Effect of Import Liberalization on Tariff Revenue in Ghana

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Abstract

In contributing to the ongoing debate on the impact of trade liberalization, this paper investigates the quantitative effect of import liberalization on tariff revenue in Ghana. A decomposition analysis was conducted to determine the relative effects of the different features of the import policy reforms. In addition, the impact of tariff rate reductions on tariff revenue was inferred using estimated results from the real imports equation. The study indicates that import tariff revenue is neither buoyant nor elastic in Ghana. Even though exchange rate depreciation over the liberalization period has increased tariff revenue, it is offset by the revenue-reducing effect of tariff reductions over this period. Moreover, the net effect of import liberalization in the form of reductions in the average tariff rate has been negative. The study recommends further improvements in customs administration and duty collection mechanisms to reduce leakage, an effective detection of evasion, enforcement of penalties, and tax replacements as key complementing measures.

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1. Introduction

Trade liberalization has formed a very important component of economic reform programmes in Ghana since 1983. In terms of sequencing, Ghana did not go through the normal intermediary stage of translating quantitative restrictions into equivalent tariffs before gradually reducing the tariffs. Most quantitative restrictions, including import licensing, were eliminated at the same time as the country went ahead to reduce the level and range of tariffs.

The main reason for import trade liberalization under economic reforms was to reduce the wedge between the official and the parallel exchange rates. Also important was the need to provide foreign exchange to ease import suppression with the aim of increasing output, particularly in the export sector. In this regard, the long-term goal was to replace quantitative restrictions with price instruments.

More recently, the impact of the liberalization on trade tax revenue has been a subject of debate. There are concerns about existing ambiguity in both theory and empirical evidence on the relationship between trade liberalization and trade tax revenue in the global context. In theory, liberalization in the form of lower tariff rates and the simplification of rates causes direct trade tax revenue loss, on the one hand, but on the other can also amount to an increase in volume of imports, and hence the tax base and revenue. The net effect depends on a host of factors, including the initial trade regime and the extent of increase in demand for imports. Empirical studies confirm this ambiguous relationship suggested in theory (see Tanzi, 1989; Ebrill et al., 1999; Glenday, 2000; Khattry et al., 2002; Agbeyegbe et al., 2003; UNECA, 2004; Suliman, 2005).

Oduro (2000) asserts that trade liberalization was fiscally incompatible in Ghana during the 1990s even though Jebuni et al. (1994) find it fiscally compatible for the second half of the 1980s. Such studies rely only on descriptive analyses of changes in tax revenues. They do not apply testable models in investigating the exact impact of trade liberalization on trade tax revenues in Ghana. In order to validate Oduro's assertion, this study used regression analysis, applied to testable models, to examine the short- and long-run dynamics of such relationships from observed data.

The empirical purpose of the study is to contribute to the settling of the debate by examining the quantitative effect of import liberalization on import tariff revenue in Ghana. The intention is to provide evidence that can be used in the structuring or sequencing of import trade liberalization programmes. This focus is justified on the grounds that import tariff remains Ghana's main trade policy instrument, accounting for an average of over 60% of revenue generated from international trade. International trade revenue remains an important source of government tax revenue in Ghana, accounting for 25% on average,

whilst import taxes alone have contributed not less than 70% of total trade tax revenue since 1990. The continued reliance of the Ghanaian economy on trade taxes, particularly from imports, suggests that sensitivity to trade policy reform is likely to be strong in Ghana.

To meet the objectives the study attempted a decomposition analysis of the sources of changes in import tax. The study also considered a decomposition analysis of duty evasion using data on Ghana's relations with a selection of major trading partners. The justification for this is that poor revenue mobilization from international trade can also be attributed to revenue leakage, such as duty evasion. An examination of the short-run dynamics and long-run analysis of the relationships between import liberalization and imports (the taxable base) was done. The study then inferred from the outcome of the results the effect of liberalization on import tax revenue in Ghana.

The organization of the paper is as follows: In Section 2 we present a description of trade liberalization in Ghana. This includes a brief account of Ghana's involvement in the trade liberalization scheme of the Economic Community of West African States (ECOWAS), the tariff structure of the country and trends in imports. Section 3 provides a precise definition of what the authors mean by import trade liberalization, along with a presentation of the approaches used for the study. In Section 4, we report on the results from estimating import tax revenue productivity, while a report on the decomposition analysis from examining the relative revenue effects of alternative features of import policy reform forms the core of Section 5. This section also includes a brief decomposition analysis of the incidence of duty evasion in Ghana. This is followed in Section 6 with a presentation and analysis of estimation results and an inference on how tariff reductions affect tariff revenue in Ghana. Section 7 summarizes and provides conclusions and policy implications of the study.

2. Trade liberalization in Ghana

Ghana's first experience with a fairly liberal trade regime was between 1950 and 1961. During this period, Ghana was a member of the sterling zone; there were comparatively no restrictions on payments to and from member countries but payments to countries outside of the sterling zone were restricted. But substantial increases in government spending with high import content resulted in huge budget deficits and a quick drain of the country's foreign exchange reserves. Response to this was the introduction of foreign exchange controls coupled with comprehensive import licensing in 1961. The ever-increasing trade restrictions further depleted foreign exchange reserves, compelling the government to resort to increased external borrowing. The controlled regime continued until July 1967, which saw the beginning of a liberalized import regime.

Under the liberalized import regime in 1967, the domestic currency was devalued by about 43% and import duties on some selected items were reduced. The rapid increase in government expenditures and imports through the open general licence caused the balance of payments position of the country to deteriorate. Alongside this, there was an upsurge in inflation, which eroded the gains from devaluation and cheapened imports because of real exchange rate appreciation. With an upsurge in government's budget deficit in 1971 and 1972, a substantial rise in domestic prices eroded import taxes and export subsidies. Over the same period, world cocoa prices also fell, thereby worsening the country's trade balance and depleting foreign exchange reserves. The end result was a political overthrow and resort to control measures in 1972, thus completing the first cycle of Ghana's trade policy.

Between 1972 and 1982, trade policy in Ghana was characterized by strict import controls. The major features of this regime included the revaluation of the domestic currency by 26%, resort to import controls including use of import licences as the main instrument, and the maintenance of exchange controls. Others were the wide variations in import duties and frequent changes in import taxes aimed basically at revenue generation. These wide variations in import duties made tax evasion possible through misclassification of imported goods. By 1982, import volumes, cocoa export volumes and real government revenue had fallen to their lowest levels since 1960. The economy suffered severe foreign exchange constraints and a general deterioration in most economic fronts. Thus, the resort to trade reforms after 1982 with the long-term goal of replacing quantitative restrictions with price instruments and creating a liberal trade regime was most welcome.

Appendix A, tables A1 and A2, summarizes selected macroeconomic indicators. The trends in the tables can be seen to track the foregoing account of trade liberalization.

Trade liberalization under structural adjustment programme, since 1983

Trade liberalization under the adjustment programme since 1983 can be categorized into three phases. These are: the period of attempted liberalization or transition to import liberalization; the period of import liberalization; and the period of liberalized trade regime.

The period of attempted liberalization or transition to import liberalization covers the years 1983–1986. This period is characterized by the introduction of a system of bonuses and surcharges, and their later replacement by frequent nominal devaluations. Import tariff rates were adjusted downward, but the range of rates with the import licensing system and import programming were maintained. Aside from these, the period witnessed a decline in export tax rates that was greater than the decline in the import tariffs.

The period of import liberalization per se ran from 1986 to 1989. This period was characterized by the introduction of a formal dual exchange rate system, which was later unified into a single exchange rate system based on auctioning and a further liberalization of the exchange rate. Other features of this phase of the liberalization process include a redefining of the import licensing categories, a reduction of the import tax schedule and a reduction in the sales taxes on imported goods by 10 percentage points. The foreign exchange retention scheme was liberalized in 1987, whilst the cocoa export tax rate (made up of the ratio of cocoa duties to cocoa export earnings) was reduced.

A liberalized trade regime has been in place since 1989. This period has been characterized by a replacement of retail auctioning with wholesale auctioning in the foreign exchange market in 1990, abolishing of the import licensing system, decline in import tax rates on raw materials and capital goods, and reduction in sales tax on imported basic consumer goods. Over this same period, protective duty rates were introduced for specific goods in 1990 and 1994, and the export retention scheme was phased out.

The most-favoured nations (MFN) tariffs apply on most imports, except those from ECOWAS member countries, which have attracted duty-free rates since 1996.

ECOWAS trade liberalization scheme

Under the ECOWAS trade liberalization scheme established in 1990, Ghana initially provided preferential tariff reductions of 20% on imports of a few goods from some countries that had been granted community status. Products from member states that qualified for preferential treatment attracted rates of 8%, 16% and 20%, whilst similar items from other countries attracted duty rates of 10%, 20% and 25%, respectively.

Since 1996, however, most imports from member countries have attracted duty-free rates. Ghana provides duty-free preferences on a range of unprocessed agricultural products and several industrial products imported from producing enterprises, cited within member countries, and that are eligible to receive such preferential treatment. Eligibility is based on whether the imports meet ECOWAS rules of origin and have sourced at least 60% of their raw materials from within the Community.

Ghana's tariff structure

Over the pre-adjustment period, several changes were made to the tariff rates in a bid to influence the amount and composition of imports, and to generate revenue. Objectives were set with targets for both direct controls and the tariff. In particular, the import duty and import licence levy on some selected items were increased with the aim of generating revenue. This goal was not achieved, however. As indicated in Table 1, the effective collection rate declined from an average of 21.8% during the 1965–1971 period to an average 15.4% for the 1972–1982 period. The standard deviation of the average official tariff rate over the pre-adjustment period also indicates a widening of the range of rates, which gave room for evasion through misclassification of imports. Clearly, the controlled regime was characterized by high average duty rates and comparatively wide disparities across rates. The simple average rates over the control period ranged from 26% to almost 49%, with standard deviations ranging from 18% to 42%.

Table 1: Actual average import duty schedule/rates (%), dispersion and collection rates (%)

	1965–71	1972–82	1983–89	1990–2003
Over simple (unweighted) average	-	32.6	20.6	11.3
Standard deviation	-	35.5	8.4	10.6
Effective collection rate	21.8	15.4	13.6	7.7

Source: Averages computed with data from various sources including national annual budget statements, Ghana Statistical Services, Ministry of Finance and Economic Planning, and Customs, Excise and Preventive Services.

Reduction in the level of rates and disparities characterized the move towards liberalization during the 1983–1986 period. Effective collection rates over this period did not show any marked improvement in customs duty collection.

In 1988, a special import tax of 10% was introduced to provide temporary protection for a number of selected industries, such as certain drugs, garments, cosmetics and non-alcoholic beverages. A higher special tax of 40% was set for alcoholic beverages. The inclusion of the special import taxes raised the simple average tariff from 17.5% to 22% for that year.

Additional reforms to the tariff structure ensured further lowering of the tariff levels, but the structure became more disparate and thus less uniform between 1990 and 1996. The re-introduction of the special import taxes in 1990 with an extension of its coverage between 1990 and 1992 raised the average duty rates to about 17% for 1991 and 1992. Again, Table 1 indicates an upward trend in the standard deviation over the adjustment period, indicating increased dispersion of the import tax rate. The outcome of this is, in part, responsible for the decline in the effective collection rate over this period. Another possible cause for the decline in the effective rate is the widespread use of exemptions despite substantial growth in the total value of imports. Growth in imports is partially attributed to the removal of most direct quantitative restrictions on imports. Notably, the import licensing system was abolished in 1989, but the widespread use of exemptions created a gap in the government's tax base, both directly through legitimate imports of

exempted goods and indirectly through the misuse of the exemptions offered. Available data indicate that total exempt imports constituted close to 40.1% of total imports in 1998. A little over 50% of such goods was exempted on the basis of the third schedule of the Customs and Excise Act, whilst the rest were exempt because of clearance through bonded warehouses and free zones (WTO, 2001).

On an annual basis, significant progress has been made in tariff reforms since the mid 1990s, particularly with further lowering of the level of tariff rates. However, the collection rates have remained low. This could mean that despite the upsurge in imports, revenues collected from import duties have not improved to match increases in imports since the latter part of the 1990s. Growth in real imports over the adjustment period averaged 32.4%, which far exceeded the 17.7% average growth in duty revenue. The question, then, is whether trends in tariff revenue can be sufficiently explained by import liberalization alone. Revenue leakages from duty evasion and wide use of exemptions could be a major cause of the low effective collection rates for some years. Thus, it will also be interesting to examine how import liberalization in the form of tariff liberalization and rationalization of the rates affect duty evasion.

Table 2 indicates an escalating tariff structure established since 1986, with capital goods and raw materials attracting lower rates relative to consumer and luxury goods. The essence of this structure is to have an effective rate of protection for domestic import substituting (consumer goods) industries compared with the pre-reform era.

Table 2: Actual import duty schedule/rates (%) of broad import categories (1983–2003)

Year	Concessionary	Consumer goods	Capital goods	Raw materials	Luxury
1983	10–20	30	30	25–30	30
1984	10–20	30	30	25–30	30
1985	20–25	30	30	25–30	30
1986	10–20	25	20	10–20	30
1987	10–25	35	25	15–20	30
1988	10–25	20	15	10–15	25
1989	10	20	15	10–15	25
1990	10	20	10	10	25
1991	0	20	10	10	25
1992	0	20	10	10	25
1993	0	20	10	0–10	25
1994	0	25	10	0–10	25
1995	0	25	10	0–10	25
1996	10	25	10	0–10	25
1997	0	25	5	0–5	25
1998	0	10	5	0–5	25
1999	0	10	5	0–5	25
2000	0	10	5	0–5	20
2001	0	10	5	0–5	20
2002	0	10	5	0–5	20
2003	0	10	5	0–5	20

Source: National Annual Budget Statement (various issues), Ghana Statistical Services, and Customs, Excise and Preventive Services.

Quantitative restrictions

As indicated earlier, the pre-reform period was characterized by a complex system of quantitative restrictions and high tariffs on external trade, with frequent changes in the levels of rates and within various commodity categories.

Unlike tariffs, which were used to generate revenues, quantitative restrictions were used to directly control imports for a favourable balance of payments position. Quantitative restrictions were implemented in two forms. One was through the issue of import licences and also through banning of items. The banning of items was mainly as a protective measure. Table 3 shows an increase in the special licence tax from 20% in 1984 to 50% in 1986. The import licensing system was abolished in 1989, however, on the premise that the introduction of a liberal exchange rate system made the operation of the import licensing system ineffective and redundant.

Table 3: Import licence levy/fee during reforms (%)

Item	1983	1984	1985	1986	1987	1988	1989	*1990*
Special development tax Special licences	10	20	50	50	50	50	0	*0*
Import licence fee Special licence	20	20	20	20	20	20	0	*0*
"A" licence				0.1	0.5	0.5	0	0

Source: Ghana Statistical Services.

Since the phasing out of the import licensing system, import tariffs and the exchange rate are now the main instruments employed in the implementation of import trade policy in Ghana.

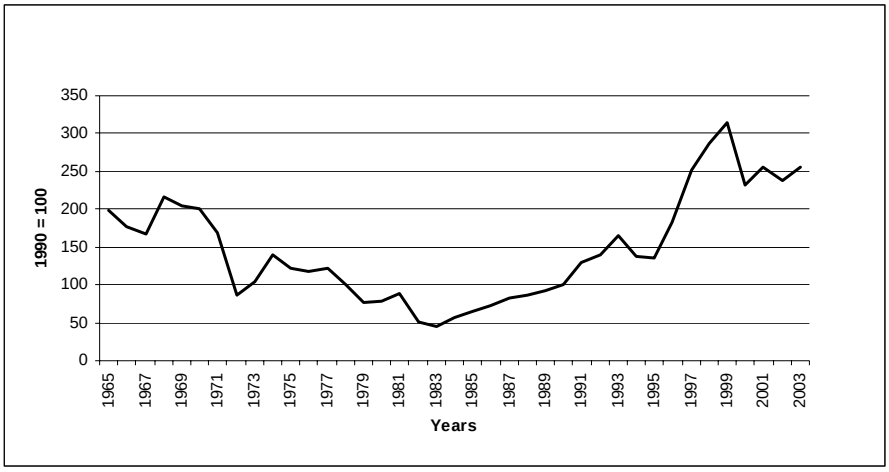
Imports: Growth trends and commodity composition

Figure 1 indicates substantial growth in the volume of imports, particularly since the mid 1990s. This could be largely attributed to the liberalization programme and the accompanying massive inflows of foreign aid, part of which was used to finance imports.

Table 4 shows the dominance of producer goods imports over the period of a largely controlled regime. This pattern, particularly for the 1960s and early 1970s, is consistent with the import-substituting industrialization strategy over the period. The pattern has remained so, although by 1980 industry had suffered from restricted access to needed imported inputs and equipment and operated far below existing capacity. The import liberalization of 1967–1971 did not cause any change in the structure of imports, basically because the import licensing system remained in operation as an instrument for achieving government policy objectives.

Over the liberalization period, the relative importance of raw materials and capital goods imports remained virtually unchanged. In particular, the decline in the relative importance of consumer imports over the liberalization period may be attributed to the escalating tariff structure established since 1986, with relatively higher tariff rates for consumer imports (particularly luxuries).

Figure 1: Import volume index



Source: Based on data from the Ghana Statistical Service and the International Monetary Fund databases.

Table 4: Composition of imports by broad classification (in percentage)

	1965–66	1967–71	1972–82	1983–89	1990–2003
Consumer imports	21.8	23.2	17.5	14.3	14.8
Raw materials imports	39.7	42.3	35.5	27.4	27.1
Capital goods imports	32.8	23.1	28.0	28.3	30.9
Other imports	5.7	11.4	19.0	30.0	27.2
Total	**100**	**100**	**100**	**100**	**100**

Source: Derived from Ghana Statistical Services' Quarterly Digest of Statistics and the International Monetary Fund's International Trade Statistics

Imports from ECOWAS member countries rose in importance, accounting for about 25% of total imports (c.i.f. value) in 1990. However, 1991 and the 1993–1996 periods witnessed a dip in the relative importance of imports from the community. The sudden rise in the importance of imports from the community again in 1997 to about 16% of total imports may be attributed to the duty-free preferential treatment on a wide range of products imported from the subregion. Notably, 2000 and 2002 are years in which the relative importance of imports from ECOWAS member countries rose substantially, recording about 17.4% and 21% of total imports, respectively.

3. Concepts and methods

Before delving into the approaches used in our analysis, our initial effort is to discuss the definition and concept of trade liberalization broadly, as well as those specifically considered in our analysis. We take this approach because the definition is fraught with ambiguity (Edwards, 1989). On a wider scale, the benchmark definition of trade liberalization indicates a change from the use of quantitative restrictions to the use of price instruments. This interpretation lends support to the assertion that quantitative restrictions must be replaced with equivalent tariffs (Krueger, 1986). Jebuni et al. (1994) regard this definition as only second best liberalization.

A second approach frequently regards trade liberalization as a move towards neutrality in relative prices. In this case, trade liberalization is considered as the provision or increase in financial incentives for exports that is equivalent to some given proportion of custom duty on imports. An extensive definition of trade liberalization demands the elimination of quantitative restrictions and reduction in import tariff rates. This represents a move towards free trade. (For further details refer to Appendix B.)

Ghana's liberalization process could be described as one of a move towards free trade. Unlike many developing countries, Ghana did not go through the stage of translating its quantitative restrictions into equivalent tariffs before steadily but progressively reducing the tariffs. Most quantitative restrictions, including import licensing, were eliminated at the same time as the country went ahead to reduce the level and range of tariffs.

In practice, trade liberalization basically consists of the liberalization of quantitative import restrictions, tariff liberalization, and the reduction or elimination of taxes on exports. Often, trade liberalization has been accompanied by exchange rate devaluation and liberalization and has in most cases been regarded as an integral component of the liberalization process. The liberalization of quantitative import restrictions consists of the relaxation or removal of the restrictions. Tariff liberalization involves reducing the average tariff rate, a unification of the range of import tax rates towards a single rate and the phasing out of tariffs. The focus of our estimation exercise is on the impact of import liberalization on tariff revenue from imports. Consequently, our measures of trade liberalization exclude changes in export taxes, but involve a brief consideration of the relative importance of exchange rate variations.

Buoyancy and Elasticity

Our analysis begins with evaluating the import tariff yield in Ghana. This is meant to determine the efficiency of the trade tax administration system and to find out whether revenue leakage remains a major problem for import tax after trade liberalization.

Two measures are usually used for this exercise. These are the buoyancy and the elasticity of a given tax system. The buoyancy measures growth in duty revenue as a result of growth in income, reflecting the combined effects of tax base expansion and discretionary changes in tax rates, base definition, and changes in collection and enforcements of the law. Elasticity measures, on the other hand, control for discretionary tax measures, implying that changes in duty revenues are attributed to automatic or natural growth of the economy (Osoro, 1993).

Generally, the buoyancy of a tax is obtained by assuming the following functional form:

$$TR = \alpha Y^{\beta}{}_{\varepsilon} \tag{1}$$

This can be rewritten in double log as follows:

(2)

where *TR* and *Y* are real import tariff revenue and income or GDP in aggregate level, respectively, and $\propto$ and ε represent a constant and error term, respectively. The parameter β then becomes the direct measure of buoyancy. It follows from Equation 1 that $(\partial TR/\partial Y)(Y/TR) = \beta$.

The buoyancy of a tax system, which generally refers to the responsiveness of tax revenue to a change in income, is defined as:

$$\text{Å}_{t,y} = (\partial TR/\partial Y)*(Y/TR) = [(\partial TR/\partial B)*(B/TR)][(\partial B/\partial Y)*(Y/B)] \tag{3}$$

where *TR* is tax revenue, *Y* is income (GDP) and ∂ denotes partial derivatives. The right-hand side of Equation 3 represents a decomposed version of the tariff buoyancy, interpreted as elasticity of tariff revenue with respect to tax base (imports in this case) and the elasticity of the base with respect to income (GDP). Overall, tax base-to-income elasticities can be determined by how the economic structure changes with economic growth. The tax-to-base elasticities, on the other hand, show the revenue growth that is within the control of customs administration or that can be attributed to efficiency in customs administration.

To find out the responsiveness of tariff revenue to change in the tax base, we assume the following functional form:

(4)

This can be rewritten in double log form as follows:

(5)

where *TR* and *B* are import tariff revenue and the tax base (imports *M*, in this case) respectively, and *a* and *v* represent a constant and error term, respectively. The parameter

b then becomes the direct measure of the responsiveness of import tax revenue to change in the tax base. It follows from Equation 4 that $(\partial TR/\partial B)(B/TR) = b$.

In determining elasticities, two main techniques are usually used for cleansing the revenue series of discretionary effects. One is that of proportional adjustment, which involves use of historical time series tax data adjusted for discretionary tax measures, as in Mansfield (1972), Osoro (1993), and Muriithi and Moyi (2003). The other is the use of unadjusted historical time series tax data with time trends or dummy variables incorporated as proxies for discretionary tax measures, as in Singer (1968) and Artus (1974).

Lack of sufficient data made us opt for the dummy method, usually referred to as the Singer approach. Thus, we introduce dummy variables to control for discretionary tax measures and a lagged base variable into Equation 5 as follows:

$$Log\ TR_t = Log\ a + b_1 LogB_t + b_2 LogB_{t-1} + \Sigma\, b_{3i}\, D_i + v_t \quad (6)$$

where the dummy variable *D* takes on the value of one for discretionary tax measures and zero otherwise. The summation accounts for the multiple discretionary changes over the sample period. More specifically, three dummies are introduced. A liberalization dummy, D_{1983}, is introduced as a dummy for tariff reforms undertaken to accommodate import liberalization initiated in 1983 measures. A second dummy, D_{slope}, which is an interactive term, is a slope dummy introduced to capture any shift in the slope of the tariff revenue function as a result of the liberalization. D_{slope} is defined as TR^*D_{1983}, where *TR* denotes tariff revenue. The third dummy, D_{tar}, is introduced to capture the impact of customs administration reforms in Ghana. Tax reforms in Ghana started with the establishment of the National Revenue Secretariat with an oversight responsibility of supervising the operations of revenue collection agencies, as well as the granting of autonomy to the agencies including customs administration in 1985.

$TR = \tau EM$

Decomposition analysis

As part of the approach to this study, a formal decomposition analysis of changes in import tax revenue was also attempted, using existing data for Ghana. The outcome of the computational analysis provides information about the actual or revealed effects of import policy reform measures required for examining the relative revenue effects of alternative features of import policy reform.

We first make a presentation of an identity for import tax revenue as follows:

(7)

where *TR* is import tariff revenue in the current year, τ is the effective tax rate on imports, and *E* is the exchange rate and *M* is imports (measured in US dollars) in the current year.

When expressed in log form and as regression equation to be estimated, this yields the following:

$$Log\ TR_t = \grave{e}_0 + \grave{e}_1 log\ \hat{O}_t + \grave{e}_2 log\ E_t + \grave{e}_3 log\ M_t + \mathring{a}_t \quad (8)$$

As usual, all measures are in real terms. However, in view of the fact that regressing Equation 8 confirms it as an identity with coefficients of 1 for each explanatory variable, the effective tariff rate for imports was replaced with the official average tariff rate. The replacement is further justified on the grounds that the effective rate may simply be a reflection of the rate of revenue collection by the customs agency, and may not be an indication of trends in official rates. Thus, following from Equation 8, we get the following equation:

(9)

where Δ denotes changes, *Tm* is official average tariff rate, for $i= 1,\ldots n$ represent coefficients for the explanatory variables and ε is the error term denoting the residual unexplained variation in import tax revenue *TR*. The estimation exercise was done using the Cochrane–Orcutt iterative procedure, which corrects for multicollinearity and autocorrelation (Cochrane and Orcutt, 1949).

The estimated coefficients obtained from regressing Equation 9 were then used to conduct the formal decomposition analysis of changes in import tax revenue (see Section 5).

Tariff evasion

An attempt is also made to present a brief decomposition analysis of the incidence of duty evasion in Ghana's imports from a selection of the country's major trading partners. We do so by comparing the total value of imports from the trading partners as reported in Ghana and the value of the partners' reported exports to Ghana. In the absence of evasion (and measurement error), Ghana and the trading partners' reported numbers should be the same. Thus, the implicit assumption is that exporter data are accurate. In this instance, the evasion gap represents evasion attributed to misreporting of imports. Duty evasion in an importing country could be the result of under-reporting the true value of imports or misreporting types of imports.[1] The reporting gap could also simply be, in part, the outcome of misreporting of exports in the exporter country.

Our basic definition of the evasion gap is given by

$$Gap\_Value_t = log\ (Export\_value_t) - log\ (Import\_value_t) \quad (10)$$

where *Export_Value* is defined as the total value of exports reported by Ghana's trading partners destined for Ghana and *Import_Value* as the value of imports reported by Ghana arriving from her trading partners. A larger gap is an indicator of greater evasion. This approach to estimating duty evasion follows from Fisman and Wei (2001).

Estimating aggregate imports equation

Our next effort involved an assessment of the impact of import liberalization on aggregate imports. This was done by estimating an aggregate imports equation for the Ghanaian economy and inferring from the results how liberalization affects import

tariff revenue. The assumption is that import liberalization causes an upsurge in imports and the taxable base and consequently in the country's capacity to generate greater revenue from taxing imports even at lower tax rates.

The estimation equation for aggregate real imports expressed in log form is presented as follows:

$$Log\ M_t = b_0 + b_1\ log\ RPM_t + b_2\ log\ GDP_t + b_3\ log\ IR_{t-1} + b_4\ log\ FXR_t + u_t \quad (11)$$

In view of the focus of the study, an estimation of the import equation, with the introduction of the average tariff rate instead of the relative import price was also attempted.

$$Log\ M_t = b_0 + b_1\ log\ Tm_t + b_2\ log\ GDP_t + b_3\ log\ IR_{t-1} + b_4\ log\ FXR_t + u_t \quad (12)$$

where *RPM* is relative prices of imports, *Tm* is average tariff rate, *GDP* is proxy for income, IR_{t-1} is international reserves lagged one period, *FXR* is foreign exchange receipts and *u* is the error term. All variables are measured in logs and real terms.

The consumer theory of demand forms the basis for explaining demand for imports with emphasis on the important roles of income and relative prices in explaining individual demand. Summing the individual demand for imports constitutes the aggregate import demand for the entire economy (Harrod and Hague, 1963). The inclusion of foreign reserves (lagged one period) and foreign exchange receipts is to capture the role of foreign exchange availability (Hemphill, 1974). This model has been used extensively to explain import demand behaviour in country specific studies, like those by Egwaikhide (1999) and Mwega (1993).

On the basis of theory and existing literature, we assume the coefficient b_1 to be less than zero. In Ghana, imports are considered one of the important factors that drive the domestic economy, as most development activities are import-driven. A significant percentage of imports to the Ghanaian economy are non-competitive in nature, particularly over the liberalization period. Thus, the demand for imports in the aggregate is expected to be price inelastic. The expected signs of the remaining coefficients b_2, b_3 and b_4 are also positive, suggesting that a rise in real incomes and foreign exchange availability (for an economy with foreign exchange constraints) improves the total value of imports.

Our approach to this analysis involved an investigation of the time series properties of the variables for the aggregate import functions. The Johansen cointegration procedure was used to establish the long-run relationship between the relevant variables and to generate the error correction term for the aggregate import function. The study period is from 1965 to 2003 (Johansen, 1988; Johansen and Juselius, 1990).

Data sources and definition of variables

Annual data collected from various sources were used for the study. These include the International Monetary Fund (IMF) database, the World Bank database, United Nations' Commodity Trade Statistics, Ghana Statistical Services, Customs, Excise and Preventive Services, and the Ministry of Finance and Economic Planning.

For this paper, the following variable definitions applied. Real import tax or duty revenue was calculated by deflating nominal import duty revenues with the consumer price index. Aggregate relative import price was computed as the import price index for aggregate imports deflated by the consumer price index for respective years. The values of real imports were obtained by deflating nominal imports with import price indexes. Real GDP is nominal GDP deflated by a GDP deflator. Real foreign or international reserve was defined as nominal foreign reserves deflated by aggregate import price index. Real foreign exchange receipts were also calculated as nominal foreign exchange receipts deflated by aggregate import price index. The average import duty rate variable used in the estimation exercises is the average official duty rates for imports. The real exchange rate was computed by deflating the nominal exchange rate by the consumer price index.

4. Import tax revenue productivity – Buoyancy and elasticity

Estimates of the import tariff buoyancy and elasticity have been derived using the Cochrane–Orcutt iterative procedure, which corrects for the problem of multicollinearity and autocorrelation. Report of the estimates on tariff buoyancy is presented in Table 5. The estimates indicate that import tax has become less buoyant over the period of import liberalization compared to the pre-reform period (before 1983). Similarly, Table 6 indicates that the import tariff has become less elastic over the period of import liberalization compared with the pre-reform period. The low buoyancy on imports might be attributed to duty evasion, duty exemptions, corruption in customs administration and the existence of underground activity in the form of smuggling.

Table 5: Estimates of import tariff buoyancy in Ghana

Period	Coefficient	DW
1966–2003	0.556	1.273
1966–1982	0.330	1.566
1983–2003	0.313	1.479
Difference in coefficients	-0.017	

Source: Computed by the authors using *Stata* 9.0..

In particular, there has been widespread use of discretionary exemptions, often administered under poorly specified authority. It is estimated that about 14% of total imports in 1998 alone, passed through bonded warehouses, including many duty-free goods. Bonded goods are estimated to be the single largest category of exempt imports, accounting for 35% of total exempt imports. This common use of bonded warehouses tends to contribute to duty evasion. Duty evasion also arises from under-invoicing of imports and outright smuggling, often with the connivance of corrupt customs officials.

Table 6: Estimates of overall elasticity of tariff revenue

Period	Coefficient	DW
1966-2003	0.282	1.85
1965-82*	0.814	1.54
1983-2003*	0.049	1.28
Difference in coefficients	-0.765	

Source: Computed by the authors using *Stata* 9.0.

Estimates of the decomposed tariff buoyancies (Table 7) indicate high growth of taxable imports over the liberalization period compared with the pre-liberalization (pre-

1983) period. This supports earlier analysis showing that imports have grown substantially over the period of import liberalization under the economic reforms initiated in 1983. However, the liberalization period has also witnessed a comparatively slowed growth in tariff revenue. This observation implies that the administration of collection of duties has remained weak, despite earlier efforts to strengthen it. The estimates of the tax-to-base elasticity indicate that elasticity fell from 0.614 during the pre-reforms period (pre-1983 period) to 0.179 during the liberalization period (since 1983). This suggests the need to further strengthen and improve duty collection administration in Ghana.

Table 7: The decomposed tariff buoyancies over the reform and pre-reform period

Period	Coefficient	DW
A. Base-to-income elasticity		
1966–2003	0.491	1.614
1966–1982	0.173	1.002
1983–2003	0.530	1.893
Difference in coefficients	0.457	
B. Tax-to-base elasticity		
1966–2003	0.396	1.886
1966–1982	0.614	1.816
1983–2003	0.179	1.660
Difference in coefficients	-0.435	

Source: Computed by the authors using *Stata* 9.0.

Estimates of the elasticity of tariff revenue presented in Appendix C, tables C4, C8 and C12, indicate that the coefficient of the lagged base variable has a negative sign for the pre-liberalization period. This implies that there had been administrative inefficiencies in the customs duty collection for the pre-liberalization period. The lags in tax collection can be very expensive to the economy particularly for the years in which the country experiences high inflation. The situation has improved over the liberalization period.

A comparison of duty buoyancy and elasticity (Table 8) indicates that duty buoyancy outweighed duty elasticity when considering the entire study period, a suggestion that discretionary tax measures (DTMs) have improved tariff revenue mobilization over the entire period. A comparison of regimes, however, indicates that the contribution of DTMs in improving tariff revenue mobilization has been positive during the period of import liberalization. Measures such as comprehensive reforms to customs duties (which includes reduction of the level and range of rates) and customs collection administration have improved efficiency in the import tax system during the liberalization period.

Table 8: Comparison of import tax buoyancy and elasticity

Period	Buoyancy	Elasticity	Difference
1966–2003	0.556	0.282	0.274
1965–1982	0.330	0.814	-0.484
1983–2003	0.313	0.049	0.264

Source: Computed by the authors using *Stata* 9.0.

Overall, the evidence obtained indicates that import tax is neither buoyant nor elastic in Ghana, and suggests that a lot needs to be done to improve efficiency in the customs collection administration system.

A cursory look at Table C4 in Appendix C also indicates that although the import liberalization dummy has not been significant in explaining tariff revenue, and hence its exclusion from the equation presented, the significance of the interactive slope dummy in explaining tariff revenue suggests that the slope of the tariff revenue function has shifted upward as a result of import liberalization. This could mean that the share of commodities subject to tariff in total imports has increased.

5. Decomposition analysis

Here we report on the results of the decomposition exercises undertaken to determine the relative revenue effects of alternative features of the import trade policy reforms. Trends in the incidence of import duty evasion attributed mainly to understating of imports and smuggling are also reported under this section.

Decomposition analysis of changes in imports tax revenue

Estimation results for Equation 9 are presented in Table 9. The results indicate that on average, a 1% increase (decrease) in the official average tax rate reduces (increases) import tax revenue by 1.31%. Real currency depreciation (appreciation) is the most important factor accounting for increases (reductions) in import tax revenue in Ghana for the period under study.

Table 9: Regression results for import tax revenue

îlogTR	Coefficient	Standard error	t	P>{t}
Constant	0.007	0.043	0.16	0.870
DLog E	0.427	0.163	2.63	0.013
DLog M	0.008	0.151	0.05	0.959
DLog Tm	-1.306	0.769	-1.70	0.099

D-W (original) 2.338246 D-W (transformed) 1.979636

Source: Computed using Intercooled Stata 9.0

The estimated coefficients are then used to conduct the formal decomposition analysis of changes in import tax revenue. This analysis considers three main relative effects of alternative elements of the trade policy reform. The data reflect the contribution of or magnitude of impact of change in each policy feature to change in import tax revenue.

The contributions of the import policy features to changes in import tax revenue vary considerably (Table 10). While the contribution of exchange rate to changes in import tax revenue was positive for 20 out of 38 years, imports (in dollar value) and official average tariff rate contributed positively to changes in import tax revenue for 17 and 18 years out of a 38-year period, respectively. With regard to the impact of real exchange rate variations on import tax revenue, Table 10 indicates a positive contribution in nine out of a period of 17 years, and a negative contribution in five out of a period of 17 years.

Table 10: Decomposition analysis of sources of changes in import tax revenue

Year	E	M	tm	Overall net contribution
1966	0	-1.37	-37.20	-38.57
1967	-0.62	0.01	-0.62	-1.24
1968	-0.54	-0.002	-2.24	2.78
1969	0	-0.02	-1.14	-1.16
1970	0.38	-0.002	0.07	0.4
1971	0.01	0.001	0.13	0.15
1972	-0.48	0.01	0.16	-0.30
1973	-0.11	0.007	-0.12	-0.23
1974	0.78	-0.02	0.30	1.07
1975	0	0.002	0.06	0.06
1976	1.30	-0.007	0.69	1.97
1977	7.10	-0.04	1.45	8.51
1978	0.63	0.005	0	0.63
1979	-1.08	0.01	-0.85	-1.91
1980	0.29	-0.004	0.28	0.57
1981	0.54	-0.002	0.11	0.65
1982	0.91	0.02	0	0.92
1983	0.23	0.002	0.48	0.72
1984	2.12	-0.03	0	2.10
1985	-0.71	-0.60	0.60	-0.17
1986	0.06	-0.004	0.07	0.13
1987	-0.91	-0.01	0	-0.91
1988	0.10	0.02	0.17	0.29
1989	0.04	0.01	0.26	0.31
1990	-1.04	-0.01	0.06	-0.99
1991	-0.65	-0.02	1.00	-1.68
1992	-0.04	-0.01	0	-0.05
1993	0.16	0.01	0.07	0.24
1994	1.10	-0.03	0.12	1.19
1995	-0.31	-0.01	0	-0.33
1996	0.26	0.03	0	0.28
1997	0.48	-0.02	-0.18	0.28
1998	1.20	0.003	0	1.20
1999	-0.10	0.004	0	-0.09
2000	1.51	-0.01	-0.46	1.04
2001	-0.47	0.02	3.61	3.17
2002	-0.19	-0.001	0	-0.19
2003	-0.56	0.01	0	-0.55

Note: Change in import tax revenue is expressed as the contribution of each policy feature to change in import tax revenue each year, where *e* is defined as the product of change in real exchange rate and its respective estimated coefficient divided by change in import tax revenue, that is *(è2 Älog E)/ ÄLog TR*; *m* is defined as the product of change in the dollar value of imports and its respective estimated coefficient divided by import tax revenue, that is *(è3 Älog M) / ÄLog TR*; and *tm* is defined as the product of change in the official average import tax rate and its respective estimated coefficient divided by the change in import tax revenue, that is *(è1Älog Tm)/ ÄLog TR*.

Source: Computed by the authors using data from Ghana Statistical Services' *Quarterly Digest of Statistics*.

However, real exchange rate adjustments contributed nothing to overall changes in import tax revenue in three out of a period of 17 years between 1966 and 1982. These were years of largely controlled import policy regime. The non-contribution of exchange

rate adjustment to changes in tariff revenue in 1966, 1969 and 1975 can be attributed to the non-alteration of the nominal exchange rate over these years. The experience over the period 1966 to 1982 was one of real currency appreciation basically as a result of the fixed exchange rate policy that existed over this period. With the exception of the devaluation of the cedi in December 1971 and 1978, the nominal exchange rate was hardly altered. This was accompanied by expansionary macroeconomic policies, which caused acceleration of domestic inflation rates above those of major trading partners. As a result, the currency became severely over-valued and accounted for real exchange appreciation of an average of 21.8% during this period. This implied that the domestic currency value of imports declined, even though their real dollar value increased (albeit marginally), thereby reducing the taxable base. Real domestic currency appreciation has thus accounted for reductions in import tax revenue over this period. Even though the cedi was over-valued during the controlled period prior to 1983, the exchange controls of the period made it difficult to get foreign currency to import goods. Consequently, the value effect of the exchange outweighed the volume effect of imports.

Since the inception of economic reforms in 1983, exchange rate variation has remained an important contributor to changes in tariff revenue. Exchange rate liberalization has been considered relevant to import liberalization, and has been introduced as an equilibrating factor in the absence of quantitative restrictions on imports. The outcome of this policy measure has been real domestic currency depreciation. The 1983–1988 period, in particular, witnessed a rapid depreciation of the domestic currency of about 54.6% in real terms. The after-effect has been a substantial upsurge in the domestic currency value of imports, and consequently the taxable base. For most of the period, in 11 out of 21 years, real domestic currency depreciation contributed directly to increases in tariff revenue, even though the magnitude of impact of exchange rate variation on import tax revenue changes has been less for the period of import liberalization. Tariff revenue has grown substantially over the period of liberalization, averaging 17.7% between 1983 and 2003. The indication is that growth in tariff revenue specifically as a result of real currency depreciation has been positive on average.

Real imports have not been particularly important in contributing to the growth in tariff revenue. The pre-adjustment period saw comparatively sluggish growth in the real dollar value of imports, partly because of the continuous decline in the volume of imports following the imposition of quantitative restrictions through the issue of import licences and the maintenance of exchange controls. In relative terms, the sluggish growth in the real dollar value of imports contributed inversely to overall changes in tariff revenue over the pre-adjustment period. Tariff revenue reduced on average during the pre-reform period (that is before 1983), even though real imports recorded some positive average growth. The contribution of growth in imports to tariff revenue over the pre-reform period was negative for most of the period (that is, for 9 out of 17 years). This is in part attributed to the multiplicity of high tariff rates applicable to different types of goods, which made classification difficult. Again, the number of items exempted from duty payment was substantial during the period, a trend that reflects the existence of inefficiencies in customs administration in Ghana.

Real imports have grown substantially over the period of liberal imports regime, compared with the pre-reform period. Import liberalization, in the form of reductions in

the official average tariff rate, reductions in the range of duty rates and the removal of most quantitative restrictions on imports, has been responsible for the substantial increase in the volume (and consequently the real value) of imports since economic reforms began in 1983. In this instance, part of the growth in the volume of imports may be regarded as the consequence of the various measures of import liberalization. However, part of the rise in the volume of imports also directly reflects the removal of quantitative restrictions (or direct controls) on imports and may be considered as a policy variable. On average, the contribution of growth in real imports to changes in import tax revenue has remained negative, but the magnitude of its impact has been smaller compared with the pre-reform period. This reflects an improvement in efficiencies in customs administration over the liberalized period. That is to say, the simplification of tariffs and the reduction of the rate as result of the reform have led to improvement in the tariff administration. There are, however, many other sources of leakage of tariff revenue in the form of exemptions and evasion that are yet to be plugged.

The pre-reform period was characterized by high and frequent changes in the average official tariff rates, as reflected in increases in the effective duty rate, particularly over the 1972–1982 period (a period of controlled imports regime). The average official duty rate increased by an average of 3.9% during the pre-adjustment period (1967–1982) and 12.9% in the 1972–1982 period (the period of controlled imports regime). The outcome of this was an average decline in total import duty revenue by 10.2% and 14.4% over the respective periods. This indicates a negative impact of changes in tariff rates on import duty revenue for the period of restrictive imports regime. Table 10 clearly shows that the change in tariff revenue attributable to changes in the import tax rate was negative on average over the pre-1983 period.

The basic objective of the frequent adjustments in tariff rates on imports during the 1970s was to generate revenue, but the results of our decomposition analysis indicate that this objective was not achieved. The generally high tariff rates (with frequent adjustments and wide disparities) created incentives for tax evasion. The wide disparities in the tariff rates also gave room for misclassification and the widespread use of discretionary exemptions.

The period of import liberalization has been characterized by reductions in the official average import duty rates as well as reductions in the range of rates. The actual tariff rate has been reduced or remained unchanged for most years under liberalization. The average tariff rate was reduced in eight out of 21 years, but remained unchanged for nine years. Clearly, this is an indicator of less frequent changes in the import duty rates over the liberalization period. The average annual decline in the actual average tariff rate has been about 4% during the liberalization period. The outcome of this has been an average increase in the effective rate for this period. The growth in the effective rate may simply suggest a rise in tariff revenue in excess of increases in the value of imports, an indication of an improvement in the rate of duty revenue collection and efficiency in import tax administration.

The average annual impact of changes in the average tariff rate on changes in tariff revenue was -2.28 for the pre-reform period, but becomes 0.18 during the post-reform period. The direction of impact of changes in average tariff rates on revenue since the reforms began in 1983 indicates that the tariff reforms in the form of reductions in level

and range of rates has amounted to some revenue loss over this period. This outcome may suggest that the average official rate is currently below the optimum, although this assertion requires further scientific investigation.

It is conclusive from this analysis that the negative relationship between changes in average official tariff rates and the tariff revenue obtained from the estimation exercise (see Table 9) is largely the result of reductions in import tax revenue accounted for by high and frequent changes in official tariff rates over the pre-reform period.

Conclusively, the period of import controls (the pre-1983 period) witnessed an average annual reduction in import tax revenue of about -14.6%. The overall net contribution of the three import policy features to changes in import tariff revenue (Table 10) was negative during the period of the controlled imports regime. The average total net contribution was -1.836 between 1966 and 1982. The main contributors to overall import tax changes were the high and frequent changes in the official average tariff rate and exchange rate adjustments. On the other hand, the period of import liberalization has been characterized by an average increase in tariff revenue of about 15.3%. The average overall net contribution of the three import policy features to change in import tax revenue was a positive 0.28. The main contributors to the overall import tax change for the liberalization period were real currency depreciation and reductions in the average official tariff rate. The positive effect of real currency depreciation was offset by the revenue-reducing effect of reductions in the average official tariff rate.

It is postulated in theory that reductions in the average official import tariff rate have both direct and indirect effects on import tax revenue. Consequently, our effort in the regression analysis of the imports equation presented in the next section is to complement attempts at investigating the revenue effects of import liberalization.

Decomposed analysis of duty evasion

Available estimates of the evasion gap (presented as Table 11), using Ghana's trade relations with her major trading partners, indicate positive values of evasion gap for the entire period of observation.[2] Despite the fall in the extent of evasion in the early stages of the adjustment period, the magnitude of evasion increased during the 1990–2003 period. This can be attributed to under-invoicing and outright smuggling, which make importers evade customs duties.

Table 11: Estimated evasion gap – Major trading partners

	UK	USA	Germany	Italy	Nether-lands	France	Nigeria	Total
1965–1966	0.053	-0.060	0.850	0.024	0.254	-0.119	0.037	0.062
1967–1971	0.013	-0.038	1.390	-0.023	0.049	0.006	-0.063	0.058
1972–1982	0.023	0.010	2.096	0.124	0.078	-0.065	0.035	0.116
1983–1989	-0.036	0.114	0.173	0.088	-0.008	0.036	0.027	0.017
1990–2003	0.059	0.017	0.034	0.155	-0.081	0.133	0.200	0.067

Source: Computed with data from World Bank's World Integrated Trade Solutions database, UNCTAD Trade Analysis and Information System database, Commodity Trade database, Ghana Statistical Services, and IMF Direction of Trade Statistics.

The highest incidence of evasion is recorded for the 1972–1982 period, a suggestion that the period of strict import controls was characterized by inefficiencies in customs administration in the country. It is estimated that as much as 22.6% of total imports from Ghana's major trading partners was not reported to the destination office (as indicated in Table 12).

Table 12: Percentage share of missing imports from major trading partners attributed to under-invoicing and smuggling

	UK	USA	Germany	Italy	Nether-lands	France	Nigeria	Total
1965–1966	10.9	-18.4	85.5	3.5	44.2	-32.0	7.3	13.1
1967–1971	2.9	-9.6	80.9	-5.9	6.8	0.3	-40.6	12.1
1972–1982	4.4	1.5	98.0	23.3	10.8	-20.5	6.5	22.6
1983–1989	-12.7	19.4	4.4	15.6	2.4	6.7	-0.5	1.3
1990–2003	6.6	-1.5	1.6	16.1	-29.7	16.7	23.9	10.0

Source: Computed with data from World Bank's World Integrated Trade Solutions database, UNCTAD Trade Analysis and Information System database, Commodity Trade database, Ghana Statistical Services, and IMF Direction of Trade Statistics.

Despite the fall in the incidence of evasion attributed to under-invoicing and smuggling, a close observation of data on trade with selected major trading partners indicates that there have been cases of negative values. This is recorded for the economic reform period in the case of trade with the United Kingdom and the Netherlands, and in the pre-reform period for trade with the United States of America, Italy, France and Nigeria. This suggests that there have been instances in which importers desired to evade controls on transferring foreign exchange out of the country through over-invoicing of imports, and were less motivated to evade taxes on imports through under-invoicing.

Comparatively, the extent of import duty evasion has been lower for the liberalization period. This reflects the declining incentive to evade tax on imports brought about by liberalization.

The instances of negative values for the evasion gap over the liberalization period are not surprising because Ghana maintained restrictive policy measures on her capital account transactions even during the period of import trade liberalization. With over-invoicing of imports, importers obtain extra foreign exchange from the central bank on favourable terms, which can then be transferred abroad.

The interpretation of the estimated data on evasion needs caution, however, because of the possible inclusion of misclassified indirect imports in reported data. Part of indirect imports may be misclassified as direct imports. Second, the data as presented in Table 11 are averages, which may conceal accurate information on estimates for individual years. For example, information on individual years and selected major trading partners indicate that the extent of duty evasion was negative for most of the period between 1980 and 2003 for the case of Nigeria (see Appendix D). This may suggest that for a greater part of the specified period, the desire of importers (in Ghana) to evade capital controls by over-invoicing imports or of exporters (in Nigeria) to retain funds abroad by understating the true value of their earnings outweighed the desire of importers' (in Ghana) to evade customs duties.[3]

6. Estimation results of imports equation and implications for tariff revenue

In this section we report research findings based on the estimation of the aggregate imports equation. We infer from the estimation results how import liberalization affects import duty revenue. Our discussion begins with an investigation of the time series properties of the data used in the estimation exercise. This is followed by a test for (weak) exogeneity to enable us to draw an inference about causality.

Time series properties of data

The test results indicated that all the series were non-stationary in levels but stationary after first differencing. The null hypothesis of non-stationarity could not be rejected at 1% significance level for the real imports, relative import price, import tariff rate, the dispersion of duty rates, real foreign reserve series and real GDP. For the real exchange rate the null hypothesis of non-stationarity could not be rejected at the 5% significance level. Consequently, the series are integrated of order one. Results of the augmented Dickey–Fuller and Philips–Perron tests of the series are reported in Appendix E, Table E1 (Dickey and Fuller, 1979; Phillips and Perron, 1988).

Weak exogeneity test

The model specification of the estimation equations 9 and 10 suggests that the independent variables are at least weakly exogenous. To test the validity of this assumption, we use *EViews* econometric software to conduct the pairwise Granger causality test on the individual independent variables of equations 9 and 10 at the 5% significance level (Granger and Hyung, 2004). This is used in testing for strong exogeneity. We test for strong exogeneity because the presence of strong exogeneity necessarily implies that weak exogeneity also exists (Johnston and DiNardo, 1997). The test is a simple autoregressive distributed lag test for the significance of adding the history (lags) of the dependent variable to the independent variable in a bivariate regression equation. The test is against the null that the dependent variable does not Granger-cause the independent variable, implying that the independent variable is strongly exogenous. The F statistics and their corresponding probability values shown in Table E2 indicate that the dependent variable does not Granger-cause any of the independent variables. This reveals that Ghana has not experienced strong feedback effects from real import tax revenue to real exchange rate, real GDP, import tax rate and relative import prices. Thus the

assumption of weak exogeneity is validated. To finally arrive at a parsimonious model, we pursue time series analysis.

Estimation and analysis of aggregate imports equation

In undertaking the test for the existence of cointegration for aggregate imports, the relative import price, average tariff rates and effective tariff rate were used in alternating fashion as trade or tariff policy variable in the import equation.

The test results for the aggregate imports function indicate the existence of one cointegrating vector for all cases. The cointegration test results are presented in Appendix F, tables F1–F3. One cointegrating vector was found, implying that there is a stable long-run relationship among the variables in all cases.

The long-run relationship for the import function is then derived from the first row of the un-normalized vectors reported in Appendix F, tables F4–F6. The derived long-run relationships among the series are presented as follows:

$$LM = \underset{(0.060)}{-1.089} + \underset{(0.074)}{0.241\ LGDP} + \underset{(0.065)}{1.017\ LFXR} + \underset{(0.043)}{0.004\ LIR} - 0.018\ LRMP \quad (11)$$

$$LM = \underset{(0.089)}{-0.631} + \underset{(0.092)}{0.155\ LGDP} + \underset{(0.098)}{0.781\ LFXR} + \underset{(0.082)}{0.250\ LIR} - 0.062\ LTM \quad (12)$$

$$LM = \underset{(0.107)}{0.460} + \underset{(0.092)}{0.414\ LIR} + \underset{(0.146)}{0.721\ LFXR} - \underset{(0.116)}{0.088\ LGDP} - 0.255\ L\hat{O} \quad (13)$$

All the estimated coefficients have the expected signs, except for the coefficient for real GDP in the third case. This confirms the results obtained by Mwega (1993) and Egwaikhide (1999). With the exception of the trade policy variable, all the variables – real income, foreign exchange receipts and international reserves – have a positive impact on the demand for imports.

Of the three factors, foreign exchange receipts have the greatest impact on demand for imports. The results clearly show that a 100% increase in foreign exchange receipts causes not less than 70% increase in demand for imports (in all cases) in the long run. Similarly, the build-up of the nation's international reserves has also been an important factor influencing growth in demand for imports in the country, as indicated by the estimation results in equations 12 and 13. This means that an improvement in foreign exchange availability during the period of liberal imports and exchange regime has been hugely responsible for growth in imports over this period. Economic reform has been characterized by substantial increase in export earnings and supported by a massive inflow of foreign donor assistance, coupled with a substantial build-up of foreign reserves. Imports, in general, have been immensely financed with foreign donor assistance over the period of liberalization. The outcome of the estimation results also indicates that shortage of foreign exchange during the period of strict import and exchange controls also accounted for the decline in imports over that period.

Growth in real domestic income has also accounted for the increase in demand for imports in Ghana (in the first two cases) in the long run. A 100% increase in real domestic incomes leads to a more than 15% increase in demand for imports in the first two cases.

The policy variables, relative import prices, average official tariff rates and the effective tariff rate, used in alternating fashion, have an inverse relationship with demand for imports (Appendix F, tables F7–F9). Demand for imports has increased in response to reductions in the average tariff rates (which reduces the relative import prices). The signs of the coefficients of relative price of imports and average duty rates conform to the traditional theory that a reduction in price of imports, following reduction in average duty rate, increases demand for the imports. The response of demand for imports to changes in the price and tariff rate variables has not been significant in the long run. The error correction terms (*ECM1* and *ECM2*) were computed from equations 11 and 12 and are presented below:

$$ECM1 = LM - (-1.089 + 0.241\ LGDP + 1.017\ LFXR + 0.004\ LIR - 0.018\ LRMP) \quad (14)$$

$$ECM2 = LM - (-0.631 + 0.155\ LGDP + 0.781\ LFXR + 0.250\ LIR - 0.062\ LTM) \quad (15)$$

$$ECM\ 3 = LM - (0.460 + 0.414*LIR + 0.721*LFXR - 0.088*LGDP - 0.255*L\tau\ ) \quad (16)$$

The error correction terms were used for the dynamic modelling. As usual, the general to simple estimation procedure was adopted. The preferred dynamic import demand functions are presented in Table 13.

Table 13: Results of the preferred error correction model for real imports

S/n.	Regressors	ECM model 1			ECM model 2		
		Coef	SE	t-val(prob)	Coef	SE	t-val(prob)
1	Intercept	-0.01	0.01	-1.22(0.234)	-0.003	0.01	-0.24(0.809)
2	DLRM_1	0.485	0.14	3.44(0.002)	0.242	0.16	1.52(0.139)
3	ECM1(_1)	-0.992	0.15	-6.78(0.000)	-	-	- -
4	ECM2(_1)	—	—	— —	-0.762	0.14	-5.42(0.000)
5	DLRFXR	0.432	0.07	5.91(0.000)	0.404	0.08	4.86(0.000)
6	DLRFXR_1	-0.407	0.12	-3.48(0.002)	-0.280	0.13	-2.17(0.038)
7	DLIR_1	-0.032	0.05	-0.64(0.527)	-0.076	0.06	-1.22(0.231)
8	DLRGDP	0.263	0.17	1.55(0.132)	-	-	- -
9	DLRGDP_1	-	-	- -	-0.031	0.20	-0.16(0.874)
10	DLRMP_1	0.304	0.08	3.77(0.001)	-	-	- -
11	DLTM_1	-	-	- -	0.004	0.11	0.03(0.975)

	Diagnostic test results	
	ECM model 1	ECM model 2
Autocorrelation test from lags 1 to 2: F(2,27)	0.92781[0.4077]	1.6777 [0.2057]
ARCH test with order 1:	0.63849 [0.4312]	0.1692 [0.6840]
Normality test: $Chi^2(2)$	2.3646 [0.3066]	5.3501 [0.0689]
Hetero test: F(14,14)	0.85205 [0.6157]	1.0094 [0.4931]
RESET test: F(1,28)	11.777[0.0019]**	5.8831 [0.0220]*

Source: Computed by the authors using *PCGive* 10.0 econometric software.

The results for the dynamic real imports functions presented above indicate growth in foreign exchange receipts as the most important factor explaining growth in real imports in both cases. A 100% increase in growth of foreign exchange receipts improved growth in imports by more than 40% during the same period. However, the response of growth in imports to growth in foreign exchange receipts was negative for the subsequent period.[4]

Growth in real income has not been particularly important in explaining short-term increases in imports in Ghana. Its impact on demand for imports only becomes important two years hence (shown in Table F10). Growth in demand for imports has also responded negatively to growth in international reserves in the subsequent period, though not in a significant way.

In addition, even though growth in imports has been less responsive to reductions in the average duty rates (representing import tariff liberalization), its responsiveness to changes in the relative import price (used as an alternative import policy variable) and effective tariff rates has been quite significant. A 100% increase in growth of relative prices has caused the growth of demand for imports to increase by 30% in the subsequent period. In either situation, the results suggest that the demand for imports did not increase in response to reductions in average tariff rates and prices (indicating import tariff liberalization) in the short run as anticipated.

The error correcting terms are also negative and significant. The significance of the error correction terms confirms the validity of an equilibrium relationship among the variables used for the cointegration tests. The coefficients of the error correcting terms indicate that about 99% of past disequilibrium is rectified after the first period in preferred ECM model 1, and 76% of the past disequilibrium is rectified after the first period in preferred ECM model 2.

Implications for import tax revenue mobilization

Both short-run and long-run results from estimating the import function have implications for import tax revenue. In view of that, an attempt has been made to combine results from the estimation of the aggregate imports equation with knowledge of changing tariff rates in Equation 5. First, the log of real imports in Equation 6 is substituted for the long-run equation for real imports and solved for the long-run elasticity of duty revenue to a change in the average tariff rate:

$$LogTR = \log \tau + (0.46 + 0.41\ logIR + 0.72\ logFXR - 0.09\ logGDP - 0.26 \log \tau) \quad (17)$$

This gives us:

$$LogTR = 0.46 + (1 - 0.26) \log \tau + 0.41\ logIR + 0.72\ logFXR - 0.09\ logGDP \quad (18)$$

This implies that:

$$LogTR = 0.46 + 0.74 \log \tau + 0.41\ logIR + 0.72\ logFXR - 0.09\ logGDP \quad (19)$$

We read from the long-run solution given above that liberalization, in the form of reduction in average tariff rate, had both direct and indirect effects on tariff revenue. A 1% reduction in average tariff rate directly caused revenue loss of 1% as indicated in Equation 17, but improves tariff revenue by causing an upsurge in imports by 0.26%. The total net effect of a 1% reduction in the average tariff rate is a revenue loss of 0.74%. This suggests that liberalization has amounted to a duty revenue loss in the long run since direct revenue loss from tariff rate reductions outweighs the revenue enhancing effect.

The short-run solution adds nothing new to the analysis of the direct and indirect effects of liberalization on tariff revenue, hence its omission from the report.

7. Conclusions and policy implications

Ghana has been hailed by the international community as one of the countries that have pursued deep economic reforms since 1983. As part of the programme, efforts have been made to reform the external trade sector with import liberalization as an important component. Among the instruments used were reductions in the level of tariffs, simplification of rates into more uniform rates, the removal or relaxation of quantitative restrictions, and the equilibrating role of a liberal exchange rate regime.

However, experiences with tax revenues from international trade, particularly during the 1980s and 1990s, raised concerns about whether import trade liberalization conflicts with the revenue generation objectives of economic reform in Ghana. This has been important because fiscal discipline in the earlier part of adjustment was relaxed and government was no longer prudent with its spending.

Conclusions

We have attempted in this study to address one of the prevailing issues in the trade liberalization debate. To do this we adopted a robust approach to quantitatively determine the exact impact import liberalization has on import tax revenue in Ghana.

The findings from the analysis are as follows:

- Import tax is neither buoyant nor elastic in Ghana over the entire period, suggesting the continued existence of administrative inefficiencies in the country's customs duty collection.
- Import tax has become less buoyant and less elastic over the liberalization period compared with the pre-reform period (before 1983). Aside from the continued existence of inefficiencies in customs administration, this may also be attributed to duty evasion, duty exemptions (as there has been widespread use of tariff exemptions), corruption in customs administration and the existence of underground activity in the form of smuggling.
- The degree of responsiveness of import tax to change in its taxable base declined during the liberalization period compared with the pre-liberalization period.
- Discretionary tax measures, such as reforms made to the tariff structure in conformity to import liberalization, the temporary introduction of special import tax on selected items, and reforms to customs administration such as the granting of operational autonomy, improved tariff revenue mobilization over the liberalization period.
- A cursory look at Table C4 in Appendix C, also indicates that although the import

liberalization dummy has not been significant in explaining tariff revenue, the significance of the interactive slope dummy in explaining tariff revenue suggests that the slope of the tariff revenue function has shifted upward as a result of import liberalization. This could mean that the share of commodities subject to tariff in total imports increased.

- From the regression and decomposition analysis of how liberalization affects import tax revenue, there is a negative relationship between the official average tariff rate and tariff revenue on average for the entire period of study. This negative relationship is largely accounted for by the negative contribution of the high and frequent changes in official duty rates to tariff revenue over the pre-reform period.
- From the decomposition analysis, reductions in the official average tariff rate (reflecting reductions in level and range of rates) amounted to some revenue loss over the period of liberalization.
- Real currency appreciation was a major contributor to reductions in tariff revenue over the period of controlled imports regime. This period was characterized by an extremely over-valued domestic currency, which contributed to real currency appreciation.
- Real currency depreciation since liberalization, on the other hand, has contributed positively to growth in import tax revenue over this period.
- Growth in real imports has not been particularly important in contributing to growth in tariff revenue. This is in part attributed to the high and wide range of rates applied to different types of goods, which made classification difficult, and the substantial number of items exempt from duty payment.
- The relationship between changes in average official tariff rates and changes in tariff revenue obtained from the regression results was negative. This was largely accounted for by the negative contribution of high and frequent changes in official tariff rates to changes in revenue during the pre-reform period.
- From the decomposition analysis, the average overall net contribution of the three import policy features to change in import tax revenue was negative for the period of import controls, but positive for the period of import liberalization.
- Of the three import policy features, the main contributors to overall import tax change for the liberalization period were real currency depreciation and reductions in average official tariff rate.
- High and frequent changes in tariff rates that characterized the pre-liberalization period comprised the major import policy feature accounting for reductions in tariff revenue.
- Reductions in the average official tax rate remained the major contributor to change in revenue during the liberalization period.
- The regression analysis of the imports equation revealed that tariff liberalization improved the demand for imports (in the aggregate) in the long run. However, the reductions in tariff rate do not induce a revenue-compensating increase in imports. It is inferred from the long-run regression results that the overall effect of tariff reductions has been a net reduction in tariff revenue.

Policy implications

In sum, this study supports Oduro's assertion that import liberalization in the form of tariff rate reductions has been in conflict with the revenue objective of economic reforms, as research findings indicate that the revenue-enhancing effect of import tariff reductions has not been enough to offset the direct revenue loss from tariff rate reductions. These results support useful insights for public policy.

First, the collective positive contribution of exchange rate liberalization and the removal of quantitative controls on imports outweigh the net negative contribution of tariff rate reductions to growth in tariff revenue. This suggests that the fiscal incompatibility of import trade liberalization may not be an issue as long as complementary policies such as a liberal exchange rate regime are in place.

Moreover, the response of import tax to expansion in economic activities and imports has not been significant throughout the period of observation. Import tax is neither buoyant nor elastic in Ghana, suggesting continuing inefficiencies in import tax administration in the country. The low duty collection rate and productivity even during liberalization suggests that customs administration in the country remains weak, despite efforts to strengthen the tax collection system. Thus, customs administration requires further strengthening to generate more duty revenue from imports.

The study also suggests that revenue leakages such as duty evasion, which could be attributed to the exploitation of widespread duty exemptions, outright smuggling and import under-invoicing, remain a problem in the country. Public policy should focus on the identification of the major sources of duty revenue leakage. The pervasive use of exemptions creates a gap in the tax base, especially through abuses of the exemptions offered. A further review of the rationale for the duty exemption programme and reduction in range of items exempt from duty payments in Ghana will be required.

Finally, import liberalization in Ghana may not be fiscally incompatible if the liberalization is coupled with other policy measures such as tax replacement, for example substituting sales taxes for tariffs, improves total tax revenue sufficiently. Thus the fiscal policy issue may be whether these suggested measures improve revenue sufficiently to compensate for tariff revenue loss due to import liberalization.

Notes

1. Misreporting of types of imports here could be interpreted as the mislabelling of imported products from higher taxed type to lower-taxed type.

2. The selected major trading partners of Ghana here include the United Kingdom, the United States of America, France, the Netherlands, Germany, Italy and Nigeria. Imports from these selected trading partners alone accounted for over 50% of total imports for both the pre-liberalization and liberalization periods.

3. This is for imports coming from Nigeria only. See Appendix D, Table D1.

4. See Table F10 in Appendix F for the preferred ECM model with effective tariff rate as import policy variable.

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Appendix A: Selected macroeconomic indicators

Table A1: Ghana's import revenues, total imports, import tax rates, and exchange rates, 1965–2003

Year	Real import tax revenue (million cedis)	Total imports (million US$)	Effective import tax rate	Average official import duty rate (simple averages)	*Real exchange rate*
1965	824.2	451.8	0.256	0.410	*7.1*
1966	824.2	353.8	0.328	0.450	*7.1*
1967	715	300.6	0.274	0.383	*8.7*
1968	632	308.2	0.201	0.167	*10.2*
1969	605	347.4	0.171	0.129	*10.2*
1970	547.7	409.3	0.132	0.170	*10.2*
1971	736.5	430.2	0.166	0.140	*10.3*
1972	586.2	295.7	0.149	0.168	*13.3*
1973	949.8	449.5	0.181	0.213	*11.7*
1974	565.7	820.6	0.120	0.266	*5.8*
1975	464.4	790.7	0.102	0.275	*5.8*
1976	475.2	862.3	0.114	0.325	*3.8*
1977	272.2	1,037.7	0.160	0.363	*1.6*
1978	258.4	955.6	0.184	0.363	*1.5*
1979	198.9	852.4	0.161	0.317	*1.5*
1980	110.8	1,128.6	0.100	0.450	*1.0*
1981	65.2	1,267.0	0.100	0.488	*0.5*
1982	77.0	1,011.5	0.143	0.488	*0.5*
1983	108.6	1,248.2	0.163	0.213	*0.5*
1984	136.8	608.2	0.144	0.213	*0.6*
1985	259.5	1,723.7	0.035	0.275	*4.3*
1986	449.1	1,046.6	0.151	0.213	*2.8*
1987	401.5	1,136.9	0.102	0.213	*3.5*
1988	404.8	966.7	0.115	0.220	*3.7*
1989	590.1	1,285.2	0.124	0.140	*3.7*
1990	631.4	1,205	0.161	0.138	*3.3*
1991	671.6	1,054.8	0.204	0.170	*3.1*
1992	390.7	2,174.7	0.053	0.170	*3.4*
1993	503.8	5,199.8	0.335	0.138	*2.9*
1994	567.3	2,121.0	0.057	0.117	*4.7*
1995	457.1	1,906.8	0.071	0.117	*3.4*
1996	441.5	2,499.1	0.056	0.117	*3.2*
1997	437.2	3,326.7	0.042	0.100	*3.1*

Continued

Table A1, contnued

Year	Real import tax revenue (million cedis)	Total imports (million US$)	Effective import tax rate	Average official import duty rate (simple averages)	Real exchange rate
1998	545.6	3,218.8	0.050	0.100	*3.4*
1999	615.2	3,501.7	0.056	0.100	*3.1*
2000	714.8	2,964.4	0.047	0.147	*5.1*
2001	810.2	3,125.9	0.047	0.088	*5.5*
2002	1,089.3	3,031.9	0.068	0.088	*5.3*
2003	1,264.1	3,471.3	0.079	0.088	4.6

Note: Part of data is computed by authors with original data sourced from the institutions indicated above. Sources: Ghana Statistical Services, Ministry of Finance (Annual Budget Statements, various editions), Customs Excise and Preventive Service, International Monetary Fund databases.

Table A2: Ghana's CPI, GDP, import prices, foreign exchange receipts and international reserves, 1965–2003

Year	CPI (1990 = 100)	GDP deflator (1990= 100)	Real GDP (million cedis)	Relative import price	Real foreign exchange receipts (million cedis)	Real international reserves (million cedis)
1965	0.1	0.1	14,660	0.004	8,427.1	1,912.95
1966	0.1	0.1	15,180	0.004	8,531.7	2,074.7
1967	0.1	0.1	15,040	0.01	5,947.7	1,674.5
1968	0.1	0.1	17,000	0.01	10,403.6	2,494.2
1969	0.1	0.1	19,990	0.01	9,099.1	1,540.8
1970	0.1	0.2	11,190	0.07	4,777.7	705.6
1971	0.1	0.2	11,415	0.12	7,379.9	558.4
1972	0.1	0.2	12,850	0.17	4,031.6	1,090.0
1973	0.1	0.2	16,265	0.21	5,515.8	1,603.6
1974	0.2	0.3	14,426.7	1.48	5,117.6	480.9
1975	0.2	0.3	17,160	1.57	5,430.5	755.8
1976	0.3	0.4	16,315	1.73	4,128.4	490.3
1977	0.7	0.7	15,947.1	1.04	5,011.7	686.2
1978	1.2	1.3	16,143.1	0.87	3,730.8	1,151.7
1979	1.9	1.7	16,606.5	1.23	3,339.5	1,023.7
1980	2.8	2.6	16,481.9	0.91	3,052.9	492.7
1981	5.3	4.5	16,139.1	0.40	3,484.7	457.5
1982	5.2	5.8	14,905.5	0.36	2,543.6	391.1
1983	16.5	12.4	14,841.8	0.49	1,811.1	208.1
1984	23.1	17.1	15,285.9	1.19	2,368.5	1,129.9
1985	12.8	21.3	16,105.6	1.83	1,982.1	1,398.1
1986	31.6	30.3	16,877	2.25	2,617.2	1,424.3
1987	44.4	42.1	17,719.7	3.28	3,139.1	560.1
1988	55.3	56.2	18,704.6	3.28	3,983.3	823.8
1989	72.9	72.1	19,656.2	3.30	2,880.1	990.5
1990	100	100	20,316.9	3.24	3,853.3	714.0
1991	118	120.3	21,402.9	2.63	7,898.9	2,647.3

Continued

Table A2, continued

Year	CPI (1990 = 100)	GDP deflator (1990 = 100)	Real GDP (million cedis)	Relative import price	Real foreign exchange receipts (million cedis)	Real international reserves (million cedis)
1992	130	135.4	20,700.7	2.91	3,831.7	803.3
1993	162.3	113.6	34,082.2	2.50	2,470.3	511.8
1994	202.7	126.3	41,207.8	4.50	4,825.1	1,483.8
1995	353.4	166.3	46,631.1	3.84	4,901.6	1,941.0
1996	515.2	216.1	52,472.2	3.03	9,524.9	2,816.4
1997	661.7	309.6	45,586.3	2.37	9,029.5	2,284.5
1998	686.7	432.8	39,961	2.78	9,381.1	1,659.8
1999	853.5	517.3	39,778.8	2.95	8,882.7	1, 602.2
2000	1068.3	658	41,265.8	5.48	5,469.7	716.7
2001	1295.9	885.5	42,992	5.79	5,811.03	1,175.8
2002	1492.9	1087.1	60,856.5	5.44	6,119.2	1,861.2
2003	1872.6	1398.5	56,940.01	5.37	3,295.04	1,614.9

Note: Part of data is computed by authors with original data sourced from the institutions indicated above.
Sources: Ghana Statistical Services, Ministry of Finance (Annual Budget Statements, various editions), Customs Excise and Preventive Service, International Monetary Fund databases.

Appendix B: Conceptual framework

Import liberalization

Macroeconomic policies used during trade liberalization tend to have varying effects on tax revenues, implying that the net effect is often uncertain (Tanzi, 1989; Greenaway and Milner, 1993).

Import policy reform has involved the relaxation of quantitative restrictions, reduction and simplification of tariffs, accompanied by devaluation and the eventual liberalization of the exchange rate. Such processes have an essential fiscal feature as they affect prices. The ultimate effect on revenues, however, depends on their demand and supply responses to the price changes.

Replacing quantitative restrictions with tariffs

As an instrument of protection, it is recommended that quotas be replaced with equivalent tariffs as part of the adjustment programme. This process adds to tax revenue received as long as the equivalent tariff is not prohibitive. The underlying factor is that quota rents are transferred from the local importer to the fiscal authorities. The tariff rate chosen and the original quota rent size determine the magnitude of increase in tariff revenues. Where quantitative restrictions have been widespread, the liberalization is expected to have a significant effect on the tax base. However, tariffs make domestic prices more variable, which could be a disincentive to trade, thereby eroding revenue gains.

Reduction and simplification of tariff rates

Liberalization of the tariff regime involves reduction of the official tariff rate as well as a simplification of the rate towards a more uniform rate on all imports. The Laffer curve indicates that if the initial tariff rate is prohibitively high, then reductions in tariff are likely to increase revenue by reducing the incentive to evade taxes and smuggle with an improvement in compliance. On the other hand, if the initial tariff rate is lower than the revenue-maximizing rate, then tariff reduction will directly cause revenue loss (Khattry and Rao, 2002; UNECA, 2004). The consolidation of a variety of import taxes into uniform rates ensures greater transparency. The consolidation may impact positively on tariff revenue so long as greater simplicity limits the scope for evasion and reduces administrative costs.

The indirect effects of tariff liberalization depend on the elasticity of demand for imports or the elasticity of substitution between imports and domestic import substitutes. A change in relative prices due to tariff reforms is likely to motivate changes in the level and composition of imports. As such, the revenue outcome depends in part on the price elasticity of demand for imports. If the demand for imports is sufficiently price elastic, tax revenue may be increased.

In most cases, tariff liberalization involves an unequal reduction of the highest tariffs, applied to commodities that are mostly elastic in demand (especially consumer goods). In this case, the response of higher imports may be sufficient to offset the revenue losses from the lower tariff rate. However, in cases where change in relative prices due to unequal tariff reductions leads to a shift in composition towards more price inelastic and less heavily taxed commodities (including domestic substitutes), this may contribute to reduced revenues (Agbeyegbe et al., 2004).

Reductions in tariff exemptions

In developing countries, tariff exemptions usually apply to state organizations, any organization linked to aid projects, international organizations, diplomatic groups, and expenditures financed by project aid. In most cases, exemptions are discretionary. As such their scope tends to increase over time. Exemptions make up a very important source of revenue loss. Consequently, trade reforms that reduce exemptions tend to increase revenue collections.

Appendix C: Import duty revenue productivity

Table C1: Import tax buoyancy (1966–2003)

Log TR	Coefficient	Standard error	t	P>{t}
Constant	0.171	1.288	0.13	0.895
Log Y	0.556	0.283	1.97	0.057

D-W (original) 0.196479 D-W (transformed) 1.273240

Note: The estimates are obtained after applying the Cochrane-Orcutt iterative process to correct for the problem of autocorrelation and multicollinearity.
Source: Computed using Intercooled Stata 9.0.

Table C2: Base-to-income elasticity (1966–2003)

Log M	Coefficient	Standard error	t	P>{t}
Constant	1.583	1.750	0.90	0.372
Log Y	0.491	0.387	1.27	0.212

D-W (original) 0.422251 D-W (transformed) 1.614239

Table C3: Tax-to-base elasticity (1966–2003)

Log TR	Coefficient	Standard error	t	P>{t}
Constant	1.180	0.408	2.89	0.007
Log M	0.396	0.107	3.71	0.001

D-W (original) 0.518263 D-W (transformed) 1.886340

Source: Computed using *Intercooled Stata* 9.0.

Table C4: Estimates of overall elasticity of tariff revenue (1966–2003)

Log TR	Coefficient	Standard error	T	P>{t}
Constant	(dropped)			
Log M	0.282	0.087	3.24	0.003
Dslope	0.001	0.0002	4.52	0.000
Dtar	0.128	0.096	1.34	0.189

D-W (original) 0.784204 D-W (transformed) 1.849686

Note: The inclusion of lagged Y one period could not ensure convergence hence its removal from the equation.
Source: Computed using *Intercooled Stata* 9.0.

Table C5: Import tax buoyancy (1966–1982)

log TR	Coefficient	Standard error	T	*P>{t}*
Constant	(dropped)			
Log Y	*0.330*	*0.446*	*0.74*	*0.471*

D-W (original) 0.247368 D-W (transformed) 1.566120

Note: The estimates are obtained after applying the Cochrane-Orcutt iterative process to correct for the problem of autocorrelation and multicollinearity.
Source: Computed using Intercooled Stata 9.0.

Table C6: Base-to-income elasticity (1966–1982)

Log M	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
Log Y	0.173	0.425	0.41	0.690

D-W (original) 0.236068 D-W (transformed) 1.001621

Table C7: Tax-to-base elasticity (1966–1982)

Log TR	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
Log M	0.614	0.224	2.74	0.015

D-W (original) 0.725932 D-W (transformed) 1.815719

Source: Computed using *Intercooled Stata* 9.0.

Table C8: Estimates of overall elasticity of tariff revenue (1966–1982)

Log TR	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
log M	0.814	0.225	3.19	0.006
log M_1	-0.394	0.266	-1.48	0.161

D-W (original) 0.958375 D-W (transformed) 1.660210

Source: Computed using Intercooled Stata 9.0.

Table C9: Import tax buoyancy (1983–2003)

Log TR	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
DLog Y	0.313	0.325	0.96	0.347

D-W (original) 0.239281 D-W (transformed) 1.231957

Note: The estimates are obtained after applying the Cochrane-Orcutt iterative process to correct for the problem of autocorrelation and multicollinearity. The notation 'D' denotes first differencing. This was done because of convergence was not achieved.
Source: Computed using *Intercooled Stata* 9.0.

Table C10: Base-to-income elasticity (1983–2003)

Log M	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
Log Y	0.530	0.646	0.82	0.422

D-W (original) 0.027547 D-W (transformed) 1.892860

Table C11: Tax-to-base elasticity (1983–2003)

log TR	Coefficient	Standard error	t	P>{t}
Constant	(dropped)			
Log M	0.179	0.136	1.32	0.202

D-W (original) 0.958375 D-W (transformed) 1.660210

Source: Computed using *Intercooled Stata* 9.0.

Table C12: Estimates of overall elasticity of tariff revenue (1983–2003)

Log M	Coefficient	Standard error	t	P>{t}
Constant	1.798	0.402	4.47	0.000
LogM	0.086	0.068	1.27	0.223
LogM_1	0.049	0.083	0.60	0.559
Dslope	0.006	0.0001	7.17	0.000
Dtar	0.066	0.067	0.97	0.347

D-W (original) 1.370453 D-W (transformed) 1.281407

Source: Computed using *Intercooled Stata* 9.0.

Appendix D: Duty evasion gap – Selected major trading partners

Year	UK	USA	Germany	Italy	Netherlands	France	Nigeria	Total
1965	0.0977	-0.1690	0.7532	0.1125	0.2530	-0.1551	0.0919	0.0325
1966	0.0074	0.0493	0.9460	-0.0635	0.2544	-0.0828	-0.0188	0.0916
1967	0.0447	-0.0951	1.4360	-0.0323	0.2495	0.1145	0.1999	0.0833
1968	-0.0266	-0.0162	1.8613	-0.0837	0.0889	-0.0863	-0.2565	0.0424
1969	0.0141	0.0151	0.0582	0.0086	0.0141	0.0058	0.0034	0.0002
1970	0.0041	-0.0587	1.9287	-0.0440	-0.1400	-0.0094	-0.4762	0.0573
1971	0.0301	-0.0364	1.6644	0.0376	0.0302	0.0044	0.2160	0.1045
1972	-0.0487	-0.0292	1.9800	0.0597	-0.1006	-0.0660	-0.1271	0.0608
1973	0.0139	-0.0051	1.8158	-0.0269	-0.1098	0.0174	0.1350	0.1009
1974	0.0372	-0.0148	2.1694	0.0730	0.0417	-0.0202	0.0528	0.1523
1975	0.0241	-0.0656	2.2206	0.1448	0.2282	-0.0358	0.0496	0.1059
1976	0.0425	0.0344	2.4934	0.1748	0.1839	-0.0344	0.1024	0.1649
1977	0.0882	0.0204	2.8274	0.0331	0.3063	0.0572	0.0697	0.1869
1978	0.1304	0.1096	2.7405	0.1925	0.2798	0.0601	0.0669	0.2203
1979	0.0772	0.0589	2.3861	0.1111	0.0162	-0.1603	0.0394	0.1393
1980	-0.0365	0.0095	2.1374	0.3107	-0.0814	-0.0822	-0.0006	0.0720
1981	-0.0220	0.0804	0.9010	0.1536	-0.1173	-0.1042	0.0367	0.0750
1982	-0.0525	-0.0868	1.3889	0.1338	0.2109	-0.3494	-0.0431	-0.0069
1983	0.0347	0.4247	0.6655	0.0346	0.0728	0.0544	0.4035	0.2258
1984	0.0723	0.1646	1.0647	0.0745	0.0309	-0.0454	-0.0249	0.0782
1985	-0.1149	0.0656	-0.1423	-0.0187	0.0139	-0.0628	0.0347	-0.0410
1986	-0.0019	-0.0413	-0.0479	-0.0296	-0.0493	0.1564	-0.1822	-0.0432
1987	-0.2514	0.0262	-0.0605	0.3464	-0.0428	0.0024	-0.0825	-0.1104
1988	0.0898	0.1283	-0.0845	0.0696	-0.0242	0.1050	-0.0307	0.0367
1989	-0.0838	0.0299	-0.1824	0.1383	-0.0566	0.0414	0.0677	-0.0290
1990	-0.0001	0.0026	0.0004	0.00004	0.0042	-0.0008	-0.0008	0.0005
1991	0.7318	0.5705	0.6625	1.0093	-0.5017	1.0036	0.7074	0.3838
1992	-0.0392	-0.2046	-0.1965	-0.3168	0.1409	0.0744	-0.0002	-0.0737
1993	-0.0008	-0.0011	0.0026	0.0030	0.0015	-0.0097	-0.0323	-0.0088
1994	0.0004	0.0016	0.0016	-0.0002	0.0036	0.0042	-0.0382	-0.0094
1995	-0.0002	-0.0007	-0.0011	0.0010	0.0061	0.0059	-0.0009	0.0005
1996	0.0817	0.0009	-0.0012	0.3098	0.0196	0.0533	0.6939	0.1538
1997	0.0234	-0.0391	0.0024	-0.0366	-0.2615	-0.0936	0.4017	0.0788
1998	0.0649	-0.1045	0.0028	0.3899	0.0210	-0.0050	0.6244	0.2123
1999	0.0066	0.0028	0.0003	0.0539	-0.1130	0.4538	0.3028	0.1037
2000	0.0176	-0.0300	-0.0002	0.3890	-0.1384	0.0962	-0.0462	0.0450
2001	-0.1400	0.0075	0.0008	0.0047	-0.2369	0.0774	-0.0695	-0.0624
2002	-0.0130	0.0209	-0.0013	0.2030	-0.0336	0.0469	0.3303	0.1003
2003	0.0973	0.0079	-0.0001	0.1637	-0.0505	0.1584	-0.0795	0.0102

Source: Computed with data from World Bank's World Integrated Trade Solutions database, UNCTAD Trade Analysis and Information System database, Commodity Trade database, Ghana Statistical Services and IMF Direction of Trade Statistics.

Appendix E: Test for stationarity of series and pairwise Granger causality tests

Table E1: Augmented Dickey–Fuller and Philips–Perron tests of unit roots

Variables	Assumption	ADF test statistic			P-P test statistic		Order of integration
		Levels	Lag	1st diff	Levels	1st diff	
LM	**I**	**-1.878 (-3.617 – 1%)**	**1**	**-4.122 (-3.623 – 1%)**	**-1.81 (-3.612– 1%)**	**2-4.170 (-3.617– 1%)**	**I(1)**
LRMP	I	-1.588 (-3.617– 1%)	1	-4.608 (-3.623– 1%)	-1.315 (-3.612– 1%)	-4.543 (-3.617– 1%)	I(1)
LTm	I	-1.773 (-3.617– 1%)	1	-5.172 (-3.623– 1%)	-1.539 (-3.612– 1%)	-6.019 (-3.617– 1%)	I(1)
LT	I	-2.643 (-3.617 – 1%)	1	-6.555 (-3.623 – 1%)	-2.083 (-3.612 – 1%)	-6.535 (-3.617 – 1%)	I(1)
LIR	I	-3.311 (-3.617– 1%)	1	-5.172 (-3.623– 1%)	-1.539 (-3.612–1%)	-6.019 (-3.617– 1%)	I(1)
LGDP	I	-0.072 (-3.617– 1%)	1	-4.326 (-3.623-1%)	-0.012 (-3.6117– 1%)	-6.198 (-3.617– 1%)	I(1)
LFXR	I	-2.122 (-3.617– 1%)	1	-5.748 (-3.623– 1%)	-2.576 (-3.612– 1%)	-8.284 (-3.617– 1%)	I(1)

The notation "I" denotes the assumption of an intercept only.
Source: Computed by the authors using *EViews* computer software.

Table E2: Pairwise Granger causality tests

Null hypothesis	Obs	F-statistic	Probability
1. LGDP does not Granger cause LM	37	0.83445	0.44334
LM does not Granger cause LGDP		0.04426	0.95676
2. LRMP does not Granger cause	37	1.39807	0.26176
LMLM does not Granger cause LRMP		0.99596	0.38053
3. LIR_1 does not Granger cause LM	36	3.34486	0.04838
LM does not Granger cause LIR_1		4.65527	0.01707
4. LFXR does not Granger cause LM	37	2.13013	0.13536
LM does not Granger cause LFXR		1.55471	0.22679
5. LTm does not Granger cause LM	37	0.57341	0.56929
LM does not Granger cause LTm		1.04294	0.36409
6. LIR does not Granger cause LM	37	4.92048	0.01370
LM does not Granger cause LIR		1.16026	0.32623
7. LT does not Granger cause LM	37	1.10964	0.34203
LM does not Granger cause LT		0.57425	0.56882

Source: Computed by the authors using *EViews* 3.0 econometric software.

Appendix F: Cointegration tests and general dynamic specifications

Table F1: Cointegration test for aggregate real imports LM, using relative import price as policy variable

Sample: 1965–2003
Included observations 37
Series: LM LGDP LFXR LIR LRMP
Lag interval: 1 to 1

Eigenvalue	Likelihood ratio	5% critical value	1% critical value	Hypothesized No. of CE(s)
0.69	86.8	68.5	76.1	None**
0.52	43.7	47.2	54.5	At most 1
0.27	16.7	29.7	35.7	At most 2
0.12	4.9	15.4	20.0	At most 3
0.01	0.2	3.8	6.7	At most 4

*(**) denotes rejection of the hypothesis at 5% (1%) significance level. L.R. test indicates 1 cointegrating equation(s) at 5% significance level.
Source: Computed by the authors using *EViews* econometric software.

Table F2: Cointegration test for aggregate real imports LM, using average official duty rate as policy variable

Sample: 1965–2003
Included observations: 37
Series: LM LGDP LFXR LIR LTM
Lag interval: 1 to 1

Eigenvalue	Likelihood ratio	5% critical value	1% critical value	Hypothesized No. of CE(s)
0.63	75.18	68.52	76.06	None*
0.46	38.90	47.21	54.46	At most 1
0.26	16.15	29.68	35.65	At most 2
0.13	4.98	15.41	20.04	At most 3
0.00	0.00	3.76	6.65	At most 4

L.R. test indicates 1 cointegrating equation(s) at 5% significance level.
Source: Computed by the authors using *EViews* econometric software.

Table F3: Cointegration test for aggregate real imports LM, using effective tariff rate as policy variable

Sample: 1965–2003
Included observations: 37
Series: LM LGDP LFXR LIR L f
Lag interval: 1 to 1

Eigenvalue	Likelihood ratio	5% critical value	1% critical value	Hypothesized No. of CE(s)
0.65	85.2	68.52	76.07	None**
0.47	46.4	47.21	54.46	At most 1
0.35	23.15	29.68	35.65	At most 2
0.17	7.22	15.41	320.04	At most
0.006	0.21	3.76	6.65	At most 4

LR test indicates 1 cointegrating equation(s) at 5% significance level
Source: Computed by the authors using *EViews* econometric software.

Table F4: Un-normalized cointegration coefficients, using relative import price as policy variable

LM	LGDP	LRMP	LFXR	LIR
2.11	-0.51	0.04	-2.15	-0.01
-0.28	0.41	-0.26	1.36	-1.12
-1.15	0.15	0.70	0.77	0.53
-0.31	0.56	-0.30	0.52	0.07
-0.04	0.98	-0.10	-0.05	0.07

Source: Computed by the authors using *EViews* econometric software.

Table F5: Un-normalized cointegration coefficients, using average official duty rate as policy variable

LM	LGDP	LFXR	LIR	LTM
1.85	-0.29	-1.44	-0.46	0.12
-1.42	0.12	1.97	-0.99	-0.56
0.22	0.49	0.74	-0.28	0.94
-0.61	1.05	0.04	-0.24	0.51
0.12	-0.71	-0.12	-0.02	0.23

Source: Computed by the authors using *EViews* econometric software.

Table F6: Un-normalized cointegration coefficients, using effective tariff rate as policy variable

LM	LGDP	L*f*	LFXR	LIR
1.85	0.16	0.47	-1.33	-0.77
-0.75	1.41	1.03	1.38	-1.05
1.80	0.95	1.65	2.01	0.11
-0.40	0.95	0.29	-0.57	0.11
0.50	1.15	0.44	-0.45	0.01

Source: Computed by the authors using *EViews* econometric software.

Table F7: General dynamic specification for real imports, using relative import price as policy variable

Variable	Coefficient	Std. Error	t-value	t-prob	Part. R^2
DLM_1	0.568	0.185	3.06	0.006	0.320
DLM_2	0.245	0.215	1.14	0.269	0.061
Constant	-0.026	0.014	-1.80	0.087	0.139
DLGDP	0.371	0.197	1.88	0.075	0.150
DLGDP_1	0.112	0.186	0.60	0.553	0.018
DLGDP_2	0.320	0.254	1.26	0.222	0.074
DLFXR	0.391	0.112	3.48	0.002	0.377
DLFXR_1	-0.740	0.255	-2.90	0.009	0.297
DLFXR_2	-0.272	0.188	-1.45	0.163	0.095
DLIR	-0.021	0.061	-0.34	0.736	0.006
DLIR_1	-0.044	0.061	-0.72	0.482	0.025
DLIR_2	-0.025	0.060	-0.41	0.685	0.008
DLRMP	-0.022	0.101	-0.21	0.833	0.002
DLRMP_1	0.274	0.105	2.61	0.017	0.254
DLRMP_2	0.140	0.136	1.03	0.316	0.050
ECM1_1	-1.396	0.320	-4.37	0.00	0.4883

Source: Computed by the authors using *PcGive* 10.0 econometric software.

Table F8: General dynamic specification of real imports, using average import duty rate as policy variable

Variable	Coefficient	Std. error	t-value	t-prob	Part. R^2
DLM_1	0.478	0.20	2.43	0.025	0.228
DLM_2	0.144	0.208	0.69	0.497	0.023
Constant	-0.017	0.015	-1.08	0.294	0.055
DLFXR	0.222	0.128	1.73	0.099	0.131
DLFXR_1	-0.733	0.245	-2.99	0.007	0.308
DLFXR_2	-0.330	0.187	-1.77	0.092	0.135
DLIR	0.082	0.079	1.05	0.308	0.052
DLIR_1	-0.184	0.078	-2.35	0.029	0.216
DLIR_2	-0.098	0.069	-1.43	0.169	0.093
DLGDP	0.309	0.239	1.29	0.211	0.077
DLGDP_1	-0.004	0.208	-0.02	0.984	0.000
DLGDP_2	0.428	0.259	1.65	0.114	0.120
DLTM	0.006	0.124	0.05	0.961	0.000
DLTM_1	0.085	0.120	0.71	0.487	0.024
DLTM_2	0.022	0.140	0.15	0.879	0.001
ECM2_1	-1.431	0.318	-4.50	0.000	0.503

Source: Computed by the authors using *PcGive* 10.0 econometric software.

Table F9: General dynamic specification of real imports, using effective import duty rate as policy variable

Variable	Coefficient	Std. error	t-value	t-prob	Part. R^2
Constant	-0.014	0.013	-1.06	0.301	0.053
DLM_1	0.231	0.243	0.95	0.353	0.043
DLM_2	-0.027	0.199	-0.13	0.895	0.001
DLFXR	0.258	0.137	1.87	0.076	0.149
DLFXR_1	-0.455	0.274	-1.66	0.113	0.121
DLFXR_2	-0.165	0.191	-0.86	0.399	0.036
DLIR	0.168	0.078	2.15	0.044	0.187
DLIR_1	-0.171	0.101	-1.69	0.106	0.126
DLIR_2	-0.095	0.073	-1.31	0.207	0.079
DLGDP	-0.066	0.211	-0.31	0.758	0.005
DLGDP_1	-0.106	0.212	-0.50	0.622	0.012
DLGDP_2	0.394	0.229	1.72	0.101	0.129
DL*f*	-0.268	0.108	-2.48	0.022	0.235
DL*f* _1	-0.014	0.155	-0.09	0.929	0.0004
DL*f* _2	-0.053	0.145	-0.36	0.719	0.007
ECM3_1	-1.074	0.339	-3.16	0.005	0.334

Source: Computed by the authors using *PcGive* 10.0 econometric software.

Table F10: Preferred error correction model for real imports, using effective import duty rate as policy variable

variable	Coefficient	Std. error	t-value	t-prob	Part. R^2
Constant	-0.016	0.011	-1.45	0.159	0.078
DLM_1	0.267	0.137	1.94	0.063	0.131
DLFXR	0.248	0.106	2.35	0.027	0.181
DLFXR_1	-0.486	0.147	-3.31	0.003	0.305
DLFXR_2	-0.187	0.107	-1.74	0.093	0.109
DLIR	0.156	0.060	2.60	0.015	0.213
DLIR_1	-0.186	0.063	-2.97	0.006	0.261
DLIR_2	-0.112	0.053	-2.12	0.044	0.152
DLGDP_2	0.418	0.193	2.16	0.040	0.157
DL*f*	-0.246	0.085	-2.91	0.007	0.253
ECM3_1	-0.991	0.213	-5.18	0.000	0.517

Diagnostic test results
AR 1-2 test: F(2,23) = .11185 [0.8947]
ARCH 1-1 test: F(1,23) = 6.5250 [0.0177]*
Normality test: $Chi^2(2)$ = 0.94647 [0.6230]
hetero test: F(20,4) = 0.32361 [0.9608]
RESET test: F(1,24) = 9.9661 [0.0043]**

Source: Computed by the authors using *PcGive* 10.0 econometric software.

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