Fiscal Policy and Tax Incidence

Trade Policy and the Missing Revenue

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Chapter 14

Trade Policy and the Missing Revenue

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Abstract

In many African countries, large discrepancies exist between revenues implied by published tariff rates multiplied by estimated import volumes and actual receipts. We develop a stylized trade model where average and marginal tariff rates diverge and incorporate insights from this model into a computable general equilibrium model of an African economy (Mozambique) to study the implications of trade policy reform. Model simulations indicate that lowering tariff rates and reducing duty free importation in a manner that maintains official revenue benefits nearly everyone. The main exception is those who benefited from duty free imports in the base.

JEL: D58, H26, O55

Key words: Trade policy, tax evasion, public revenue, Africa

1. Introduction

In many African countries, actual government revenues differ substantially from the amounts implied by multiplication of tax rates with the presumptive tax base. Estimates of this "missing revenue" are almost invariably large enough to be of macroeconomic interest. Following a review of attempts to measure tax evasion, McLaren (1996) characterizes the extent of tax evasion in general in many LDCs as "staggering". The studies reviewed by McLaren suggest that the value of taxes avoided is often close to the value of actual collections for major taxes. With respect to trade policy, avoidance of taxes at the border is often combined with a complex patchwork of legal exemptions. Tsikata (1999) and Pritchett and Sethi (1994) find actual tariff revenues at levels between 44% and 87% of the amounts implied by published tariff rates and estimated import volumes for selected developing economies in Africa and elsewhere. In addition, Pritchett and Sethi find a significant positive relationship between the importance of exemptions and posted tariff rates. Their simulations reveal that reductions in peak tariff rates would likely have minimal revenue effects. These two studies relied on official imports data, so focus is on legal exemptions.

Recently, Fisman and Wei (2004) examine bilateral trade data between Hong Kong and China in an attempt to identify both legal exemptions and smuggling. They report an elasticity of evasion with respect to the tariff rate of approximately three. According to their findings, tariff rate declines, particularly for highly taxed items, would result in

substantial *increases* in revenues. They conclude that there are widespread practices of under-reporting and mislabelling from highly to lightly taxed product categories.

Given the magnitude of the issue, the study of exemptions and tax evasion has received considerable attention in the public finance literature. Sandmo (2004) provides a general review of the theory of evasion. Burgess and Stern (1993) review the public finance literature with specific focus on developing countries. They delve into, among other items, the perennial problem of the application of high rates to relatively small bases with attendant strong incentives for evasion. In more recent work, McLaren (1998) develops a model where evasion incentives drive the optimal tax pattern. McLaren's model is consistent with the well-documented tendency for poorer countries, with weak tax administrations, to focus revenue raising efforts on a few relatively easy to administer choke points within the economy, while more advanced economies tend to employ more broad based revenue raising approaches (see, for example, Tanzi and Zee, 2002). Bliss (1992) develops a model that explicitly recognizes the limited availability of tax handles in poor economies and the concomitant important role that taxes levied at the border often play in these economies.

While public finance economists highlight the importance of border taxes in financing activities of the state for poor countries, trade economists frequently tout the benefits of openness for growth prospects.[1] The work of Fisman and Wei (2004) and Pritchett and Sethi (1994) indicate that these views are not necessarily in conflict in light of the fiscal

[1] See Winters (2004) for a balanced view.

realities present in many developing countries. Given the ubiquity of tariff exemptions and evasion, it is possible that revenue neutrality can be maintained despite reductions in tariffs through accompanying reductions in the volume of official exemptions and the empirically observed tendency for rate reductions to reduce incentives to evade.

Nevertheless, the degree of disconnect, particularly in analyses of poor countries, between the role of revenue in the analysis of border policy and the role of the border in revenue analysis is striking. For example, even though trade taxes provide significant revenue to poor countries, analyses of the implications of global trade liberalization for developing countries under the auspices of the World Trade Organization (WTO) rarely contain more than a cursory discussion of revenue issues.[2] Furthermore, even though evasion and exemptions are known to be widespread, they are rarely accounted for explicitly in empirical trade policy analyses for developing countries. So, while computable general equilibrium (CGE) models are widely recognized to have been influential in the formulation of trade policies for developing countries over the past two decades, relatively few trade policy applications of a CGE model specifically account for evasion or exemptions.

In the context of official exemptions and revenue considerations, it is important to emphasize that some official exemptions are applied for specific and potentially justifiable reasons. In particular, rationale exists for policies, such as exemptions or rebates, which allow exporters to operate at world market prices for intermediates and

[2] Winters and Hertel (2005) is a recent exception.

investment goods. This is especially true when critical factors of production are internationally mobile, such as the case of textiles and wearing apparel. Some work in the trade literature has focussed on these cases. For example, Bach et al. (1996) model exemption of imported textiles later exported as wearing apparel. Ianchovichina (2005) considers whether these exemptions/duty drawbacks are really worth the administrative effort. She concludes, using China as a case study, that the wisdom of these schemes depends upon initial conditions and objectives. They may or may not be good policy.

So, some share of the "missing revenue" can potentially be justified by appealing to export competitiveness, particularly for footloose industries where imported intermediates constitute a high cost share in the exported product. The remaining share of the "missing revenue" is difficult to justify. High levels of evasion are hardly to be celebrated, especially from a governance perspective. Even considering exports, the case for official exemptions weakens considerably when one considers export of natural resource based products. In these cases, the critical factor of production, the natural resource, is immobile. The natural resource rent should be distributed reasonably equitably across the population. Taxation is one way, and oftentimes the only way, to achieve this objective. Official exemptions for consumption goods and for intermediate purchases for non-exporting industries are also difficult to justify.[3]

[3] If the tariff rate schedule is flat or broadly upward sloping from capital goods/imported intermediates to final domestic consumption goods (as is typically the case), exemption on imports of intermediates by non-exporters results in increases in effective protection rates. Exemption is easier to justify in the case of negative effective protection but these cases are rare.

In the context of African economies, especially poor African economies, the value of exemptions targeted for the specific and justifiable purposes considered by Ianchovichina (2005) is often very small. For example, information on five African countries (Malawi, Mozambique, Zambia, Tanzania, and Uganda) from version 6 of the GTAP database (see Dimaranan and McDougall, 2005) indicates that exports from these countries are overwhelmingly natural resource based. Sectors, especially manufactures, where access to imported intermediates at world prices is crucial to competitiveness, represent less than 10% of total exports in these five country cases.

In short, in the context of poor African economies, the share of "missing revenue" attributable to the sorts of exemptions featured in the trade literature is likely to be small. Yet, the value of taxes avoided, though difficult to measure, is clearly very large. The authors are unaware of any CGE application that captures the patchwork of exemptions and evasions that bring tariff collection rates down to the levels observed by Tsikata; Pritchett and Sethi; and Fisman and Wei.

This paper seeks to take a first step towards integrating the perspectives of public finance and trade economists in the analysis of developing country border policy. To do so, a simple stylized model of tariff avoidance through exemptions and/or smuggling is developed. The insights from this model are subsequently incorporated into a detailed CGE model to consider the implications of trade policy reform in a representative sub-Saharan country (Mozambique). The CGE model explicitly considers exemptions and evasion, and since the right to import duty free while others must pay tariffs (for example

via an exemption) has a value, the distributional implications of trade policy reform are also considered.

The paper is structured as follows. Section 2 presents a simplified model of international trade in order to investigate theoretical issues associated with duty free imports. Section 3 examines the extent and nature of duty free importation for the case of Mozambique specifically. Section 4 presents the CGE model employed for the analysis. Section 5 presents model simulations and results, while Section 6 summarizes and concludes.

2. A Simple Model of Trade and Tariffs with Missing Revenue

We seek to examine the issues of exemptions and evasion in the simplest possible way. Our model contains three goods: an importable that is not produced domestically (M), an exportable that is produced, but not consumed, domestically (E), and a non-tradable that is produced and consumed domestically (D). There are h households with identical Cobb-Douglas preferences. Each household has a labour endowment z_h. Production technology is linear in labour units, and standard neoclassical behavioural assumptions apply.[4]

[4] The model is motivated by the 1-2-3 model of Devarajan *et al*. (1990). This model is simplified by assuming perfect transformation between domestics (D) and exports (E).

The mathematical form of the model is as follows:

Consumer demand for M	$M_h P_m = (1-\alpha)Y_h$	(1)
Consumer demand for D	$D_h P_d = \alpha Y_h$	(2)
Consumer budget constraint	$Y_h = z_h W + T_h$	(3)
E production technology	$E = aL_E$	(4)
D production technology	$\Sigma_h D_h = bL_D$	(5)
E first order condition	$W = ap_{we}R$	(6)
D first order condition	$W = bP_d$	(7)
Trade balance	$p_{we}E = p_{wm}\Sigma_h D_h$	(8)
Price transmission	$P_m = p_{wm}(1+t)R$	(9)
Government balance	$\Sigma_h T_h = t\Sigma_h M_h p_{wm}R$	(10)
Numeraire definition	$R \equiv 1$	(11)
Factor market balance	$L_E+L_D = \Sigma_h z_h+WAL$	(12)

Ignoring subscripts, L represents labour allocations, W the wage, P prices (p_w indicates fixed world price), R the exchange rate, t the tariff rate applied to imports, α the share of the household budget devoted to good D, and T transfers. Variables are in uppercase while parameters are in lower case. The variable WAL effectively drops the factor market balance equation (12) in accordance with Walras' law. Note that tariff revenue is distributed back to households in the form of direct transfers (equation 10). Also, note that the model, as given above, is incomplete as the distribution of transfers, T_h, across households is left unspecified. Finally, note that by solving for P_m and P_d and substituting into equation sets (1) and (2), the model boils down to a system of linear equalities

(assuming the allocation mechanism for transfers is linear). Accordingly, the model can be solved as long as the matrix of parameters is invertible.

For our purposes, the closed form solution is not strictly necessary. Rather, it suffices to note that all prices, including the wage, can be determined as a function of the tariff rate t, the production parameters a and b, world prices p_{we} and p_{wm}, and the exchange rate R, which serves as numeraire. As a result, from an individual household perspective, income is exogenously determined by the household specific labour endowment and the level of government transfer. Production side issues are essentially abstracted from and changes in welfare are determined uniquely by changes in prices (through, for example, changes in the tariff rate) and changes in transfer income.

The model is used to consider three separate situations.

1) A tariff where particular groups obtain access to imported goods duty free, either via smuggling/corruption or via legal exemption, when these groups face no supply constraints.
2) A tariff with a legal exemption scheme under which particular groups are allowed access to goods duty free but are constrained from satisfying full domestic market demand.
3) A tariff with smuggling/corruption where those who are engaged are constrained from satisfying full domestic market demand.

Situation 1 implies no supply constraints on exempted imports or smuggling, so market demand will be completely filled at world market price. Hence, the *de jure* tariff is completely ineffective, and the operational tariff rate is zero. There is no revenue to distribute. The model arrives at the free trade solution. Analytically, situation 1 is not a particularly interesting case. It is, however, worth noting that the same solution can be obtained via an offsetting consumer subsidy on the importable good. The addition of a consumer subsidy on the purchase of imports can be achieved by modifying two equations of the model as follows:

Consumer demand for M $M_h P_m(1-s) = (1-\alpha)Y_h$ (1a)

Government balance $\Sigma_h T_h = t\, \Sigma_h M_h p_{wm} R - s\, \Sigma_h M_h P_m$ (10a)

It is straightforward to show that, if (1-s)(1+t)=1, the free trade equilibrium is re-established.

Situation 2 recognizes the existence of official tariff exemptions. For example, expatriates and locals, who travel frequently, are often able to legally avoid paying import tariffs up to some specified value of imports. Government regularly exempts itself from import tariffs, and large investment projects negotiate special import treatment (see Gauthier and Reinikka (2006) for discussion of these phenomena in the case of Uganda). Situation 2 differs from Situation 1 in that the ability to import duty free is extended only to certain actors and only on a specified volume of imports. The situation is analogous to a tariff rate quota where the in-quota import volume arrives duty free and the out-of-quota import volume pays posted tariff rates.

We model this situation by dividing the market for imports. Some groups import and consume with tariff laden prices while others import and consume at world prices. We focus on division of markets across households in our simplified model. This situation requires further modification to the model. The market division can be achieved in at least two ways. First, a subscript h could be added to the tariff rate, t. In this case, only certain groups pay the tariff. This modification also requires an h subscript on the domestic price of imports, P_{hm}. Alternatively, an offsetting consumption subsidy to specific households, s_h, can achieve the same outcome when a single tariff rate is applied in a manner analogous to the ineffective tariff situation considered above. These modifications are shown below.

Consumer demand for M	$M_h P_{hm}(1- s_h) = (1-\alpha)Y_h$	(1b)
Price transmission	$P_{hm} = p_{wm}(1+t_h)R$	(9b)
Government balance	$\Sigma_h T_h = t_h \Sigma_h M_h p_{wm} R - s_h \Sigma_h M_h P_{hm}$	(10b)

Any given household j faces free trade prices if $(1-s_j)(1+t_j)=1$. Further, in this simple model, if household j also receives zero transfers, it faces the free trade equilibrium. Note that situation 2 is captured through manipulation of indirect tax rates.

Situation 3 captures the basic elements of smuggling and/or corruption. Suppose that household j possesses the means to illicitly import duty free. It both imports commodities duty free for direct consumption and imports and resells commodities at the tariff laden price. As in Situation 2, duty free importation for direct consumption can be modelled by

setting $(1-s_j)(1+t_j)=1$ (for household j only). Resale of imported products at the tariff laden price by household j is captured by imposing the posted tariff rate t on imports of these goods that are resold but directing the value of this tariff revenue to household j in the form of a transfer, T_j. Effectively, household j consumes at world prices and benefits from additional income by importing at world prices and selling at tariff laden domestic prices.

In order for Situation 3 to exist in equilibrium, something must prevent the volume of imports from reestablishing the free trade equilibrium as in Situation 1. As pointed out in Allingham and Sandmo (1972), risk-averse individuals may engage in evasion given positive returns despite a positive probability of detection and a penalty associated with detection. If one assumes that both the probability of detection and the penalty associated with detection increase with the scale of evasion, then individual willingness to evade will be circumscribed. Under these conditions, the free trade equilibrium is not possible as some returns are required to compensate for penalties, such as fines, loss of import license, or time in jail, associated with detection. A second avenue involves complicity in evasion by government officials. In this case, the smuggler effectively obtains an unofficial exemption with the power of the state directed to enforcing compliance on other importers. In this instance, some degree of discretion in the volume of goods imported on the part of the smuggler and the enabling government official(s) is required in order to avoid detection and to prevent collapse to the free trade equilibrium.

For the Mozambican case that we are to consider shortly, two empirical observations support the existence of some barriers preventing collapse to the free trade equilibrium. First, prices for commodities, particularly consumer goods that are highly taxed, traded between South Africa and Mozambique are almost invariably substantially higher in Mozambique.[5] Second, collapse to the free trade equilibrium when border taxes are significant would almost surely imply that honest importers would be forced out of business. This does not appear to be the case as the relative success of large South African retailers, such as Game and Shop Rite, who are highly unlikely to engage in broad scale smuggling, indicates.

Situations 2 and 3 are similar to the rent-seeking models developed by Krueger (1974) in that rents exist. They differ in that real resource absorption (rent-seeking) in the allocation of these rents is assumed to be small relative to the size of the actual rents. Krueger considers the opposite extreme where the presence of rents generates real resource allocations in rent-seeking equivalent to the value of the rents. In other words, the supply curve for smuggled goods is upward sloping and fairly steep. However, Krueger also explicitly points out that other outcomes are possible and goes on to indicate that the degree of real resource consumption allocated to rent-seeking depends upon the manner and environment in which the rent is generated. As argued in Section 3 below, the evidence for Mozambique does not point to substantial real resources allocated to smuggling, especially relative to the size of the rents. As the Krueger result for the case of relatively steep upward sloping supply curves for smuggled goods (a large scale

[5] This is true even for the capital, Maputo, which is located less than 100 km from the South African border by very good road.

misallocation of real resources) is well established and as this case appears to be of limited relevance for the case of Mozambique, we confine our analysis to situations 2 and 3.[6]

Reality is, of course, much more complicated than the simple model presented above. However, the role of our model is to capture the essential features of the phenomena of interest. In the next sections we seek to examine empirically the interactions between revenue and trade considerations in the context of significant exemptions and evasions. Rather than constructing an archetype economy, we choose to focus on a representative poor African country (Mozambique) where about 50% of government revenue comes from taxes (tariffs, value added, and assorted consumption taxes) levied at the border. This has the advantage of directly confronting the challenge of estimating exemptions and evasion in a particular case and incorporating these estimates into a CGE model, a class of models frequently used for trade policy analysis.

3. Mozambique as Case: Import Values, Tariff Revenues, and Rents

A direct attempt at valuing unrecorded trade flows for the case of Mozambique was undertaken by Macamo (1998). He systematically attempted to observe unrecorded cross border trade at major border checkpoints with neighbouring countries. He estimated $98

[6] Pitt (1981) presents a model where legal imports must exist in order to disguise illicit importation. In the Pitt model, market prices for imports settle within an intermediate range between the CIF price and the tariff laden price such that the gains from smuggling and selling at above the CIF price are exactly offset by the losses from importing officially but selling at less than the tariff laden price. If real resource costs of smuggling are zero, smuggling acts like a reduction in tariffs and is welfare enhancing. Note that, in a competitive version of the Pitt model, all honest importers would be forced out of business.

million in illegal trade for the year 1996.[7] This amounts to about 10% of the value of total imports in 1996. While already large, this estimate likely substantially understates inflows that avoid border taxes. Macamo focused on cross border trade with Mozambique's neighbours while significant imports also arrive from overseas. In addition, Macamo focused on small, relatively unsophisticated operators with larger presumably more sophisticated operators "not necessarily" included (Macamo, 1998, p. 12). Also, Macamo did not observe legal exemptions, which constitute a significant share of duty free imports.[8] Finally, if, as is likely, smuggling is concentrated in highly taxed products, then the implications for revenue would be much stronger than the implications for import volumes.

Mozambican National Accounts effectively estimated the combined value of evasion and official exemptions for 1997 by estimating import volumes based on a combination of import data for Mozambique, export data from important trade partners, and capital account data from the Central Bank. The results are shown in Table 1. In all, actual revenue collections amount to less than 40% of the value implied by multiplying import volumes with the published tariff rates. Further, product categories with high tariff rates tend to exhibit higher volumes of missing revenue.

More recent analysis of South Africa-Mozambique trade data confirms the general picture. In total, the value of declared exports to Mozambique from South Africa

[7] More precisely, Macamo estimated unrecorded trade for the period December 1995 to November 1996.
[8] Van Dunem (2005) calculated the value of official exemptions at about 15% of the value of the theoretical tariff take for the period 2002-2004.

exceeded the value of imports registered in Mozambique from South Africa by about 24% in 2004 (Van Dunem and Arndt, 2005).[9] Revenue implications would be stronger since the detailed data indicate higher discrepancies between declared South African exports and declared Mozambican imports for items in more highly taxed product categories. South Africa is, by far, Mozambique's largest trading partner.

So, while the degree of precision in all of these figures leaves much to be desired, the available information paints a qualitatively similar picture of large volumes of goods entering duty free. Nevertheless, as indicated earlier, retail prices for imported goods, particularly consumer goods, are almost invariably substantially higher than any reasonable calculation of CIF costs indicating the presence of rents for those with access to imports duty free. The presence of rents corresponds with Situations 2 and 3 identified within the framework of the stylized model presented in the preceding section.

As discussed earlier, basic correspondence with Situations 2 and 3 also requires small consumption of real resources relative to the size of the rents. Hence, the degree of competition for these rents merits further discussion. Macamo (1998) does find evidence of real resource use in smuggling. For example, border traders wishing to evade tariffs often divide goods into small lots and hire numerous transporters to bring the goods across the border before re-amassing the contraband for transport to consumption centres. This is clearly much more expensive than simply trucking the goods across the border.

[9] Differences between FOB and CIF values are accounted for in the analysis.

Nevertheless, the evidence collected by Macamo confirms that the large majority of unrecorded cross border transactions (with neighbouring countries) either passes through or very close to official entry points.[10] Some simply pass straight through in trucks with very minor to no increment in transport costs relative to official imports. Even when dissembled into smaller lots, the incremental transport cost appears to be small compared to the value of the tariffs avoided. Macamo considers beer head transported, which draws an incremental transport cost of only about 10-15% of the value of the tariffs avoided. Regarding international seaports, one would expect incremental transport costs to be relatively small since the options in terms of physical transport are much more limited. Incremental transport costs are almost surely about zero for officially exempted goods.

Payments to corrupt customs officials in order to facilitate smuggling or to public officials in order to gain access to exemptions are properly accounted for as transfers, not real resource allocations. Overall, the evidence points to the existence of rents and a relatively small quantity of real resource allocated in pursuit of these rents. Situations 2 and 3 described in the simple model in section 2 therefore guide the construction of a more formal empirical model of Mozambique.

Since substantial volumes of goods enter Mozambique duty free, as is the case in other developing countries, the overall average tariff rate (total tariff revenue divided by the total CIF value of imports) in 1997 was relatively low at 6.9%. Nevertheless, substantial volumes of imports do arrive through official channels and pay duty at the published or

[10] Given the underdeveloped state and characteristics of the existing transport infrastructure, this is not surprising.

marginal rate, which is typically well above the average rate. The marginal import appears to be tariff inclusive; so, the price of traded goods within the country reflects the world price and the associated marginal tariff rate. When tariff rates are high, significant benefits therefore accrue to those individuals with ability to import duty free either through legal exemptions or through smuggling/corruption at official border points.

Table 1 shows import values and actual tariff revenue according to the commodity classification employed in the social accounting matrix (SAM) underlying the computable general equilibrium (CGE) model employed for analysis in this paper.[11] About 44% of the value of imports entered the country duty free in 1997 despite positive posted tariff rates. However, as indicated in the Table, duty free imports tend to be concentrated in sectors with higher posted tariff rates.[12] Therefore, as indicated above, tariff revenue forgone due to unrecorded trade and legal exemptions amounts to about 60% of the total tariff revenue implied by the multiplication of posted tariff rates with actual import volumes.

Protection rates are highest for Food Processing, Beverages and Tobacco, and Primary Product Processing (which include textiles, clothing, and leather products). The rates for exemptions and unrecorded trade in these categories are estimated to be particularly high as well with more than 80% of the value of these products entering the country duty free

[11] The SAM and modeling code can be obtained from the authors on request.

[12] In many cases, the same posted tariff rate does not apply across all the goods comprising the aggregate commodities shown in Table 1. As a result, aggregation of posted tariff rates is necessary in order to determine the actual tariff rate that should be applied. A number of complex conceptual issues are associated with appropriate aggregation of tariff rates. These issues are explored in Bach and Martin (2001), among other sources. In Table 1, the posted tariff rates reflect weighted averages of import volumes with a small corrective factor to account for the fact that higher tariffs tend to drive down import volumes.

(value shares and shares of tariff revenue foregone are the same in this instance since a flat rate of 35% was applied to all goods in these three categories). The commodity composition observed by Macamo also reflects this concentration of unrecorded trade in these three commodity categories.

Finally, it is worth noting that Processed Food, Beverages and Tobacco, and Primary Product Processing represent an important part of consumer budgets. The 1997 SAM indicates that these products accounted for about 29% and 37% of total expenditure for rural and urban households respectively. Consequently, price changes for these commodities have the potential to impact household welfare fairly strongly.

4. Modelling Approach

The Mozambique CGE Model and SAM

The empirical CGE model used in this paper addresses the issue of exemptions/evasion in the spirit of the theoretical model in Section 2. Specifically, access to imported goods at world prices (either via smuggling or official exemption) is assumed to generate rents that are large relative to resources allocated to rent seeking. In addition, some agents are assumed to import duty free goods and consume them directly; hence consumption decisions for these agents are made on the basis of world market prices. Other agents import duty free and resell on the domestic market at tariff laden prices. Profits from these resales are modelled as transfers of virtual tariff revenue. A final set of agents do not have access to goods at world market prices. The latter two groups of agents base

consumption decisions on tariff laden prices. More standard elements of the model took as their point of departure an existing model of Mozambique described in Tarp *et al.* (2002). Relatively straightforward elements are briefly summarized first.

The model assumes profit maximization by producers under translog technology and utility maximization with Cobb-Douglas preferences by consumers. Investment and government consumption are allocated in a Leontief fashion (a fixed basket of goods). The Armington (1969) assumption is employed with constant elasticity of transformation functions on the export side and constant elasticity of substitution functions on the import side. The external sector of the model is closed by fixing foreign currency inflows (primarily aid) and allowing the exchange rate to adjust. Investment is driven by available savings. Finally, the government deficit is fixed (more details on government closure are provided in the simulations section). The model numeraire is the consumer price index. Finally, detailed accounting for marketing margins is accomplished as described in Arndt *et al.* (2000).

Following the stylized model from section 2, the Mozambique model as applied here involves the simultaneous capturing of average and marginal tariff rates when these diverge. As shown in Table 1, such differences are substantial in Mozambique. When confronted with this situation the CGE modeller has traditionally faced a choice. One can apply the average tariff rate, which gets revenue correct. This is clearly desirable in public finance applications. However, this approach understates the true import tariff wedge at the margin, which is in focus in trade policy analysis. Alternatively, one can

apply the published rate, which overstates tariff revenue, but captures the distortions inherent in trade policy.

In practice, modelling goals (and expedience) have guided analytical choices. For example, the Global Trade Analysis Project GTAP data usually reflect published (marginal) tariff rates since most users are trade policy focused and the model is relatively poorly suited to public finance applications (Dimaranan and McDougall, 2005). On the other hand, a series of studies of southern African economies conducted by the International Food Policy Research Institute (IFPRI) typically employed average tariff rates since the public finance dimensions of these studies maintained a higher profile (see, for example, Tarp *et al.* 2002).

While the choice has typically been one or the other, both the average and the marginal rates can in fact be captured in a CGE model using the analytical model derived in Section 2. Conceptually, Situations 2 and 3 described in section 2 can be modelled in a manner similar to a tariff rate quota where a certain volume of imports enters the country duty free and the remainder enters the country at a strictly positive tariff rate (i.e. the published tariff rate). As in the case of a tariff rate quota, the ability to import duty free (or at the within quota rate) has a value. For those with access to goods duty free, the tariff revenue foregone by the government effectively represents income in the form of either a rent or an implicit subsidy. With relatively few modifications, the basic

machinery for modelling tariff rate quotas can be applied to the issue of low rates of tariff revenue collection.[13]

In this particular case, the implicit value of tariffs avoided is calculated for each commodity. The actual tariff inclusive import value of all commodities is then augmented by the respective amounts of tariff payments avoided through (legal or illegal) duty free importation in order to obtain the CIF value of imports plus the full amount of tariff revenue implied by published rates. From the theory discussion presented in Section 1, the destination of the virtual tariff revenue (the tariff revenue not actually collected by government) depends upon the use of the imported commodity. If it is imported and then consumed directly, the importing/consuming agent could be viewed as paying the import tariff and receiving an exactly offsetting consumer subsidy. If the good is imported and then resold at tariff laden prices, then the importing agent could be viewed as receiving a transfer from the government equivalent to the value of the tariff revenue avoided.

There is very little information to indicate the share of duty free imports that is consumed directly and the corresponding share that is resold at tariff laden prices. Legal exemptions would tend to fall into the former category while smuggled goods would tend to fall into the latter. The available evidence indicates that both of these categories are important. However, for Beverages and Tobacco, Food Processing and Primary Product Processing, where tariff rates and tariff avoidance are the highest, the share that is resold at tariff laden prices likely predominates. In this light, we assume that 33% of duty free imports

[13] See Elbehri and Pearson (2000) or Rutherford (1995) for general equilibrium analysis of tariff rate quotas.

are consumed directly and the remaining 67% are imported and resold. Further, we assume that government, investment, and urban household accounts have some ability to import duty free and consume directly. Rents (modelled as transfers) from importing duty free and reselling at tariff-laden prices are assumed to accrue to urban households.[14] Rural households, on the other hand, are assumed not to have access to duty free goods.

In the model, price linkage equations remain exactly as before. So, for example, import prices are equal to the world price converted to domestic currency times the sum of one plus the marginal tariff rate (plus any marketing margins). The tariff revenue side differs. Similar to the perspective of duty free imports as a tariff rate quota, we assume on a commodity by commodity basis that a certain fraction of imports enters the country duty free while the remaining fraction pays marginal tariffs. Actual tariff revenue in the government revenue equation becomes this fraction multiplied by the value of tariffs implied by the full marginal tariff rate. The remaining amount, the value of tariffs avoided, is divided between consumption subsidies (relating to goods that are consumed directly) and direct transfers to urban households (relating to goods that are imported and then resold).

[14] To simplify the modeling, the real resource costs associated with importing duty free are assumed to be zero. If real resource outlays to avoid tariffs are indeed a relatively small share of the value of tariffs avoided, as the available evidence suggests, then this simplification is harmless. The other case, involving significant real resource outlays, has as already discussed above been examined in the seminal paper by Krueger (1974) among others.

5. Simulations and Results

5.1. Simulations

Table 2 illustrates the simulations undertaken with the model. In the first, labelled "All Products Pay", the share of products imported duty free is set to zero while all tariff rates are adjusted proportionately to maintain revenue neutrality with respect to all indirect taxes (not just tariff revenue). Consumption subsidies reflecting direct consumption of products imported duty free are also set to zero. This corresponds to a fictional scenario where all legal exemptions are eliminated and all smuggling is stopped. In the second, labelled "Flat Tariff Rates", all non-zero tariff rates are reset to a single level that maintains revenue neutrality with respect to all indirect taxes.[15] The share of products imported duty free remains constant. Consumption subsidies adjust to offset the level of virtual tariff revenue associated with direct consumption of duty free imports. In the third, labelled "Both", the share of products imported duty free drops to zero and all positive tariff rates are reset to a single rate. This rate is adjusted to maintain revenue neutrality with respect to all indirect taxes.

The simulations are designed to investigate the implications of a lower tax rate applied to a wider base, a common public finance application. As in most public finance applications, careful attention is given to the maintenance of revenue neutrality. Maintenance of total indirect tax revenue was also targeted since these are the taxes that

[15] As Table 1 indicates, the tariff rate applied to some imports, particularly services, is zero in the base. These rates remain at zero in all simulations.

interact with the price system. The value of indirect taxes (less output subsidies) represented 75% of government revenue in 1997. Changes in revenue from indirect taxes have implications for welfare analysis. As shown by Robinson and Thierfelder (1999), changes in indirect tax rates that change indirect tax revenue invalidate wages as an acceptable welfare indicator. With the revenue closure adopted, wages remain an acceptable welfare indicator (at least for the large majority of the population that lacks rights to import duty free).

The third scenario combines the first two scenarios to create a scenario of policy interest. This scenario asks the question: "What flat tariff rate applied to all imported commodities (excluding commodities with a tariff rate of zero in the base) would be required to maintain revenue assuming all imported goods paid tariffs at the published rate, and what are the welfare implications of this policy?"

5.2. Results

Macroeconomic results are illustrated in Table 3. Trade expands in all scenarios. Growth in trade is led by increased imports of processed food, beverages and tobacco, and processed primary products, which are associated with the highest initial rates of protection. Reductions in tariff rates applied to these products are large in all scenarios. In scenario one, the existing rate structure is reduced by nearly two thirds (see the Tariff Rate Expansion Factor at the bottom of the Table). Consequently, rates on these three commodities decline from 35% to about 12%. In scenario two, duty free shares remain constant but tariffs are reset to a single flat rate of about 17% (the flat tariff rate is equal

to the Tariff Rate Expansion Factor). For most commodities, this involves a tariff rate increase, which tends to reduce trade volumes. However, for the three highly taxed commodities mentioned above, tariffs decline by 18 percentage points. The net effect is a very small increase in trade volumes in this scenario.

Scenario three involves the elimination of exemptions and the application of a flat tariff rate. Under these conditions, revenue neutrality can be maintained with a 7% tariff rate. This involves a substantial tariff rate cut for each of the commodity aggregates. However, trade expands less than in scenario one (All products pay) since importing duty free and consuming directly is no longer an option. All products are assessed duties.[16] The expansion of imports induces a devaluation of the currency in order to stimulate import competing and exporting sectors. Due to the large level of external financing received by Mozambique, the value of imports exceeds the value of exports. As a result, exports must grow by proportionately much more for a given proportional change in imports in order to maintain external balance. Real GDP changes little in all scenarios, but total absorption – a measure of economy-wide welfare – increases mildly in the "Flat" and "Both" scenarios.

Table 4 provides information on the contribution of each sector to real GDP at factor cost in the base, the level of value added generated by each sector, and the percentage change in real value added generated by each producing sector for each scenario. Focusing on the

[16] As indicated earlier, deriving an appropriate aggregate tariff rate for an aggregate commodity is complex. In 1997, some components of some aggregates were taxed at a rate lower than 7%, so the 7% flat rate does represent a tariff rate increase for some commodities when a more detailed level of disaggregation is considered.

third scenario ("Both"), one observes some changes in the composition of value added, but they are not dramatic. Small sectors that enjoy substantial protection, such as Beverages and Tobacco, shrink when protection is removed. Increases in production are observed in Insurance and Finance. Import penetration in this sector is fairly large at about 30% of the value of domestic consumption and initial levels of protection were zero. The devaluation enables this sector to compete more effectively against imports and hence increase value added. The devaluation also increases the local currency value of foreign capital inflows. Since most of these inflows fund investment expenditure, investment spending increases spurring activity in, for example, the construction sector. An intuitive explanation of the decline in value added produced by the livestock sector will be deferred for later.

Table 5 provides information on factor prices. In all scenarios, all wages and rental rates increase relative to the base. The increases range from about 1.5% to 1.8% for all factors. This implies that all households lacking access to duty free imports benefit from the policy change. These are compelling results that are relatively simple to explain. Two broad effects dominate these increases in real wages.

First, the figures reported in Table 5 are real factor prices with deflation being performed by the consumer price index (the numeraire). As indicated above, the three commodities with the highest rates of protection (Processed Food, Beverages and Tobacco, and Processed Primary Products) represent a significant share of the consumer consumption bundle. When protection is removed, prices for these commodities decline. The level of

the consumer price index (CPI) cannot decline by definition. Only relative prices matter in a CGE model. As a result, other prices, including factor prices, tend to rise relative to the CPI in order to achieve a relative decline in the prices of the basket of goods comprising the CPI.

Second, as indicated earlier, the rents that accrue from importing duty-free and reselling on the domestic market at tariff laden prices function in a manner analogous to imposing a tariff and having the government reimburse these "tariff payments" back to those relatively few individuals with the right to import duty-free. In a macroeconomic sense, the rents from duty-free importation and subsequent resale function like a tariff (an indirect tax) that is later reimbursed (a direct transfer) to selected individuals.[17] Reductions in these "transfers", through tariff rate reductions (which lower the implicit value of the rents) or reductions in the share of goods imported duty free, function like reductions in standard tariffs with concomitant reductions in transfers.

The macroeconomic impact on wages can best be perceived by considering the fundamental national accounting identity:

$$C + I + G + (X - M) = GDP = GDPfc + IT$$

where C is consumption, I investment, G government expenditure, X exports, M imports, GDP gross domestic product, GDP*fc* GDP at factor cost, and IT total indirect taxes. The right hand side of the above expression can be rewritten as:

[17] Direct consumption of duty free imports, on the other hand, functions as if the government had imposed a tariff at the border and then given back the revenue in the form of a commodity specific consumption subsidy. These two indirect taxes exactly offset one another.

$$\sum E_i w_i + TR^o + TR^r + IT^o$$

where E_i represents the quantity of each factor employed, w_i the wage for each factor, TR^o official tariff revenue, TR^r rents from resale of goods imported duty free, and IT^o other sources of indirect tax revenue. The sum of employment of endowments (in this case, various categories of labour and capital) multiplied by their respective wages yields GDP at factor cost. The sum of the three tax components gives total indirect taxes.

In the simulations considered here, endowment supplies are fixed and fully employed. Hence, the only way to increase nominal GDP at factor cost is to increase wages. By assumption in each scenario, the sum $TR^o + IT^o$ is held constant. The remaining term represents the rents from resale of goods imported duty free, TR^r. In scenarios one and three, this value is reduced from about 2.4% of GDP at factor cost to zero. If nominal GDP remained constant and TR^r were the only source of indirect tax revenue, average wages would have to increase by about 2.4%. In the event, nominal (CPI deflated) GDP declines by about 0.6% and other indirect tax revenue sources remain in place (at a constant value). Simple calculations indicate that average factor prices must rise by slightly more than 1.7%, which is approximately equal to the change in the weighted average factor price one obtains from Table 5.

This effect on nominal wages often leads to the erroneous conclusion that trade liberalization increases household and economy-wide welfare due to the wage effect. As pointed out by Robinson and Thierfelder (1999), this is not necessarily the case. For example, if the tariff revenue is replaced by direct taxes such as income taxes, households

might find that the increase in income taxes more than offsets the "wage increase" which follows from reductions in indirect tax revenue. In this instance, the household is not better off. More generally, using factor prices as a welfare indicator in trade liberalization scenarios will tend to overstate the benefits of trade liberalization if the implications of reductions in government tariff revenue are not accounted for.

In order to conduct an acceptable welfare analysis using wages, we must account, not for the reduction in tariff revenue actually collected (which remains essentially constant), but for the reduction in rents accruing to those with the ability to import duty free. Even though we know relatively little about these people, it is safe to assume that they are not particularly numerous and that they are not poor. For these relatively few individuals (such as corrupt border guards), the reductions in the rents received will almost surely exceed the average increment to wages predicted by the model. Hence, their welfare declines. However, for the large majority of working people who lack access to duty free imports, wages are an acceptable welfare indicator. The results indicate that wages for these people will rise (with no offsetting reduction in rents).

A composite view of welfare effects on households can be obtained by examining household equivalent variation. This is done in Table 6. As shown, urban household welfare declines very substantially while rural household welfare increases significantly.[18] The decline in urban household welfare is attributable entirely to the disappearance of rents from resale of products imported duty free, which formerly

[18] These are large numbers for trade policy simulations where welfare changes are often on the order of 1%.

accounted for about 5.6% of total income. If the information existed to divide urban households into those receiving rents and those not receiving rents, simple calculations indicate that urban households not receiving rents would experience welfare gains of about 2%.[19]

6. Conclusions

Tax exemptions and smuggling are basic characteristics of many African countries. *De facto* tax collections are consequently far below revenue implied by published (marginal) or *de jure* tax rates. Efforts to address this problem have therefore been a key component of economic reform programmes geared at macroeconomic stabilization and promoting a better balance in public finances. Yet, there is a curious lack of consistency between the way in which respectively public finance and trade policy analysts have treated average and marginal tax rates. Public finance studies typically rely on average tariffs, which get revenue right. Yet, this approach underestimates the distortions inherent in trade policy, which are a prime concern of trade analysts. These have therefore traditionally resorted to using published rates, even if this leads to overstating revenue.

The above disconnect is unsatisfactory, in both theory and practice. In Section 1 we therefore developed a simple theoretical model to clarify the conceptual issues involved

[19] This aggregation of urban households into a single average helps to explain the somewhat counterintuitive decline in livestock production shown in Table 4. Urban households are, on average, considerably wealthier than rural households; and they direct a much larger fraction of their income to meat consumption. When average urban household income declines, direct demand for livestock products declines as well. In addition, marketed meat products (butchered animals) are considered processed foods. With declines in domestic processed food production following reductions in tariffs, intermediate demand for livestock products falls as well. A more detailed analysis with more disaggregate data would provide a more precise insight into production effects for the livestock sector.

in capturing average and marginal tariff rates simultaneously in a common analytical framework. Motivated by this model, we proceeded in Section 3 to demonstrate that the key methodological challenge faced in this paper can in large measure be viewed as a tariff rate quota (TRQ) within a model of international trade where a certain volume of imports enters a country duty free whereas the remainder enters at a strictly positive tariff rate. We also noted that the ability to import duty free has a value as in the case with a TRQ. For those with access to duty free goods, the tariff revenue foregone by the government effectively represents income, in the form of a rent or as an implicit subsidy.

In sum, we demonstrated that the basic machinery known from modelling TRQs can be applied to the combined public revenue and trade issue at hand. On this basis, we revised a standard CGE model of international trade, so it could be applied to conduct a trade policy analysis with specific attention to capturing the importance of divergence between average and marginal tariff rates. We took as our point of departure the fact that CGE models represent an attractive framework for the analysis of public finance issues for low income African countries, and proceeded to detailed accounting of revenue from the border, which is a natural extension from models focused on trade policy. Similarly, improved representation in the model of the actual implementation of trade policies is clearly important for the items of classic interest to trade economists such as the structure of production, welfare, and income distribution.

The model was implemented with Mozambique as case study. We argue that the analytical approach developed here is easily replicable and could be brought to bear on a

series of other countries across the African continent. Moreover, our results in Section 4 indicate that there are considerable possibilities for increasing both efficiency and equity. Losers from trade reforms include those households (urban households by assumption), who benefited from their ability to import duty free one way or the other. It is highly unlikely that these rent-creaming households are particularly poor. In contrast, the welfare of poor rural families increases following trade reform. In the scenario "Both" where a flat tariff rate is applied and all duty-free importation ceases, rural household welfare as measured by equivalent variation increases by about 1.9%. The implications for wages are strongly positive and remarkably uniform indicating that the large majority of the urban population that does not enjoy access to duty free goods becomes better off following reforms. All in all, we appear to be as close to a win-win policy recommendation, one can in practice hope for.

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Table 1

Import values, tariff rates, and tariff revenues for 1997

Sector	Import Value	Published Tariff Rate (%)	Implied Tariff Revenue	Actual Tariff Revenue	Share Missing (%)
Primary Ag. Crops	662	10.0	66	60	9.6
Primary Ag. Livestock	85	10.0	8	6	29.5
Forestry and Firewood	5	46.1	2	2	0.0
Extraction	77	12.5	10	9	3.2
Food Processing	1,803	35.0	631	117	81.4
Beverages and Tobacco	298	35.0	104	17	83.4
Primary Product Processing	1,046	35.0	366	62	83.1
Chemicals	2,022	15.0	303	165	45.7
Other Manufactures	4,172	15.0	626	381	39.0
Other Services	168	0.0	0	0	0.0
Construction	0	0.0	0	0	0.0
Commerce	0	0.0	0	0	0.0
Transport and Communication	140	0.0	0	0	0.0
Insurance and Finance	1,308	0.0	0	0	0.0
Public Administration and Def.	0	0.0	0	0	0.0
Education	0	0.0	0	0	0.0
Health	0	0.0	0	0	0.0
Labor Intensive Services	0	0.0	0	0	0.0
Big Projects	0	0.0	0	0	0.0
Big Project Imports	45	0.0	0	0	0.0
Total or Weighted Average	11,831	17.9	2,117	820	61.3

Sources: National accounts for 1997 for import volumes and tariff revenues and *Pauta Aduaneira* for published tariff rates.

Note: All value figures are in billions of meticais. In 1997, the exchange rate was approximately 11,406 meticais to the US dollar.

Table 2

Simulations

Label	Description
Base	Base data in billions of meticais.
All products pay	The share of products imported duty free drops to zero while tariff rates are adjusted proportionately to maintain revenue neutrality.
Flat tariff rates	All positive tariff rates are reset to a single level that maintains revenue neutrality. The share of products imported duty free remains constant.
Both	The share of products imported duty free drops to zero and all positive tariff rates are reset to a single rate. This rate is adjusted to maintain revenue neutrality.

Table 3

Macroeconomic results

	Base	All products pay (%)	Flat tariff rates (%)	Both (%)
Exchange Rate	1.00	5.0	1.4	5.0
Real GDP	40,609	0.1	0.1	0.1
Total Absorption	48,357	0.0	0.4	0.3
Imports	11,831	1.7	0.0	1.4
Exports	4,083	4.9	0.1	4.2
Investment	8,173	3.9	-0.3	3.0
Tariff Rate Expansion Factor[1]	1.00	0.35	0.17	0.07

Note: All base value metical figures are in billions. Also, the levels of some macroeconomic aggregates differ slightly from published values due to more explicit accounting for the rents associated with duty-free importation.

[1]The tariff rate expansion factor is not in percentage terms and the interpretation of this factor differs by scenario. In scenarios "Base" and "All products pay", the factor multiplies existing marginal tariff rates. In scenarios "Flat tariff rates" and "Both", the factor still multiplies all tariff rates; however, these are all set to one. So, the expansion factor is the unique tariff rate applied to all goods with strictly positive tariff rates in these two scenarios.

Table 4

Real value added by sector

	Base Share (%)	Base Level	All products pay (%)	Flat tariff rates (%)	Both (%)
Primary Ag. Crops	27.4	9,963	-0.4	0.8	0.0
Primary Ag. Livestock	2.2	795	-2.1	0.3	-1.6
Forestry and Firewood	3.2	1,156	0.2	0.2	0.3
Extraction	4.3	1,570	2.4	0.5	2.3
Food Processing	3.3	1,198	-1.6	-1.2	-1.9
Beverages and Tobacco	0.9	313	-5.3	-3.1	-5.9
Primary Product Processing	2.2	802	-3.0	-3.2	-4.0
Chemicals	0.6	231	-1.7	0.4	-1.3
Other Manufactures	1.1	410	0.3	0.6	0.4
Other Services	8.3	3,018	-0.9	-0.4	-1.0
Construction	6.5	2,375	3.3	-0.2	2.6
Commerce	20.1	7,337	-0.2	-0.3	-0.3
Transport and Communication	8.9	3,236	0.0	-0.2	-0.1
Insurance and Finance	4.6	1,682	3.1	0.1	2.6
Public Administration and Def.	2.8	1,007	0.0	0.0	0.0
Education	1.6	601	-0.7	-0.2	-0.7
Health	0.5	179	-0.5	-0.1	-0.5
Labor Intensive Services	1.5	550	0.4	0.1	0.4

Note: All base value metical figures are in billions.

Table 5

Real (CPI deflated) wages

	Base	All products pay (%)	Flat tariff rates (%)	Both (%)
Unskilled Ag Labor	1.63	0.6	2.1	1.6
Skilled Ag Labor	2.66	0.5	2.2	1.6
Unskilled Non-Ag Labor	6.99	1.4	0.5	1.5
Skilled Non-Ag Labor	23.96	1.9	0.2	1.8
Highly Skilled Non-Ag Labor	57.03	1.9	0.2	1.8
Capital	0.15	1.5	0.9	1.8

Note: All base values for wages are in millions of meticais per year.

Table 6

Household welfare measured by equivalent variation

	Base	All products pay (%)	Flat tariff rates (%)	Both (%)
Urban	15,891	-3.9	-1.1	-3.8
Rural	20,102	1.6	1.1	1.9

Note: All base value metical figures are in billions.