives some useful flexibility. For example, if the X-sector is not interpreted as the natural resource sector then it is simply another tradable sector which is not subject to a trade tax, which may be entirely private sector ($\beta = 0$) and might (if A is large enough) be a second import good.

The central question we address is; what is the effect of a change in the tariff, t, on equilibrium values of other variables, in particular g? The answer comes by looking first at the public sector budget constraint, (2). We will look only at changes in the neighbourhood of free trade, $t = 1$. Since this economy has no imperfections, we know that such changes have no effect on total utility, so $dv = 0$. Differentiating around $t = 1$ gives,

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[3] $L = e_w(p,t,w)v - r_w^M(p,t,w) - r_w^X(p,t,w)$, not independent by Walras' law.

$$e.dg = mdt + \beta\left(r_t^X dt + r_w^X dw\right) - \left(e_t dt + e_w dw\right)g\,. \qquad (4)$$

This is readily interpreted. The left hand side is the cost of a change in real government consumption, *dg*. The first term on the right hand side is tariff revenue. The second is the effect of price changes on government revenue derived from the *X*-sector. The third term is the price index effect, measuring the changing cost of government consumption.

Equation (4) can be written in a more useful way. Using $d(w/t) = dw - wdt$ (around $t = 1$) and homogeneity of revenue and expenditure functions[4], (4) becomes

$$edg = \left[m + \beta\left\{r^X - pr_p^X\right\} - g\left\{e - pe_p g\right\}\right]dt - \left[e_w g - \beta r_w^X\right]d(w/t) \qquad (4b)$$

Equilibrium imports, using balance of payments condition (3) and public sector budget constraint (2) are

$$m = pr_p^X - pe_p v + A = pr_p^X - pe_p v + eg - \beta r^X\,. \qquad (3b)$$

Using this expression in (4b) gives

$$edg = \left[(1-\beta)pr_p^X - pe_p u\right]dt - \left[e_w g - \beta r_w^X\right]d(w/t) \qquad (5)$$

This expression is equivalent to equation (4), but splits the terms into two parts which capture the effects we are studying.

The first term on the right hand side is the change in tariffs times the exports of the private sector, i.e. the private sector share of *X*-production minus private consumption of *X*. Lerner symmetry says that there is equivalence between import and export taxes, but export taxes raise revenue only in so far as there are *private* sector exports to tax. Notice that the sign of these private sector net sales is ambiguous. If β is close to unity then the term may be negative and the private sector a net purchaser of *X*. The direct effect of *dt* then has a *negative* effect on real government revenue; the intuition is that an increase in the tariff gives a lower relative

[4] $pr_p^X + wr_w^X + tr_t^X = r^X, pe_p + we_w + te_t = e$

price of good X, so the private sector is paying the government less (in real terms) for its net purchases of the resource.

The second term captures the effect of a change in the price of labour/ non-tradables relative to the tariff rate. The term in square brackets is unambiguously positive, as government is endowed with no labour/ non-tradables, but uses them in X-production and in public consumption. The effect is therefore to increase (decrease) real government revenue according as wages go up proportionately less than (more than) the tariff.

To evaluate equation (5) we have to find the equilibrium response $d(w/t)$ to a change in tariffs, dt, and this can be derived from the balance of payments condition, (3). Demand and supply functions are homogeneous of degree zero in prices, so (3) can be rewritten as

$$m(p/w, t/w, 1; v) = px(p/w, t/w, 1; v) + A. \qquad \text{(3b)}$$

We look only at changes in the neighbourhood of free trade, $t = 1$, so $dv = 0$. Differentiating (3b) therefore gives the relative price changes as

$$\{m_t - px_t\}d(t/w) + \{m_p - px_p\}d(p/w) = 0. \qquad (6)$$

This says that there is no change in the price of labour/ non-tradables relative to imports, $d(t/w) = 0$, if $\{m_p - px_p\} = 0$. We discuss the interpretation of this below.

To establish the effect of tariffs on real government expenditure we now have to proceed in two steps, using equation (6) to establish the equilibrium change in t/w following the exogenous change in t, and using (5) to evaluate implications for g. We do this in a series of stages, starting with a very restricted version of the model and then increasing generality.

4: Lump sum aid and resource rents:

The simplest case is that in which aid and resource rents are pure lump sum transfers (i.e. contained in A) and there is no X-sector. The economy just has non-tradeables

and imports financed by A. Since neither the X-sector nor price p exist, equation (6), giving relative price changes associated with a change in tariffs, simply becomes

$$m_t d(t/w) = 0 . \tag{6b}$$

This tells us that the relative prices of imports and labour/ non-traded goods is constant, $d(t/w) = 0$. As outlined in the introduction, changes in the tariff rate t must cause equi-proportionate changes in w in order to hold import demand equal to the fixed supply of foreign exchange. As for the impact on real government consumption, equation (5) becomes

$$edg = -e_w gd(w/t) = 0 . \tag{5b}$$

This is the central case, in which the tariff has no effect on real government revenue.

While the tariff has no real effect, it does have a nominal effect. Imports are equal to A, so tariff revenue (at world prices) is $(t - 1)A$. Total government revenue is this plus A, i.e. $tA = eg$, so fraction $(t - 1)/t$ of government revenue appears to be tariff revenue. However, as t increases so w and the price index e increase equi-proportionately, leaving g unchanged.

5 : Resource producing *X*-sector

We now reinstate the X-sector and think of it as the natural resource sector, although we initially do this in a way that gives it limited interaction with the rest of the economy. In this section we want to focus on the relative price effect $d(w/t)$ and on the second term in equation (5), and we do this by making the following assumptions. The resource is exported, but not used in either domestic consumption or domestic production. Production of the resource uses domestic labour, and may also use imports providing that these are *not* subject to tariffs.[5] All resource revenue accrues to government, so $\beta = 1$.

The effect of these assumptions are first, that since $\beta = 1$ and there is no domestic consumption of the resource ($e_p = 0$), equation (5) becomes

[5] The resource price, p, could be defined net of imported inputs.

$$edg = -\left[e_w g - r_w^X\right] d(w/t)\,. \tag{5c}$$

Second, supply and compensated demand for each of *M* and *X* depend just on their own price relative to the wage, respectively *t/ w* and *p/w*. There are zero cross-price elasticities of demand between *M* and *X*, $m_p = x_t = 0$, so the relative price changes as given by equation (6), satisfy

$$m_t d(t/w) - px_p d(p/w) = 0\,. \tag{6c}$$

This can be rewritten using own price elasticities of import demand and export supply defined as $\eta_M \equiv (m_t / m)\, t / w \le 0$ and $\eta_X \equiv (x_p / x) p / w \ge 0$, so (6c) becomes

$$d(w/t) = -\left\{\frac{\eta_X px}{\eta_X px - \eta_M m}\right\} wdt\,, \tag{6d}$$

and hence the change in government consumption depends on *t* according to

$$edg = \left[e_w g - r_w^X\right]\left\{\frac{\eta_X px}{\eta_X px - \eta_M m}\right\} wdt\,. \tag{5d}$$

We see from these expressions that the relative price *w/t* is unchanged if the elasticity of export supply is zero; if the level of exports is zero; or if the elasticity of import demand is infinite. If these conditions are not met then *d*(*w/t*) < 0 and the tariff increase is not fully passed into wages and non-tradable prices. Given these relative price changes, (5d) gives changes in real government expenditure. The term in the square bracket is certainly positive, so *d*(*w/t*) = 0 implies that there is no change in real government revenue, while *d*(*w/t*) < 0 means that there is some increase in government revenue following from an increase in the tariff.

Figures 1 and 2 illustrate cases when the elasticity of export supply η_X is zero and when it is positive. The model is described in the appendix; it uses Cobb-Douglas preferences, CES production technologies, and is slightly more general than the model outlined in the text in allowing for a specific factor in the non-tradable sector,

as well as in the tradable sectors. The horizontal axis is the tariff rate and the vertical is real government revenue, expressed relative to its free trade value. The bottom curve is the real value of A (A/e), the second is this plus real resource rents, (($A + \beta r^X$)/e), and the top line is total real government revenue, g, so the gap between the two upper lines is tariff revenue.

In figure 1 the elasticity of export supply is zero, so aid and resource rents are lump sum transfers. (In the simulation model this is achieved by having no labour used in this sector so the quantity supplied is set by the fixed factor, i.e. the mineral stock). The example is constructed such that A and X-sector rents each account for half of government revenue under free trade. We see that increasing the tariff rate has no effect on real government revenue, so that g is flat. As the tariff rate increases to 100% ($t = 2$) so the price level doubles and the domestic value of the pure transfer and the resource rent both halve. Despite having no real effect, the tariff comes to account for 50% of government revenue. Notice also that g is constant across the whole range of t, indicating that our analytical technique of just evaluating derivatives in the neighbourhood of $t = 1$ is not critical to this central result.

In figure 2 the labour share parameter in the X-sector rises to 25%. This means that initial rents and government revenue are lower and – critically for current purposes – that there is a substantial elasticity of export supply. As the tariff increases so this raises the wage rate relative to the price of the natural resource and thereby reduces the volume of resource exports and gives payments balance at a lower value of w/t. Real revenue is increased by the tariff, up to some point at which falling X-sector supply and import volumes start to have a negative overall effect. It is still the case that the increase in g is much smaller than the increase in tariff revenues, and there is substantial erosion of real aid and resource rents.

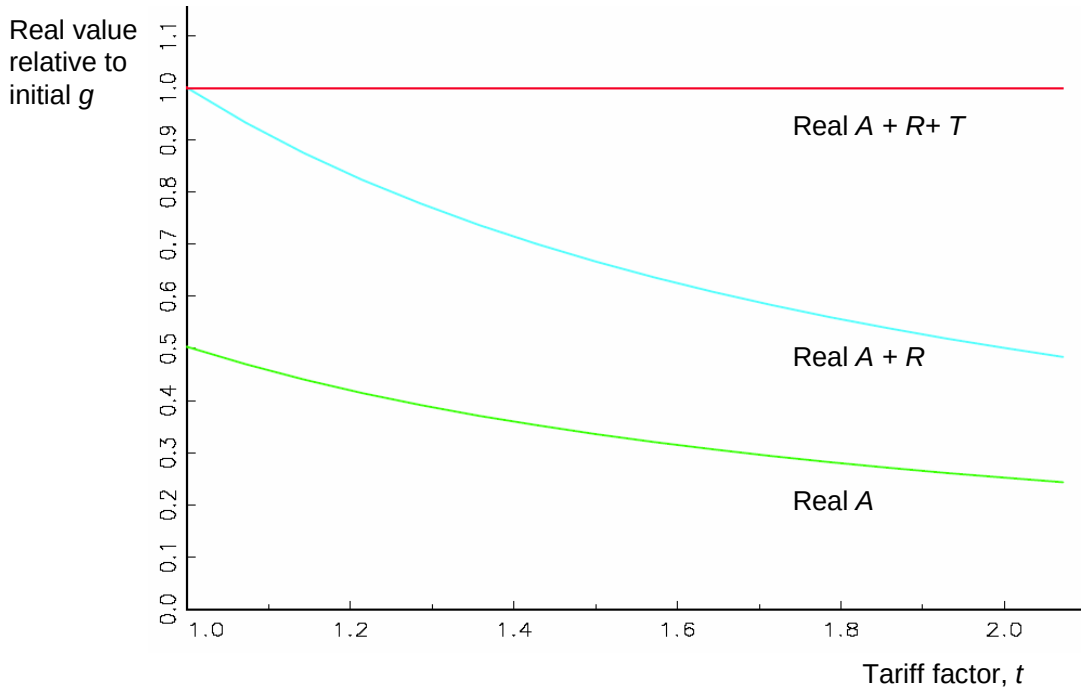

Figure 1

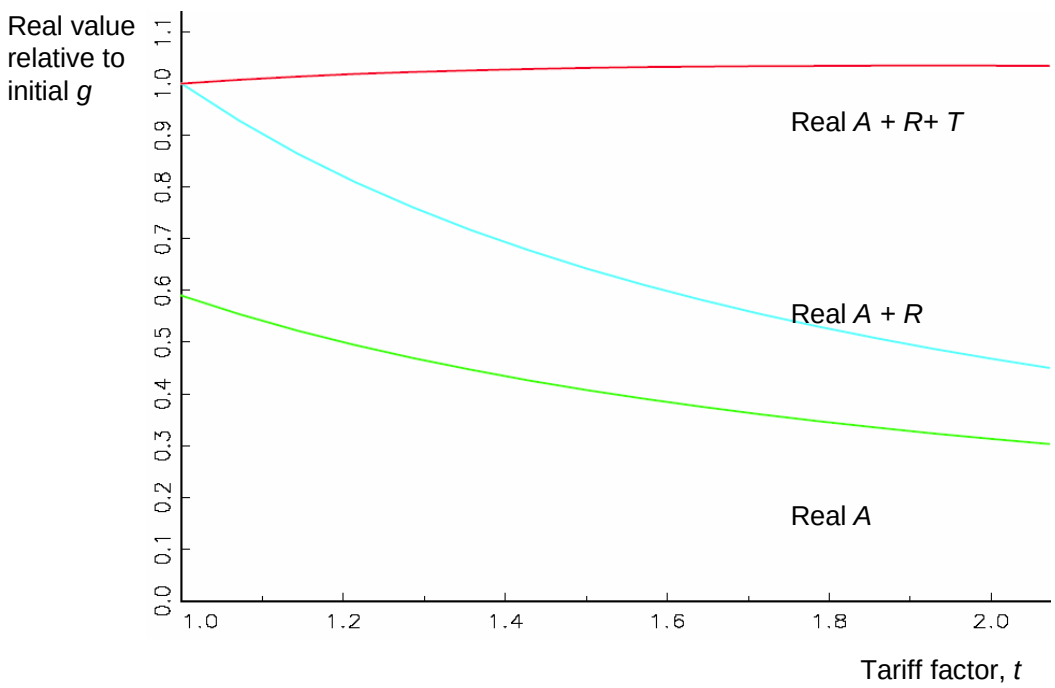

Figure 2

6. Generalising the *X*-sector

In the previous section we made a number of assumptions about the *X*-sector in order to focus on the elasticity conditions that shape the response of the wage (and non-tradable price) to a change in tariffs. We now remove these assumptions, returning to the general model as set out in section 3. This changes things in two main ways. First, there are now cross-price elasticities in import demand and export supply functions. And second, the first term in equation (5) is reinstated, and we reproduce that equation here for reference;

$$edg = \left[(1-\beta)pr_p^X - pe_p u\right]dt - \left[e_w g - \beta r_w^X\right]d(w/t)\,. \qquad (5)$$

As noted in section 3, the first term is private sector net sales of *X*-sector output, and can be either positive or negative. The intuition is that an increase in tariffs reduces the relative price of good *X*, so that the private sector is paying government less (in real terms) for its net purchases of the resource. Figure 3 illustrates possibilities. It has exactly the same parameters as figure 2, except that now $e_p > 0$, captured in the simulation by 10% of domestic income being spent on good *X*. The first term in (5) is negative, and we see that tariffs reduce *g* through the entire range.

There are two sources of rent accruing to government, and it is worth drawing out the role that each plays in this general model. Figure 4 has on the vertical axis the change in *g* associated with increasing the tariff factor from 1.1 to 1.2. This number is expressed relative to what it would be if neither of these sources of rent were present, the point labelled $A = 0$, $\beta = 0$. (All other parameters are the same as in figure 3). As is clear, giving government either aid or resource rents, $A > 0$ or $\beta > 0$, reduces the real revenue raised by the given tariff change, as the surface falls away from the point $A = 0$, $\beta = 0$. The decline is continuous, going to negative values when all resource revenues are taken by government, $\beta = 1$.

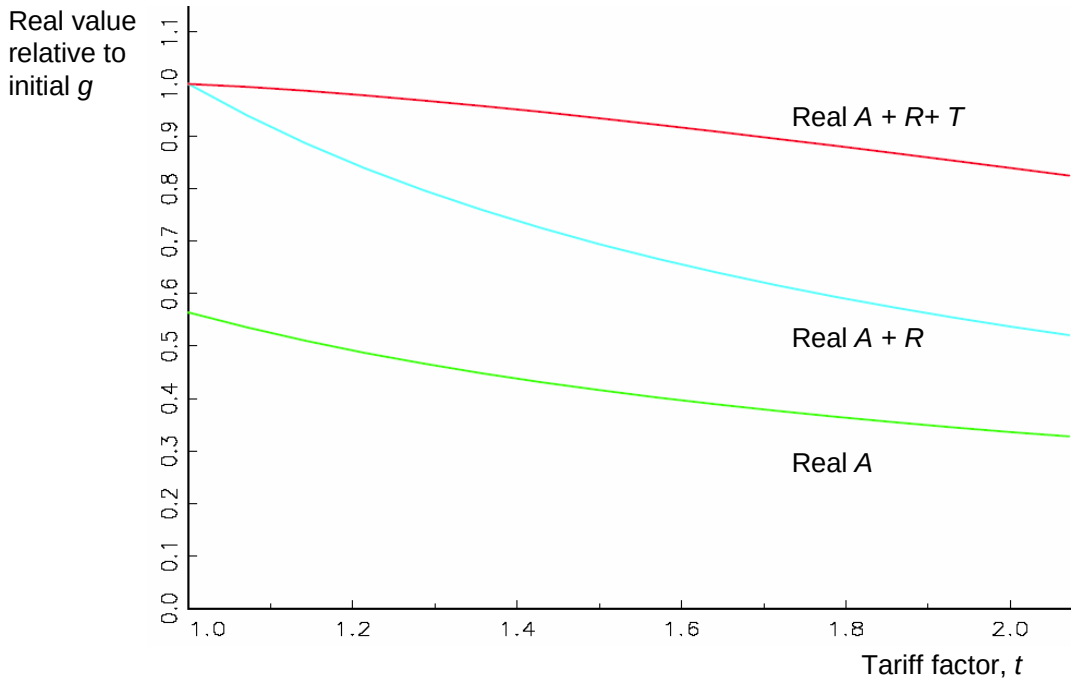

Figure 3

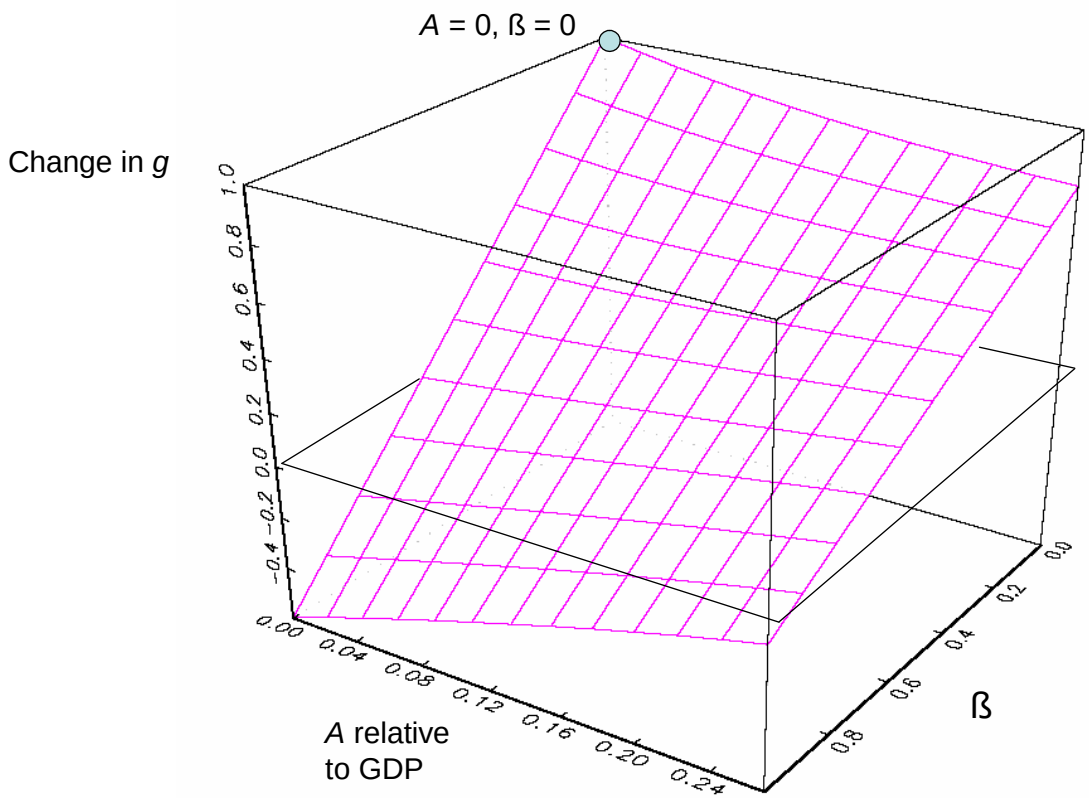

Figure 4

7. Extensions

We now turn to several extensions of our core model, adding further sectors and allowing government consumption patterns to be different from those of the private sector.

Non uniform tariffs

In our core model the tariff rate is constrained to being uniform since there is only a single import good. We now consider the implications of multiple tariffs applying to different import goods, so purchasers of imports are faced with a vector of relative prices among imports which diverges from world prices.

A central result comes from reconsidering the basic model of section 4 in which aid and resource rents are lump sum transfers. In this model, if the import sector is divided into two sectors identical in all respects except that one is subject to a tariff and the other is not, then it is the case that an increase in the tariff reduces g for all $t > 1$. The reason is the following. Consider a tariff increase around free trade. For total imports to remain equal to the fixed supply of foreign exchange there must be an increase in demand for the untaxed import equal to the reduction in demand for the taxed input. This requires equal but opposite sign changes in the prices of the untaxed import, $1/w$, and the taxed import, t/w (both these prices expressed relative to the price of the non-tradable/ labour), so $d(1/w) = - d(t/w)$, i.e. $dw/w = dt/2$, from which it follows that $de/e = dt/2$.[6] This means that the real value of non-tariff revenue is eroded at rate $dt/2$, as compared to rate dt in section 4. Turning the tariff revenue, if there were no substitutability in demand between the two imports, then this would increase at half the rate that it does in section 4. However, demand substitution from the taxed to the untaxed import means that tariff revenue increases at less than half the rate of section 4. Thus, while in the basic model of section 4 $dg = 0$, in this case the relatively slower growth of tariff revenue gives $dg < 0$.

This reasoning evidently depends on symmetry of the two import sectors – e.g. if import demand elasticities differed, we could not have made the argument of equal and opposite price changes, $d(1/w) = - d(t/w)$. Nevertheless, it makes the point that in

[6] $e = e(t, 1, w)$, where t is the price of the taxed import, 1 is the price of the non-taxed import and w is the price of the non-tradable. Totally differentiating with expenditure shares adding to unity and equal expenditure shares for the two imports gives the equation.

the central case the presence of an untaxed import further reduces the revenue generating capacity of tariffs. Numerical simulations indicate that moving away from symmetry can move the result in either direction from this central case.

Export Diversification

Many aid- and resource-rich countries are seeking to diversify their exports. To capture this, we add a second export sector to the model. The sector has a specific factor, is privately owned, and has positive supply elasticity. Figure 5 illustrates the effect of an import tariff, using an example identical to that of figure 1, except for the addition of this second export sector. Over some range increases in *t* are associated with an increase in real government consumption. The reason is that it now takes a smaller increase in *w* to restore payments balance as non-resource exports fall in response to the import tariff; the additional export sector creates an elasticity in the export supply function. As *t* increases exports fall to the point at which the sector no longer exists, as illustrated by the downward sloping line on figure 5. At this point the model reverts to that of figure 1, and further increases in tariffs have no impact on real government revenue. Having destroyed the export industry, tariffs then simply transfer revenue between government accounts.

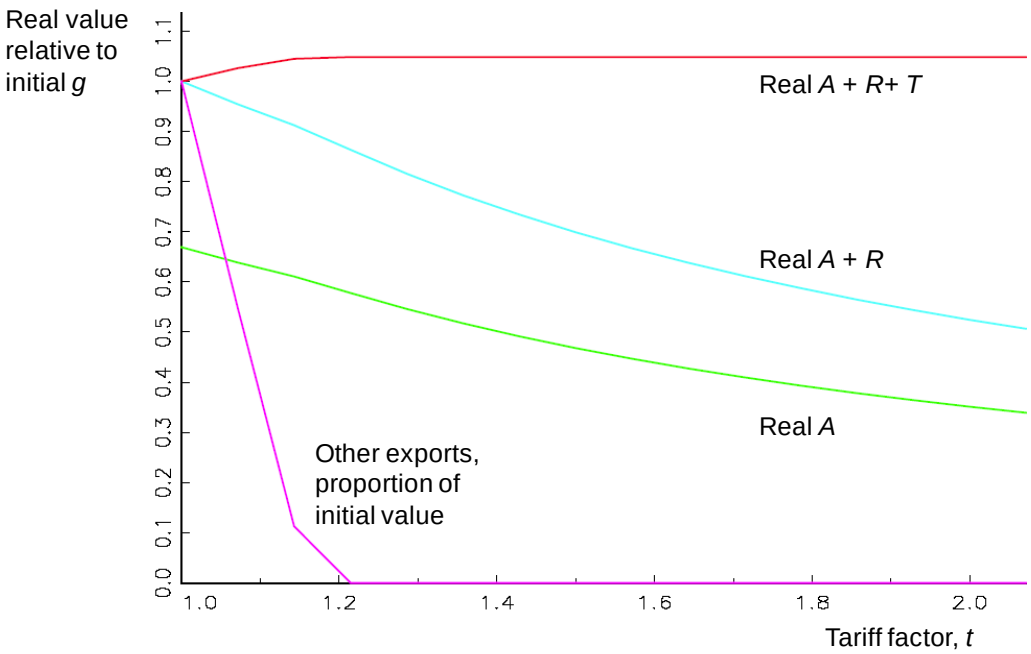

Figure 5

The composition of government expenditure

We have assumed to this point that the unit expenditure function (cost function) is the same for government as it is for the private sector. This simplifies analysis and allows us to interpret government expenditure as lump sum transfers for the private sector. The effects of relaxing the assumption are clear. The unit expenditure has three arguments, $e(p,t,w)$. As t is increased the first of these, p, is unchanged and the last, w, increases less than or in proportion to the increase in t. The impact of tariff induced price changes on the public sector are therefore greater (or less) than on the private sector according as the public sector consumption is more (or less) intensive in goods subject to the trade tax or non-traded goods/ labour, relative to X-sector output.

8. Conclusions:

We have shown that in resource-rich economies it is likely that import tariffs do not generate net revenue. The revenues shown in government budgets are illusory because they are offset by reductions in real revenues from resource rents, these losses not appearing in the budget as a line item. While the case in which the impact on net revenues is strictly zero is particular, once the analysis is generalized net revenues can either decrease or increase and so does not alter the presumption that for resource-exporting economies tariff revenues are illusory. Since aid is a form of foreign exchange rent accruing to the government, the same analysis applies. Hence the relevant measure to determine whether our analysis is pertinent in a particular context is the sum of resource rents and aid relative to the value of imports. For many low-income economies this combination of resource exports and aid is the predominant source of finance for imports.

As in other contexts, tariffs reduce welfare. They may also frustrate export diversification which is often a policy priority for resource-rich and aid-dependent economies. There is thus a strong case that countries in which tariff revenue is illusory should have lower tariff rates than those in which they generate genuine revenue. Yet we find no such tendency. This suggests that tariffs are excessive either because the illusory nature of revenue is not appreciated, or because of political advantages accruing to a shift of revenue between budget headings.

Appendix:

Unit expenditure is Cobb-Douglas,

$e(p_X, p_M, p_N) = p_X^{\alpha_X} p_M^{\alpha_M} p_N^{\alpha_N}$, $\alpha_X + \alpha_M + \alpha_N = 1$.

Production has CES unit cost functions, using labour and a specific factor.

$$c^i = \left(b_i w^{1-\sigma_i} + (1-b_i)\rho_i^{1-\sigma_i}\right)^{1/(1-\sigma_i)} \qquad i = M, X, N$$

Where b_i is a measure of factor shares, σ_i is the elasticity of substitution, and ρ_i is the rate of return on the specific factor. Equality of price to marginal cost gives $p^M = c^M$, $p^X = c^X$, $p^N = c^N$. The world price of M is unity so the domestic price is $p^M = t$. p^X *is* exogenous (simply denoted p in the text). In the model of the text $b_N = 1$ so for the non-tradable $p^N = c^N = w$. In simulation we work with the more general form above. Factor market clearing is:

$$L = \sum_i b_i \left(c^i / w\right)^{\sigma_i} , \qquad K_i = z_i (1-b_i)\left(c^i / \rho_i\right)^{\sigma_i} \quad i = M, X, N$$

where K_i and z_i are sector specific factor endowments and output levels respectively. Equilibrium is found using goods market clearing for non-tradables and budget constraints, as in the text.

Parameter values:

Figure 1:

$\alpha_M = 0.3$, $\alpha_X = 0$, $\alpha_N = 0.7$, $b_M = 0.66$, $b_X = 0.0$, $b_N = 0.9$.
$\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_N = 0.7$.
$K_M = 2$, $K_X = 4$, $K_N = 5$, $L = 9$, $A = 4$, $\beta = 1$.

Figure 2:

$\alpha_M = 0.3$, $\alpha_X = 0$, $\alpha_N = 0.7$, $b_M = 0.66$, $b_X = 0.25$, $b_N = 0.9$.
$\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_N = 0.7$.
$K_M = 2$, $K_X = 4$, $K_N = 3$, $L = 9$, $A = 4$, $\beta = 1$.

Figure 3:

$\alpha_M = 0.3$, $\alpha_X = 0.1$, $\alpha_N = 0.6$, $b_M = 0.66$, $b_X = 0.25$, $b_N = 0.9$.
$\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_N = 0.7$.
$K_M = 2$, $K_X = 4$, $K_N = 3$, $L = 9$, $A = 2$, $\beta = 1$.

Figure 4:

$\alpha_M = 0.3$, $\alpha_X = 0.1$, $\alpha_N = 0.6$, $b_M = 0.66$, $b_X = 0.25$, $b_N = 0.9$.
$\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_N = 0.7$.
$K_M = 2$, $K_X = 4$, $K_N = 3$, $L = 9$, $A \in [0,11]$, $\beta \in [0,1]$.

Figure 5: * denotes the second (privately owned) export sector.

$\alpha_M = 0.3$, $\alpha_X = 0$, $\alpha_{X*} = 0$, $\alpha_N = 0.7$, $b_M = 0.66$, $b_X = 0.0$, $b_{X*} = 0.66$, $b_N = 0.9$.
$\sigma_M = 0.7$, $\sigma_X = 0.7$, $\sigma_{X*} = 0.5$, $\sigma_N = 0.7$.
$K_M = 2$, $K_X = 2$, $K_{X*} = 2$, $K_N = 3$, $L = 9$, $A = 4$, $\beta = 1$.

Table A1: Data for countries in column 3 regression in table 1

Country	(1) Resource Revenue (% GDP)	(2) Resource Exports (% GDP)	(3) Aid (% GDP)	(4) Imports (% GDP)	(5) Trade Tax (% GDP)	(6) Tariff Rates (weighted mean)	(7) GDP per Capita
Algeria	26.3	36.8	0.4	23.7	3.2	10.6	1939.0
Angola	33.4	68.0	3.2	57.1		6.0	756.0
Azerbaijan	8.5	36.1	3.1	54.9		5.8	857.7
Bahrain	23.2	53.7	0.7	59.7	1.9	5.2	13068.8
Bolivia	5.6	5.0	8.2	27.8	0.9	5.5	1024.3
Botswana	20.6	32.3	0.5	34.7		11.2	4034.8
Brunei Darussalam	40.5	58.6	0.0			4.7	13108.7
Cameroon	4.8	8.3	4.7	21.6		16.5	713.4
Chad	3.8	42.9	8.5	48.8		12.5	211.9
Chile	2.2	11.7	0.1	32.0	0.7	3.9	5205.8
Colombia	3.0	4.4	0.5	21.0	0.9	9.6	2045.5
Congo, Rep.	22.2	68.7	8.2	53.1	1.9	17.7	951.1
Ecuador	6.6	11.8	0.7	30.5		8.7	1413.8
Equatorial Guinea	24.4	93.1	1.0			16.2	3453.6
Gabon	19.2	47.5	0.5	39.2		16.8	3869.1
Guinea	2.4	19.0	6.8	27.2		12.7	378.8
Indonesia	5.5	7.3	0.7	27.4	0.6	6.0	863.7
Iran, Islamic Rep.	14.7	69.4	0.1	24.4	2.0	13.8	1765.5
Jordan	0.2	3.5	6.5	75.8	4.0	7.6	1888.5
Kazakhstan	6.3	24.1	0.7	45.1	0.9	1.9	1604.7
Kuwait	46.1	45.1	0.0	32.8	0.8	4.5	18341.8
Kyrgyz Rep.	0.3	12.5	11.9	48.2	0.4	4.3	301.5
Libya	43.2	53.6	0.0	20.4		25.2	7007.7
Mexico	7.5	3.0	0.0	30.7	0.5	3.0	5959.3
Mongolia	2.9	26.3	17.3	84.2	2.2	4.3	427.5
Namibia	1.9	20.0	3.2	49.1	8.6	1.3	1929.3
Nigeria	32.3	46.2	0.6	36.7		10.8	416.2
Oman	38.6	19.8	0.2	36.9	0.6	3.2	8644.7
Papua New Guinea	5.6	47.9	6.5	50.5	5.4	2.2	640.5
Peru	1.5	8.1	0.7	18.1	1.1	8.3	2148.3
Russian Fed.	7.3	17.9	0.3	23.0	6.2	9.6	2077.6
Saudi Arabia	31.3	39.8	0.0	24.8		4.1	9265.4
Sudan	8.3	12.9	3.9	22.0		19.6	416.1
Syrian Arab Rep.	12.8	24.6	0.5	32.0		15.5	1135.0
Trinidad and Tobago	9.3	28.4	0.0	40.9	1.5	5.5	7607.8

Turkmenistan	8.7	28.7	0.8	59.5		2.9	633.6
United Arab Emirates	19.7	32.6	0.0	67.8		4.8	21878.6
Venezuela	15.8	25.8	0.1	19.2	1.3	12.7	4598.3
Vietnam	7.4	11.0	4.2	66.7		13.6	461.8
Yemen, Rep.	24.9	32.7	3.1	38.8		11.8	533.0

Notes:
Data used are mean values of annual data from 2000 – 2005, with the exception of tariff rates, which are annual values for specific years between 2000 and 2005.
Column 1: Natural resource revenue (% GDP). Source: *IMF Resource Transparency 2007*
Column 2: Natural resource exports (% GDP). Source: *IMF Resource Transparency 2007*
Column 3: Official development assistance. Source: *World Development Indicators 2007*
Column 4: Imports of goods and services (%GDP). Source: *World Development Indicators 2007*
Column 5: Trade Tax (% GDP). Source: *World Development Indicators 2007*
Column 6: Tariff rates (weighted mean value %) on all products. Source: *World Development Indicators 2007*
Column 7: GDP per capita (constant 2000 US dollars). Source: *World Development Indicators 2007*

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