

**Confronting the Issue of the Elasticity of Customs Evasion in Mozambique:
An Empirical Study**

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Abstract

This study examines empirically the causal relationship between border tax rates and evasion in a representative Sub-Saharan African country, Mozambique. By nature, evasion is not easy to measure. The methodology employed here follows an approach used by Fisman and Wei (2004). The approach aligns and compares (at the product level) bilateral trade flow data between Mozambique and its largest trading partner, South Africa. We find that high tax levels are associated with high levels of underreporting of import values and that tax rates have a strong and positive effect on tax evasion in Mozambique. Results also strongly confirm the presence of fraudulent classification of merchandise into lower taxed product categories. In addition, the estimates permit one to infer overall levels of evasion. On average, for each three units of imports that enter the country officially, slightly more than one unit is smuggled. For more highly taxed products, the evasion rate is higher. Lastly, the estimates permit analysis of the revenue implications of lower trade taxes. The revenue curve is quite flat but remains upward sloping with respect to the tax rate in Mozambique when only evasion is considered.

Index

1. Introduction	1
2. Model specifications	4
2.1. Baseline model specification	4
2.2. Augmented model specification	7
3. Data and empirical application	8
4. Regression results	9
4.1. Baseline and augmented model results	9
4.2. Functional form	11
5. Implications of regression estimates for evasion and customs tax revenue	12
6. Conclusion	15
7. Tables	18
7.1. Table 1. Results for the transformed baseline model	18
7.2. Table 2. Results for the augmented model	19
7.3. Table 3. Results for the quantity model	20
7.4. Table 4. Results for the nonlinearity test with quartile dummies	21
7.5. Table 5. Summary statistics	22
8. Annex A: Further data details	23
9. Annex B: Quantity model specification and results	24
10. References	26

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1. Introduction

The prominent role of tax evasion as part of the fiscal difficulties of developing countries is widely documented.² Burgess and Stern (1993), while reviewing the theory and practice of taxation in developing countries, bluntly characterize tax evasion in developing countries as “rife” and claim that evasion is a phenomenon linked to cultures, as much as a question of economic incentives and deficient tax collecting agencies. According to Burgess and Stern, “differences in the tradition of compliance probably explain as much of the worldwide pattern of taxation as do under-resourced or poorly organized tax administrations”. Two additional factors, rent seeking and corruption, are cited by those authors as elements bearing an important influence on the levels of tax evasion. In related but more specific work, McLaren (1996) surveys the burgeoning public finance literature on tax evasion and distinguishes two distinct strands of research in the relevant theory. Tax evasion related to fiscal corruption³, on one hand, and evasion merely as an undeclared transaction, on the other. McLaren reviews as well a number of studies that attempted to estimate evasion and reports, in general, a degree of revenue erosion due to evasion not too far from actual tax receipts.

Not surprisingly, a classical symptom of prevalent evasion activities in developing countries is thus the wedge between statutory and effective tax levels that it creates, to such extent that the government revenue legally payable is considerably distant from that actually collected. In this respect, a representative Sub-Saharan African country like Mozambique is no exception in spite of a tax reform program to modernize and strengthen its tax system ongoing since 1998. In a recent local assessment of the business

² For instance, Gauthier and Reinikka (2001) as well as Gauthier and Gersovitz (1993), provide surveys of widespread tax evasion among businesses in two African countries, Uganda and Cameroon respectively.

³ One of the first attempts to formalize hierarchical collusion using the principal agent framework is provided by Tirole (1986).

community's concerns in view of the tax reforms, tax evasion is perceived as a major factor in explaining "the large sums of money which remain outside the tax system" (Bolnick 2004). Throughout 2004, the Government of Mozambique commissioned a survey of perceptions of governance and corruption. Results for this comprehensive survey reveal that tax collection agencies are viewed by the overwhelming majority of Mozambicans as among the most corrupt institutions in the country whereas the popular sentiment eminently expressed is that "only the weak and poor cannot escape the law".⁴

The perception of significant corruption associated with border tax evasion often explains why the customs authorities of Mozambique get bad press. Yet, a great deal is still unknown or undocumented in relation to the full extent of evasion, its motivations, its characteristics, and its linkages with tax policy. Macamo (1998) and later Arndt and Tarp (2004) constitute rare exceptions. Macamo's study represents a singular attempt to estimate unrecorded cross-border trade between Mozambique and its neighboring countries. The author simply recorded easily observable goods crossing relevant border-monitored posts with neighboring countries. This study, in addition to assessing the impact of this type of trade on national and regional food security, suggests an amount of illegal trade close to 10% of the total value of imports in 1996. More recently, Arndt and Tarp (2004) consider the implications of trade policy reform in developing countries by exploring a CGE trade model (with Mozambique as case study) where special attention is paid to the importance of capturing the aspect of disconnected average and marginal tariff rates. The novelty in the approach adopted consists in assuming then that a certain fraction of imports enters the country as duty free while the remaining fraction pays marginal tariffs (similar to a tariff quota scenario). Results for this CGE model show, in short, the possibility of tax policy reforms maintaining revenue neutrality (with respect to all indirect taxes) while engendering positive implications in terms of efficiency and equity.

This paper seeks to shrink this considerable deficit in knowledge by focusing its attention on the causal relationship between trade tax rates and evasion in Mozambique. In so

⁴ Savana Notícias (local independent newspaper), 05/08/2005.

doing, it also investigates distinctive forms of tax evasion. Clearly, the empirical problem presented when studying tax evasion is that, by its very nature, evasion is not easy to measure. The central feature of the methodology presented here, originally pioneered by Fisman and Wei (2004)⁵, stems from the possibility of measuring evasion with some precision by aligning and comparing (at the product level) bilateral trade flow data between Mozambique and its largest trading partner, South Africa. Obviously, the choice of the latter for this study is not innocent; along with the advantage of more promptly available data, it enables inferences with respect to a regional trade partner that invariably accounts for nearly half of Mozambique's official imports. In a similar spirit, the empirical work of Pritchett and Sethi (1994) examines the relation between collected tariff rates and the official, statutory rates of the tariff code for a sample of three developing countries. The authors document an increase in collected rates of less than one-for-one following an increase in the official rates (due exclusively to an increasing ratio of imports coming in with exemption as the tariff rate increases). This approach fails to include tariff revenue losses resulting from smuggling, under-invoicing and misdeclaration of items as it only contemplates reported official statistics. As a consequence, the gap between actual tax receipts and potential tax collections (i.e. if all imports were properly reported and paid the official tax rate) is understated.

The theoretical connection between tax rates and evasion was first formally explored by Allingham and Sandmo (1972), who claim a positive association involving these two variables, provided that precise assumptions regarding risk aversion and the punishment for evasion were set. Later, the most striking and common characteristic of subsequent models developed is that they fail to be conclusive when it comes to ascertain regular predictions of the effect of tax rates on evasion. This fact is clearly pointed out by Slemrod and Yitzhaki (2000) while reviewing the rich body of modern literature on the economics of taxation. According to those authors, predictions end up relying ultimately on the assumptions that are made in those models. This paper searches for an empirical estimate of the elasticity of tax evasion with respect to tax rates in Mozambique. The

⁵ Tax Rates and Tax Evasion: Evidence from "Missing Imports" in China (R. Fisman and S. Wei), in *Journal of Political Economy*, vol. 112, n° 2 (2004).

point estimation is then applied to infer on economic implications of tax policy, with special reference to the evasion rate and revenue collections. In the next section, the regression framework adopted to understand the empirical link between evasion and tax rates is outlined. Section 3 concentrates on describing general aspects of the data used in the regression models, highlighting idiosyncrasies of Mozambique trade flow, data which may have a direct influence on the methodology explored. Section 4 presents results, and section 5 simulates economic implications of alternative rates for tax evasion and customs revenue using the estimated results. Section 6 concludes.

2. Model specifications

2.1. Baseline model specification

A central difficulty when it comes to studying evasion is its measurement. Due to its very nature, tax evasion does not generate statistical data so a satisfactory estimation is required. In this paper, along the lines of Fisman and Wei, our measure of evasion is determined by the ratio of South Africa declared exports to Mozambique (defined hereafter as X) to Mozambique's recorded imports from South Africa (defined hereafter as M). In principle, assuming no evasion and no errors of measurement, the numerator and denominator should be a mirror image of each other.⁶ A ratio X/M of unity, thus, would be indicative of an absence of evasion.

In order to study the empirical linkage between customs tax rates and tax evasion, a baseline model is specified. The baseline model posits a linear relationship between the logarithm of our measure of evasion (X/M), and the "Taxes" variable, a central variable defined as the sum of applicable taxes levied at the border for a particular product. This is given by:

⁶ In fairness, an actual source of discrepancy can be found in the existing "simplified regime" of imports (small imports cleared at border points and of value inferior to 500 USD). This type of trade flow is not captured by the Mozambican trade statistics database. Due to its insignificance as a proportion of total imports, this aspect is overlooked.

$$\text{Log } (X/M) = \alpha + \beta \text{ Taxes} + \varepsilon \quad (1)$$

Two essential points need to be highlighted in relation to (1). First, a positive β suggests that tax evasion, defined as the gap between X (exports declared by South Africa to Mozambique) and M (Mozambique recorded imports from South Africa) is positively related to the tax rate. In other words, high tax rates would be associated with high levels of evasion. Of course, because of the nature of the specification, the coefficient β indicates the responsiveness of tax evasion to tax rates, so that a marginal increase in the tax rate would bring about a change in evasion of β percent. Alternatively, equation (1) allows inferring an expression for the growth rate of evasion:

$$(\partial X/X) - (\partial M/M) = \beta (\partial \text{Taxes})$$

Secondly, as will shortly become more evident from section 3, direct imports M cannot always be directly observed. What is in fact observable is M^* that contains imports from South Africa as well as transshipments misreported as imports from South Africa. This second point implies that our baseline model will need to account for the existing difficulties in accurately filtering total imports sourced directly from South Africa. Let us first define observable M^* for any given product i :

$$M^*_i = M_i + \text{Misclassified Transshipments } i \quad (2)$$

In the Mozambican system, there are virtually no tax advantages (i.e. incentives) for deliberately misclassifying a product as South African rather than any other third country. Under the SADC trade Protocol Agreement, a preferential tax treatment is granted to SADC countries.⁷ Entering into force in 2001, this regional agreement established though that by 2003 only the vast majority of raw materials from SADC should be subject to full liberalization. This modification in the tariff structure entails a tariff reduction for most raw materials from an initial 2.5% duty rate to a zero rate. Albeit few exceptional cases,

⁷ Even though the envisaged speed in tariff dismantling of merchandise coming from RSA is slower when compared with merchandise originating from the remaining SADC countries.

other types of tradable goods maintain their original tariff rates which are, incidentally, also applied to non-SADC trading partners.

Misclassified imports are assumed, therefore, to be proportionally related to the size of the genuine amount of imports from South Africa. Amending slightly the assumption made by Fisman and Wei in the Chinese case study,⁸ misclassified indirect imports in the Mozambican context can be given by:

$$\text{Misclassified Indirect Imports}_i = \theta_i M_i \quad (3)$$

where θ_i is an independent and identical random variable and $0 \leq \theta_i \leq 1$

As a natural corollary of the actual functioning of the Trade Information and Management Systems (TIMS) software, θ_i reflects the propensity for human error. Increased vigilance and checks in terms of verification of import declarations should help to reduce θ_i to very low error rates. Thus, for any single product, incorrectly-classified indirect imports make up a proportion of total imports. From (2) and (3), we can then write:

$$M^*_i = (1 + \theta_i) M_i \quad (4)$$

Equation (4) leaves us now in a comfortable position to specify a transformed baseline model. The transformed model is then expressed by:

$$\text{Log}(X/M^*) = \alpha^* + \beta \text{ Taxes} + v \quad (5)$$

where $\alpha^* \equiv \alpha + E(\varepsilon_i - \log(1 + \theta_i))$ and $v = \varepsilon_i - \log(1 + \theta_i) - E(\varepsilon_i - \log(1 + \theta_i)) \sim N(0, \sigma^2)$

⁸ In Fisman and Wei, the magnitude of misclassified imports depends on a constant and the import value of the product (subject to some random error).

It can quickly be noticed that the transformed model in (5) has a new constant term, α^* , and a new error term, v . The error term, v , is assumed to be identically and independently distributed. Model (5) constitutes the new baseline specification which will be used to estimate the sensitivity of evasion to tax rates in Mozambique.

2.2. *Augmented model specification*

In this sub-section, an augmented model is introduced to investigate for product misclassification. Evasion occurs in several forms. One distinct type of evasion is misclassification of merchandise. Detecting whether higher taxed goods are being mislabeled as lower taxed goods requires an extension to our baseline model.

The augmented model incorporates a new variable, Av_Tax_Sim , defined as the average tax of similar products for a certain product. Notice that the error term maintains the properties specified earlier in equation (5). The augmented model hence yields:

$$\text{Log}(X/M^*) = \alpha^* + \beta_1 \text{Taxes} + \beta_2 \text{Av_Tax_Sim} + v \quad (6)$$

Product mislabeling in the Mozambican Customs implies β_2 negative and significant. That is, by holding the tax of a given product constant, once the tax of similar products is lowered the incentives to misclassify our given product as similar products are greater.

The augmented model can be further extended. For example, equation (7) includes a squared “Taxes” variable as regressor in order to test for nonlinearity of the relationship between tax rates and evasion.

$$\text{Log}(X/M^*) = \alpha^* + \beta_1 \text{Taxes} + \beta_2 \text{Taxes}^2 + \beta_3 \text{Av_Tax_Sim} + u \quad (7)$$

3. Data and empirical application

Cross-border trade data between South Africa and Mozambique has been made available by the South African National Statistics Agency and the Customs General Directorate of Mozambique. The data cover exclusively the year of 2003 and are structured at the tariff code item level, according to the Harmonized System. The adoption of a more detailed classification system for tradable goods by the two countries in question (eight digits) enables to shift the approach to a relatively more disaggregated level of individual products and, as a result, improve the precision by which evasion is measured.

According to Customs of Mozambique figures, total recorded imports from South Africa in 2003 amount to nearly 538 million USD. Overall, this figure should then include genuine imports from South Africa; but it may also contain transshipments originating from third countries. South Africa, on the other hand, is perfectly able to report separate data on transshipments versus direct exports destined to Mozambique. As a result, differences between X and M can sometimes reflect human judgment errors in the form of misreported merchandise. The 995 (out of 5538) observations with available statistics for M but lacking any data for X likely reflect this human error.

Equally important, one must bear in mind that the likelihood of deliberate keying error remains high so long as there are “sufficiently” large differentials between taxes payable under different tax regimes (e.g. preferential vs. MFN).

The Mozambican tariff structure in 2003 looks, *grosso modo*, as follows: (i) 0% tariff rates for medicines and SADC raw-materials; (ii) 2.5% for non-SADC raw materials and for cereals; (iii) 5% for equipment goods and most oil products; (iv) 7.5% for rice, sugar and intermediate goods (e.g. pieces for machinery) and (v) 25% for consumer goods. The data on Mozambican trade taxes were taken from the Mozambican Customs trade database. The trade tariff schedule ranges from 0 to 25%. A VAT tax of 17% is levied on

most imports and, in addition, selected products are subject to excise and surcharge⁹ taxes. A measure of taxation capturing the total tax burden, *Taxes*, is then constructed by adding up for each single product its applicable trade taxes. This study also required CIF value data on X and M for each tariff heading, with respective flows in quantities as well as associated units of measurement. The latter is vital to be able to estimate evasion in quantities coherently. For the regressions with quantities (see Annex B), every time it was not possible to match up units of measurement on both sides, the relevant product in the regression ended up being dropped.

After cleaning-up and reorganizing the data, the full sample contains 5538 different products at the eight-digit classification. The UN-allowed discretion enjoyed by each country to choose the levels of disaggregation beyond the six digit coding established by the Harmonized System presents another difficulty that needed to be dealt with. In total, 995 missing observations on the X side were found and, equivalently, 2057 observations on the M side were missing, predominantly as a result of tariff heading mismatch¹⁰. This contributed to further data elimination leading to a final sample of 2486 observations. Restrictions applied to samples or missing observations on regressors other than *Taxes* lead to regressions involving fewer observations.

4. Regression results

4.1. Baseline and augmented model results

In this sub-section, the focus is on results for the baseline and augmented models. Table 1 presents a first set of results for equation (5). According to Table 1, the estimate of β is positive and statistically significant. An estimate value of 1.38 suggests that if the tax rate increases by one percentage point, the ratio X/M measuring evasion will increase by

⁹ Sugar and one type of cement are two of few products enjoying protection from surcharge taxes in Mozambique in 2003.

¹⁰ In truth, it is not a completely false idea to admit that in the process we may be successfully eliminating a few existing “ghost” exports from South Africa, designation to describe goods allegedly exported to Mozambique (with VAT reclaimed) but then diverted back into the home market.

nearly 1.4%. Similarly, the result shows that a higher fiscal burden on trade in Mozambique implies a larger amount of relative tax evasion. These results demonstrate equally some robustness since once variations in the tested sample are introduced the estimate for the elasticity of evasion is pretty much unaffected¹¹.

It is important to point out the poor fit of the regressions. In spite of the significance of the β coefficient, the tax rate does not explain more than one percent of the variation in evasion across the different results. Following the argument provided by Fisman and Wei in their study of “missing” imports in China, these low R^2 values should be linked to the noise resulting from misclassified imports from South Africa. This claim is in fact supported by the method of aggregation (using the mean of X/M) which increases the R^2 statistic to a value close to 13%, while the estimate of β rises slightly to 1.9.

This first set of results reveals a positive impact of tax rates on tax evasion in Mozambique, that is, high tax levels are associated with high levels of underreporting of import values. A different proposition now is to attempt to detect the presence of misclassification of goods for tax advantage purposes. Table 2 displays results for the augmented model. The introduction of new variables into the baseline model boosts the magnitude of the evasion sensitivity coefficient, which takes now values of 2.72 and 4.24. Similarly, results confirm indisputably the presence of fraudulent classification of merchandise as the coefficient on the “Av_Tax_Sim” variable is negative and significant (at the 5 percent level for the regression omitting the “Taxes²” variable and at the 10 percent level for the full regression).

More broadly, the empirical evidence supports the results obtained. A heterogeneous trade tariff menu seems to nourish corruption among customs officials as the standard deviation of trade tariffs across goods seems to be robustly correlated with measured corruption across countries (see, for instance, Gatti 1999). Clearly, these results can be significant to tax policy recommendations in Mozambique by offering the possibility of

¹¹ After excluding observations with no average tax for similar products, the estimated coefficient is also close to 1.4%.

rethinking about ways to reduce opportunities for product misclassification. Notwithstanding improvements in Customs internal control and verification of merchandise, this could certainly be achieved, for example, through a customs tax reform that takes into account the need to harmonize the existing trade tariffs within distinctive groups of similar products (exhibiting a strong degree of homogeneity), with no overly adverse costs for revenue mobilization. This argument is explored for the broader context by Gatti (1999) who advocates that setting trade tariff rates at a uniform level limits public official's bribe taking behavior, allowing countries to obtain efficiency gains and delivering higher revenue levels. Winters (2004) illustrates the argument of simpler, more transparent and non-discretionary trade policies with the paradigmatic case of Chile.

4.2. Functional form

Throughout section 4, it has been assumed that the responsiveness of evasion to tax rates is constant, so the elasticity of evasion is equal to 1.4. But what if the actual elasticity varies across the tax scale? This is a perfectly legitimate question to ask and this subsection intends to look at two tests that can be performed to provide an answer to this question.

Table 2 offers the first result that can be used to test for nonlinearity in the relation between tax rates and tax evasion. By introducing the "Taxes²" variable into the augmented model in equation (7), we can simply concentrate on the significance and sign of its coefficient. The possibility of a nonlinear relationship between tax rates and evasion seems initially to find some empirical support when the full sample is used. Results show, in fact, a surprisingly decreasing nonlinear relation. But if we discard the first and last 5% quantiles (outliers), results seem to demonstrate that there is no evidence of a non-linear association between tax rates and evasion.

An alternative check can be conducted to elucidate the hypothesis we are trying to test. In essence, the test consists of making use of a specification with quartile dummy variables

to measure differential coefficients, by reference to the coefficient on the tax variable. A possible specification could hence be given by:

$$\text{Log (X/M*)} = \alpha^* + \beta_1 \text{ Taxes} + \beta_2 (Q_2 * \text{Taxes}) + \beta_3 (Q_3 * \text{Taxes}) + \beta_4 (Q_4 * \text{Taxes}) + v \quad (10)$$

where Q_n refers to the variable “Taxes” quartile n and $n = 1, \dots, 4$

With this type of specification, β_2 , β_3 and β_4 are differential coefficients by reference to β_1 . The test aims then at evaluating whether there are shifts in the elasticity of evasion across the different quartiles, by looking at the magnitude and significance of those differentials.

As confirmed by table 4, the estimates of β_2 , β_3 and β_4 are not significant statistically so results confirm the previously found evidence (providing outliers are eliminated) of no nonlinear evasion elasticity: hence, even allowing for the slope to differ across quartiles, the results show a stable effect of tax rates on tax evasion.

5. Implications of regression estimates for evasion and customs tax revenue

Results for the regression framework presented suggest evidence of tax evasion in Mozambique through misreporting as well as under-invoicing of merchandise. Results show, at the same time, a relatively sensitive responsiveness of evasion to tax rates with the estimate of β being equal to 1.4 percent. In this part of the paper, the focus shifts to the economic repercussions of the regression estimates for tax evasion and revenue. The point estimates obtained from the augmented model enable us to establish the empirical link between specific variables. But an additional advantage of the augmented model consists in the possibility of deriving estimations for evasion in Mozambique in 2003.

Suppose we consider the average value of “Taxes”, that is 30%. Let us assume for the present purpose that the probability of error in merchandise country of origin

classification is insignificant, and hence θ equals zero. For the mean customs tax rate, the predicted X/M ratio is equal to 1.357. That is, for every import transaction recorded the genuine import value is 1.357 and therefore the gap between reported exports and recorded imports reaches, on average, 35.7% of reported imports. Given the predominance of smuggling in highly taxed products, the consequences for revenue should be certainly stronger than the consequences for import volumes¹².

Consider now the more specific case of a consumer good, subject to the top tariff rate. For this typical product, the trade tariff is 25% and VAT applies at a rate of 17%. So the aggregate tax, “Taxes”, equals 42%. For such value for “Taxes”, the augmented model predicts an X/M ratio of 1.57 which implies a proportion of import evasion of 57% for this sort of product¹³. In short, these results show that more than half of reported imports of consumer goods were smuggled into the country in 2003. It should be pointed though that these figures fairly exceed the current basic perception of evasion rates existing among economists and policymakers in Mozambique (see Macamo 1998 and Van Dunem, 2005).¹⁴

In 2006, Mozambique envisages to reduce the top tariff rate from 25 to 20%. In light of such scenario, the model predicts an evasion rate for consumer products (with an aggregate tax of 37%) of approximately 33%. In addition, from a revenue perspective, the regression framework point estimates also allow to examine the behavior of tax receipts across the tax scale. In this context, let’s now consider the economic implications of tax policy using some simulation analysis.

The graph 1 below puts on display the Laffer Curve, using a virtual value of registered imports for a given initial tax rate. For an initial tax rate of 0%, the corresponding value of imports is, hypothetically, 1000 units. For that reason, the revenue axis is merely a

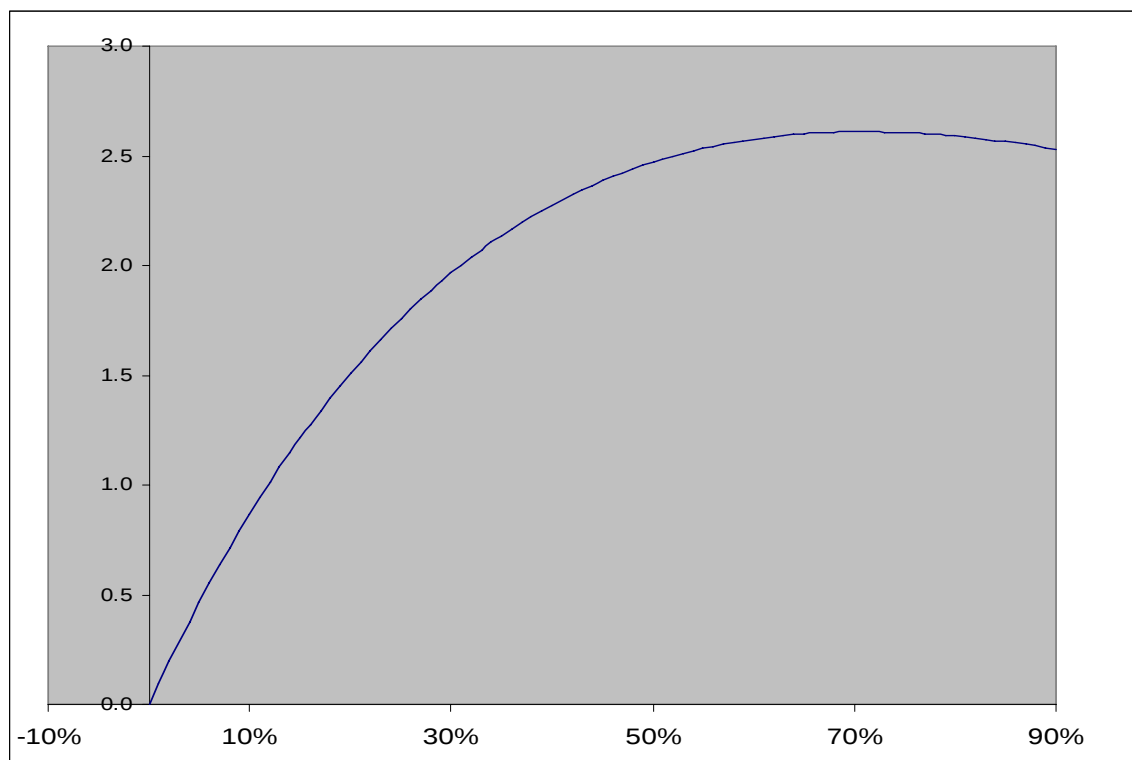
¹² Arndt and Tarp (2004) find a level of foregone revenue due to smuggling and legal tax avoidance equal to about 60% of the total statutory tariff revenue.

¹³ It has been assumed here that the average tax of similar products for consumer goods is equal to 42% (see table 5).

¹⁴ If θ equals 0.1 (i.e. 10% of South African recorded imports were misclassified), the evasion rate increases by approximately fifteen percentage points.

revenue indicator. Underlying this curve are two key elements: a) the already encountered result that a marginal increase in the tax level generates a decrease in the total value of reported imports of 1.4%; b) an inelastic price elasticity of demand of imports. Graph 1 displays an indicator of tax revenue collections which increases as we move along the tax scale and reaches its maximum point when the tax rate is slightly less than 72%. For that level of aggregate tax, revenue is maximized. Note that this simple simulation shows (assuming an unresponsive import demand to price changes) that beyond a value for “Taxes” of 72%, any increase in the tax rate would imply a decrease in the revenue collected. By the same token, when the tax rate is below 72%, decreasing “Taxes” are associated with falling revenue.

Graph 1. The relationship between revenue and tax rates



Consider, instead, the case of a responsive import demand. The current average tax rate on imports in Mozambique is approximately equal to 30% (see Table 5). What this simulation also demonstrates is that for an import demand price elasticity of 1.92 or less, the average tax rate in Mozambique is on the left hand side of the Laffer Curve. For a

price elasticity higher than 1.92, any marginal reduction in the Mozambican tax rate is likely to produce an increase in revenue. The empirical literature generally documents low price elasticity estimates for developing countries, rarely exceeding three and generally between one and two. Reinhart (1995), for example, provides a set of outstanding regional results: Africa registers a price elasticity of 1.36, one percentage point greater than the price elasticities recorded by Latin America (0.36) and Asia (0.40). Consequently, any present reduction in import tariffs (as part of an overall program of trade liberalization) for a Sub-Saharan country with low import substitution possibilities like Mozambique is likely to bring about trade revenue losses for the Mozambican Customs authorities¹⁵.

6. Conclusion

The basic conclusion emanating from this paper is that tax rates have a strong and positive effect on tax evasion in Mozambique. For every percentage point increase in the customs tax rates, evasion increases by 1.4%. The degree of responsiveness portrayed for this representative Sub-Saharan country corresponds to half of the sensitivity found in recent times for an Asian country like China.

The paper also concludes that customs tax evasion acts in Mozambique through two different channels: under-invoicing and fraudulent misclassification of merchandise. In each case, tangible evidence to characterize evasion has been found. Results indicate also no evidence of the practice of under-declaration of quantities, suggesting that under-reporting in the value of imports is caused by under-reporting in unit values. Because of flawed data on quantities though, this discussion is presented in Annex B.

The study permits as well to infer the overall levels of evasion in the country or for any type of product. The general evasion rate based on the regression estimates is

¹⁵ Mozambique is expected to reduce its top tariff rate of 25% (mainly applied to consumer goods) to 20% in January 2006. This study indicates clear consequences for trade revenue as a result of the envisaged change in the maximum duty rate.

approximately equal to 36% of recorded imports. Yet a classic consumer product (e.g. television or vegetable oil), subject to the top tariff rate, is estimated to be evaded at a rate approximately equal to 57% of genuine imports. This tendency to see increasing concentration of unrecorded trade for a higher protection rate replicates qualitatively the Macamo and Arndt and Tarp estimation outcomes.

In any case, a vital tax policy issue that needs to be taken into serious consideration in a developing country like Mozambique (where international trade taxes are a large source of revenue) is that globalization and the opening of frontiers to freer trade tend to put downward pressures on the level of taxation. This empirical study ultimately exposes the present implications of freer trade for the revenue yield due to lowering of trade taxes. The current program of trade liberalization creates, at the actual stage, revenue losses that need carefully to be addressed, in light of the government's tax policy objectives of ensuring fiscal sustainability, an effective mobilization of resources and, last but not least, reducing aid dependency.

A perfectly reasonable tax policy option would be to confront the ubiquitous problem of increasing foregone revenue through official tax exemption. In fact, Van Dunem (2005) asserts that the fiscal cost of duty exemptions in Mozambique has risen dramatically from 2002 to the next two following years by virtue, to a great extent, of spectacular increases in the volume of official exemptions granted under special authorization basis (i.e. discretionary). As discussed by Ebrill, Stotsky and Gropp (1999), "when exemptions become more prevalent, the incentive to classify taxable products as exempt also grows, further contributing to a lower rate of tax compliance". Those authors defend, in sum, that revenue will be mostly preserved when trade liberalization is accompanied by certain circumstances that include elimination of exemptions as well as improvements in customs and tax administrations which aim at limiting incentives for tax evasion.¹⁶ Tanzi (2000), in related work, proposes that the appropriate tax policy strategy to confront the short term revenue loss coming from lower tariffs should be to use separate compensatory measures, namely: "a) reducing the scope of tariff exemptions in the

¹⁶ This argument is also emphasized by Pritchett and Sethi (1994)

existing system; b) compensating for the tariff reductions on excisable imports by a commensurate increase in their excise rates; and, finally c) adjusting the rate of the general consumption tax (such as VAT) to meet remaining revenue needs”.

7. Tables

7.1. Table 1. Results for the transformed baseline model

	Constant		Taxes		No of observations	R ²
	Coef. (α^*)	t	Coef. (β)	t		
Total sample	-.12 (.11)	-1.13	1.38 (.32)	4.29	2486	.0074
Excluding first and last percentile	-.12 (.09)	-1.30	1.43 (.29)	4.96	2437	.01
Excluding first and last 0.05 quantile	.02 (.08)	.31	.99 (.23)	4.30	2237	.0082

Note: standard deviations in brackets

7.2. Table 2. Results for the augmented model

	Constant		Taxes		Taxes ²		Av_Tax_Sim		R ²	No of observations
	Coef. (α^*)	t	Coef. (β_1)	t	Coef. (β_2)	t	Coef. (β_3)	t		
Omitting Taxes ²	-.07 (.12)	-.60	2.72 (.75)	3.63	-	-	-1.61 (.80)	-2.01	.0094	2219
Full regression	-.32 (.17)	-1.91	4.24 (1.05)	4.06	-2.08 (1.00)	-2.08	-1.53 (.80)	-1.92	.0113	2219
Excluding first and last 0.05 quantile	-.08 (.12)	-.70	1.95 (.77)	2.54	-.63 (.74)	-.85	-.46 (.59)	-0.79	.0109	2003

Note: standard deviations in brackets

7.3. Table 3. Results for the quantity model

	Constant		Taxes		Av_Tax_Sim		R ²	No of observations
	Coef. (α^*)	t	Coef. (β_1)	t	Coef. (β_2)	t		
Omitting Av_Tax_Sim (7)	.19 (.16)	1.17	.30 (.50)	.60	-	-	.0002	2201
Full regression (8)	.22 (.18)	1.20	1.49 (1.10)	1.35	-1.48 (1.17)	-1.26	.0009	1965
Excluding first and last 0.05 quantile (8)	.34 (.14)	2.43	1.76 (.85)	2.08	-1.93 (.91)	-2.12	.0026	1784

Note: standard deviations in brackets

Regressions with the same units of measurement; when the units of measurement are not the same, the observations were dropped.

7.4. Table 4. Results for the nonlinearity test with quartile dummies

	Coefficient	Std. Err.	t
Constant	-.05	.21	-.26
Tax	1.30	1.15	1.13
Q ₂ * Taxes	-.61	.60	-1.03
Q ₃ * Taxes	.04	.74	.05
Q ₄ * Taxes	-.15	.99	-.16

Note: Dependent variable is Log (X/M*)

No of observations = 2486

R-squared = .0084

7.5. Table 5. Summary statistics

	mean	median	min	max	st. dev.	n° of obs.
Log (X)	18.91	19.097	7.98	27.74	2.728	4543
Log (M)	19.08	19.312	9.44	26.80	2.567	3481
Log (X/M)	.29	.282	-11.28	11.71	2.246	2486
Log (Q _x)	7.11	7.139	0	20.58	3.393	4536
Log (Q _M)	7.27	7.203	-3.51	19.40	3.661	3434
Log (Q _x /Q _M)	.29	.288	-12.28	14.26	3.109	2460
Taxes	.30	.245	0	1.07	.141	3481
Av_Tax_Sim	.30	.245	0	1.07	.134	3095

Note: Not surprisingly, because of misclassified indirect imports, the minimum value for Log (X/M) and Log (Q_x/Q_M) is negative.

8. Annex A: Further data details

A preliminary effort has been carried out to clean the original trade information and eliminate inconsistencies detected in the data. Chapter 87 of the tariff book, covering motor vehicles and its spare parts, includes a substantial amount of indirect trade. A finest example, obviously, is imported cars from Japan. To limit the noise introduced in the regression equations by indirect trade, the full chapter has been eliminated.

The lack of available data for Mozal (Mozambique's first aluminium smelter and fourth largest in the world) and energy¹⁷ imports in the Mozambican Customs database contributed to further data exclusion. Selected products imported by Mozal were identified and subsequently removed from the original database, as per the indications provided by the Mozal border agency and the Customs terminal post¹⁸.

Additionally, the tariff book reform that took place in mid-January 2003 caused changes in duty rates for few products. The logic, in the face of duplication of tariff rates for a single product, seemed to systematically consider the prevailing rate after the reform, since it virtually covers the full year (so in choosing, for example, between a pre-reform tariff rate of 0% and a post-reform rate of 2.5%, the latter has been selected).

Moreover, tariff headings displaying six-digits were not included in the database. As such cases involve invariably errors in the registration of the trade information in TIMS and identifying the correct tariff heading is a delicate task, these tariff headings were scrapped along with related eight-digit positions. Finally, to correct for the volatility in the sugar surcharge¹⁹, a simple average has been calculated for each variety of sugar.

¹⁷ The export value for energy declared by RSA substantially underestimates the official import figure reported by Motraco (private company operating under a concession contract that authorizes the import of energy into Mozambique).

¹⁸ I am grateful to Mike Wilkin, Head of Mozal operations in Ressano Garcia, for providing a valuable indication of the list of products (e.g. furnace bricks) exported to Mozal from RSA. In terms of import value, the most important product found is alumina.

¹⁹ In 2003, the variable surcharge tax applicable to raw sugar cane (with tariff book position 17.01.11.00) ranged from 62 to 105%.

9. Annex B: Quantity model specification and results

The discussion of results has highlighted the presence of under-invoicing and product fraudulent misclassification in Mozambique. Yet under-invoicing can potentially act through two different ways: under-pricing, on the one hand, and under-reporting of quantities, on the other.

To split and investigate for these two, we need to reformulate the basic regression framework. More specifically, a “quantity model” specification is now introduced to inspect the prevalence of under-reporting of quantities. Let us define Q_x and Q_M as new variables that capture the quantities exported and imported respectively for each product. The model takes now the following forms:

$$\text{Log}(Q_x/Q_M) = \alpha + \beta_1 \text{Taxes} + v \quad (8)$$

$$\text{Log}(Q_x/Q_M) = \alpha + \beta_1 \text{Taxes} + \beta_2 \text{Av_Tax_Sim} + v \quad (9)$$

Results for the quantity model are presented in Table 3. Under-reporting of quantities would simply require the estimated coefficient for β_1 to be positive and significant. When the full sample is used, the estimated coefficients for either (8) or (9) suggest that there is no evidence of under-reporting of quantities. This result should be accepted, though, with relative caution in view of the current distrust (primarily acknowledged by Mozambican Customs officials) concerning the quality of data on quantities in the TIMS trade database. In spite of quantity regressions with consistent units of measurement on Mozambican and South African sides, very often data on quantities lacks credibility, especially on the Mozambican side, due to tariff-book inconsistent data entry.²⁰

Likewise, we can also confirm from Table 3 the existence of merchandise misclassification, conditional on the exclusion of outliers. The estimate of β_2 (-2.12) turns

²⁰ One could think of the anecdotal case where rather than inserting the number of kilos (as envisaged in the tariff book), the number of boxes is computed.

out to be negative and significant once the first and last 5% quantiles are excluded from the regressions.

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