OGUAA JOURNAL OF SOCIAL SCIENCES (JOSS)

Volume 6 No. 1 May, 2011

A PUBLICATION BY
FACULTY OF SOCIAL SCIENCES
UNIVERSITY OF CAPE COAST
CAPE COAST, GHANA

Impact of Import Liberalization on Aggregate Imports and Tariff Revenue in Ghana

Ferdinand Ahiakpor[1]
Camara Kwasi Obeng[1]
William Gabriel Brafu-Insaidoo[1]

[1]Department of Economics, University of Cape Coast, Cape Coast, Ghana

Abstract

In contributing to the ongoing debate on the impact of trade liberalization, this paper investigates the quantitative effect of import liberalization on imports and tariff revenue in Ghana. The Johansen cointegration and error correction technique was employed to determine the impact of import liberalization on aggregate imports, and inferred from the estimated results, how liberalization affects import tariff revenue. The findings of the study indicate that import liberalization has been in conflict with the revenue objective of economic reforms in Ghana. It has been suggested that public policy should focus on the identification of the major sources of duty revenue leakage and also focus on complementary measures such as tax replacement, for example substituting sales taxes for tariffs.

Keywords: trade liberalization, import liberalization, aggregate import, tariff revenue, import tax, Ghana

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 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).

The only known country-case study that employs an econometric analysis is the study by Suliman (2005) for Sudan. The time series properties of the variables of interest are, however, not investigated. This could amount to a spurious regression.

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 and 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 basic objective of the study is to evaluate the short and long run impact of import liberalization on aggregate imports and tariff revenue in Ghana.

To meet the stated objectives, this study estimated the aggregate imports equation and inferred from the estimated results how liberalization affects import tariff revenue in Ghana. The use of this approach differs from what can be found in literature for both country case and cross-country panel studies which simply rely on simple multivariate regression and cross-country panel regression analysis respectively.

Methodology

The approach to analysis involved a time series (short and long run) regression analysis of the determinants of aggregate imports in Ghana. More specifically, we assessed the impact of import liberalization on aggregate imports for the Ghanaian economy and then inferred from the estimation results how liberalization, in the form of reductions in the average official import tax rate, affected import tariff revenue in Ghana. This was done by substituting results obtained from estimating equation 4 into equation 2. The assumption is that import liberalization causes an upsurge in imports and the taxable base and consequently the country's capacity to generate greater revenue from tax on imports even at lower tax rates.

Method of Analysis

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

$$TR=\tau^*M \qquad (1)$$

where TR is import tariff revenue in current year, τ is effective tax rate on imports and M is the Cedi value of imports in current year.

When expressed in log form we get the following:

$$\text{Log } TR = \log \tau + \log M \qquad (2a)$$

or

$\Delta \log TR = \Delta \log \tau + \Delta \log M$ (2b)

where Δ denotes change and 'log' denotes logarithm.

However, in view of the fact that effective tariff rate 'τ' may simply be a reflection of rate of revenue collection by the customs agency and may not be an indication of trends in official rates, the effective collection rate can be replaced with the official average tariff rate 'Tm' to reflect the focus of the study. Thus, equation 2 can be re-written as:

$\text{Log } TR = \log Tm + \log M$ (3a)

or

$\Delta \log TR = \Delta \log Tm + \Delta \log M$ (3b)

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

$Log\ M_t = b_0 + b_1 log\ RPM_t + b_2 \log GDP_t + b_3 \log IR_{t-1} + b_4 \log FXR_t + u_t$ (4) 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.

$Log\ M_t = b_0 + b_1 log\ Tm_t + b_2 \log GDP_t + b_3 \log IR_{t-1} + b_4 \log FXR_t + u_t$ (5)

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 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 played by income and relative prices in explaining individual demand. Summing up the individual demand for imports constitutes the aggregate imports 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, W. L., 1974). This model has been extensively used in explaining imports demand behavior in country specific studies, as in Egwaikhide (1999) and Mwega (1993).

Based on theory and existing literature, we assume the coefficient b_1 to be less than zero. In Ghana, imports are considered as 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 less elastic. The expected signs of the remaining coefficients b_2, b_3 and b_1 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.

Approach to analysis involved an investigation of the time series properties of the variables for the aggregate imports functions. The Johansen's Co-integration procedure was used to establish the long-run relationship between the relevant variables and to generate the error correction term for the aggregate imports function. The study period was from 1965 to 2007.

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 are 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.

Estimation and Analysis of Aggregate Imports Equation

This section reports on research findings based on the estimation of the aggregate imports equation and infer from the estimation results, how import liberalization affects import duty revenue. The section 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-stationary 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 Table A1 (under appendix A).

Weak Exogeneity Test

The model specification of the estimation equations 4 and 5 suggested the assumption that the independent variables were least weakly exogenous. To test the validity of this assumption, the pairwise granger causality test was done, using EVIEWS econometric software, on the individual independent variables of equations 9 and 10 at 5%

significance level to test 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 i.e. implying that the independent variable is strongly exogenous (Adam, 1992).

The F statistics and their corresponding probability values shown in Table A2 indicate that the dependent variable does not granger-cause any of the independent variables. This, therefore, 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. Therefore, to finally arrive at a parsimonious model, time series analysis is pursued.

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 as tables A3, A4 and A5 respectively (see appendix A). 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 imports function is then derived from the first row of the unnormalized vectors reported in tables A6, A7 and A8 (See appendix A). The derived long-run relationships among the series are presented as follows:

$$LM = -1.089 + 0.241\ LGDP + 1.017\ LFXR + 0.004\ LIR - 0.018\ LRMP \quad (6)$$

(0.060) (0.074) (0.065) (0.043)

$$LM = -0.631 + 0.155\ LGDP + 0.781\ LFXR + 0.250\ LIR - 0.062\ LTM \quad (7)$$

(0.089) (0.092) (0.098) (0.082)

$$LM = 0.460 + 0.414\ LIR + 0.721\ LFXR - 0.088\ LGDP - 0.255\ L\tau \quad (8)$$

(0.107) (0.092) (0.146) (0.116)

All the estimated coefficients have the expected signs, except for the sign of the coefficient for real GDP in the third case. This confirms the results obtained by Mwega (1993), Egwaikhide (1999) and Lopez and Thomas (1990). With the exception of the trade policy variable, all the other variables, namely real income, foreign exchange receipts and international reserves impact positively 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 percent increase in demand for imports (in all cases) in the long run. Similarly, build-up of the nation's international reserves have also been an important factor influencing growth in demand for imports in the country as indicated by the estimation results in equations 7 and 8. 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 reforms have been characterized by substantial increase in exports 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 indicate that shortage of foreign exchange during the period of strict import and exchange controls also account for the decline in imports over that period.

Growth in real domestic income also accounts for the increase in demand for imports in Ghana (in the first two cases) in the long run. A 100 percent increase in real domestic incomes leads to 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. Demand for imports has increased in response to reductions in the average tariff rates (which reduces the relative import prices). The sign of the coefficients of relative price of imports and average duty rates conform to 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 however, not been significant in the long run.

The error correction terms (ECM1 and ECM2) were computed from equations 6 and 7 and are presented below:

$$ECM1 = LM - (-1.089 + 0.241\ LGDP + 1.017\ LFXR + 0.004\ LIR - 0.018\ LRMP) \quad (9)$$

$$ECM2 = LM - (-0.631 + 0.155\ LGDP + 0.781\ LFXR + 0.250\ LIR - 0.062\ LTM) \quad (10)$$

$$ECM\ 3 = LM - (0.460 + 0.414*LIR + 0.721*LFXR - 0.088*LGDP - 0.255*L\tau) \quad (11)$$

The error correction terms were used for the dynamic modeling. As usual, the general to simple estimation procedure was adopted and the preferred dynamic import demand functions are presented as Table 1 below.

Table 1: Results of the Preferred Error Correction Model for Real Imports

S/n.	Regressors	ECM model 1			ECM model 2		
		Co-ef	SE	t-value(prob)	Co-ef	SE	t-value(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)	--	--	-0.16(0.874)
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: Chi2(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 percent increase in growth of foreign exchange receipts improved growth in imports by more than 40 percent in the same period. However, the response of growth in imports to growth in foreign exchange receipts has been negative for subsequent periods.

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 A12). 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 percent increase in growth of relative prices has caused an increase in growth of demand for imports by 30 percent 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 percent of past disequilibrium is rectified after the first period in preferred ECM model 1, and 76 percent of the past disequilibrium is rectified after the first period in preferred ECM model 2.

[4]See table A12 under appendix A for the preferred ECM model with effective tariff rate as import policy variable.

Table 1: Results of the Preferred Error Correction Model for Real Imports

S/n.	Regressors	ECM model 1			ECM model 2		
		Co-ef	SE	t-value(prob)	Co-ef	SE	t-value(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)	--	--	-0.16(0.874)
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: Chi2(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 percent increase in growth of foreign exchange receipts improved growth in imports by more than 40 percent in the same period. However, the response of growth in imports to growth in foreign exchange receipts has been negative for subsequent periods.

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 A12). 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 percent increase in growth of relative prices has caused an increase in growth of demand for imports by 30 percent 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 percent of past disequilibrium is rectified after the first period in preferred ECM model 1, and 76 percent of the past disequilibrium is rectified after the first period in preferred ECM model 2.

[5]See table A 12 under appendix A for the preferred ECM model with effective tariff rate as import policy variable.

Implication for Import Tax Revenue Mobilization

The short-run and long-run results from estimating the imports function have implications for import tax revenue. In view of this, an attempt has been made to combine results from the estimation of the aggregate imports equation with knowledge of changing tariff rates in equation 1. First, the log of real imports in equation 2 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.

$$\text{Log TR} = \log \tau + (0.46 + 0.41 \log IR + 0.72 \log FXR - 0.09 \log GDP - 0.26 \log \tau) \quad (12)$$

This gives us:

$$\text{Log TR} = 0.46 + (1 - 0.26) \log \tau + 0.41 \log IR + 0.72 \log FXR - 0.09 \log GDP \quad (13)$$

Which implies that:

$$\text{Log TR} = 0.46 + 0.74 \log \tau + 0.41 \log IR + 0.72 \log FXR - 0.09 \log GDP \quad (14)$$

We read from the above long run solution that liberalization, in the form of reduction in average tariff rate, had both direct and indirect effects on tariff revenue. A 1 percent reduction in average tariff rate directly caused revenue loss by 1 percent as indicated in equation 13, but improves tariff revenue by causing an upsurge in imports by 0.26 percent. The total net effect of a 1percent reduction in the average tariff rate is a revenue loss of 0.74 percent. 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.

Conclusions and Policy Implications

The basic objective of the study was to assess the impact of import liberalization on aggregate import and tariff revenue in Ghana. To do this, we estimated the aggregate import equation in Ghana. We then inferred from the estimation results, how tariff liberalization has affected tariff revenue in Ghana.

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.

In sum, this study supports Oduro's (2000) 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 provide useful insights for public policy. First, the study indicates a possible continued existence of substantial amounts of leakage and inefficiencies in the customs collection system. Thus, customs administration requires further strengthening to generate more duty revenue from imports. Leakages in the customs collection system could in part be attributed to the exploitation of widespread duty exemptions, outright smuggling and import under-invoicing in the country. Public policy should focus on the identification of the major sources of duty revenue leakage. Again, 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.

Secondly, the study indicates 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. Deductively, import liberalization in Ghana may not be fiscally incompatible if the liberalization 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.

Appendix A: Cointegration Tests and General Dynamic Specifications

TableA1: Augmented Dickey Fuller (ADF) and Philips-Perron (P-P) tests of unit roots

Variables	Assumption	ADF Test statistic			Philips-Perron Test Statistic	Order of integration
		Levels	Lag length	1st Difference	Levels	1st Diff.
LM	I	-1.878	1	-4.122	-1.812	-4.170
I(1)		(-3.617 – 1%)		(-3.623 – 1%)	(-3.612– 1%)	(-3.617– 1%)
LRMP	I	-1.588	1	-4.608	-1.315	-4.543
I(1)		(-3.617– 1%)		(-3.623– 1%)	(-3.612– 1%)	(-3.617– 1%)
LTm	I	-1.773	1	-5.172	-1.539	-6.019
I(1)		(-3.617– 1%)		(-3.623– 1%)	(-3.612– 1%)	(-3.617– 1%)
LT	I	-2.643	1	-6.555	-2.083	-6.535
I(1)		(-3.617 – 1%)		(-3.623 – 1%)	(-3.612 – 1%)	(-3.617 – 1%)

LIR I(1)	I	-3.311 (-3.617- 1%)	1	-5.172 (-3.623- 1%)	-1.539 (-3.612- 1%)	-6.019 (-3.617- 1%)
LGDP I(1)	I	-0.072 (-3.617- 1%)	1	-4.326 (-3.623-1%)	-0.012 (-3.6117- 1%)	-6.198 (-3.617- 1%)
LFXR I(1)	I	-2.122 (-3.617- 1%)	1	-5.748 (-3.623- 1%)	-2.576 (-3.612- 1%)	-8.284 (-3.617- 1%)

The notation 'I' denotes the assumption of an intercept only.
Source: Computed by authors using "E-views" computer software.

Table A2: 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 LM	37	1.39807	0.26176
LM 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 authors using Eviews 3.0 econometric software.

Cointegration Tests and General Dynamic Specifications

Table A3: 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

Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent 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% signficance level.
Source: Computed by authors using "E-views" econometric software.

Table A4: 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

Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent 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 authors using "E-views" econometric software.

Table A5: 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 LT

Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent 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	20.04	At most 3
0.006	0.21	3.76	6.65	At most 4

L.R. test indicates 1 cointegrating equation(s) at 5% significance level

Source: Computed by authors using "E-views" econometric software.

Table A6: Unnormalized 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 authors using "E-views" econometric software.

Table A7: Unnormalized 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 authors using "E-views" econometric software.

Table A8: Unnormalized Cointegration Coefficients, using effective tariff rate as policy variable

LM	LGDP	Lτ	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	095	0.29	-0.57	-0.11
0.50	1.15	0.44	-0.45	0.01

Source: Computed by authors using "E-views" econometric software.

TableA9: General Dynamic specification for real imports, using relative import price as policy 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	0.000	0.4883

Source: Computed by authors using "PcGive 10.0" econometric software.

Table A10: General Dynamic specification of real imports, using average import duty rate as policy 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 authors using "PcGive 10.0" econometric software.

Table A11: General Dynamic specification of real imports, using effective import duty rate as policy 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
DLτ	-0.268	0.108	-2.48	0.022	0.235
DLτ _1	-0.014	0.155	-0.09	0.929	0.0004
DLτ _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 authors using "PcGive 10.0" econometric software.

Table A12: Preferred Error Correction model for real imports, using effective import duty rate as policy 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
DLτ	-0.246	0.085	-2.91	0.007	0.253
ECM3_1	-0.991	0.213	-5.18	0.000	0.517

AR 1-2 test:	F(2,23)	=	0.11185 [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 authors using "PcGive 10.0" econometric software.

References

Adam C.S. (1992). On the Dynamic Specification of Money Demand in Kenya. *Journal of African Economies*, July.

Agbeyegbe, Terence, Janet G. Stotsky, and Asegedech Wolde Mariam (2004). "*Trade liberalization, exchange rate changes, and tax revenue in Sub-Saharan Africa*". IMF Working Paper WP/04/178. International Monetary Fund, Washington, D.C.

Artus, K.K. (1974). *Tax Revenue Forecasting: A Methodological Study with Application to Turkey.* Studies in Domestic Finance, No. 5. Washington, D.C.: The World Bank.

Brafu-Insaidoo, W. G., and Camara K. Obeng (2008). *Effect of Import Liberalization on Tariff Revenue in Ghana.* AERC Research Paper No. 180. African Economic Research Consortium, Nairobi.

Ebrill, L., J. Stotsky and R. Gropp (1999). *Revenue Implications of Trade Liberalization.* Occasional Paper No. 99/80. International Monetary Fund, Washington, D.C.

Egwaikhide, F.O. (1999). *Determinants of Imports in Nigeria: A Dynamic Specification.* AERC Research Paper No. 91. African Economic Research Consortium, Nairobi.

Glenday, G. (2000). *Trade Liberalization and Customs Revenues: Does Trade Liberalization Lead to Lower Customs Revenues? The Case of Kenya.* Development Discussion Papers No. 764. Harvard Institute for International Development, Cambridge, Massachusetts.

Greenaway, D. and C. Milner. (1993). *The Fiscal Implications of Trade Reform: Theory and Evidence.* Occasional Paper No. 9. UNDP and World Bank Trade Expansion Programme, Washington, D.C.

Harrod, R. and D.C. Hague (1963). *International Trade Theory in a Developing World.* New York: St. Martin's Press

Hemphill, W.L. (1974). "The effects of foreign exchange receipts on imports of less developed countries". *IMF Staff Papers*, 27: 637–77.

Jebuni, C.D., A.D. Oduro and K.A. Tutu (1994). *Trade, Payments Liberalization and Economic Performance in Ghana.* AERC Research Paper No. 27. African Economic Research Consortium, Nairobi

Johnston, J. and DiNardo, J. (1997). *Econometric Methods.* New York: McGraw-Hill Inc

Khattry, Barsha and J. Mohan Rao (2002). "Fiscal faux pas? An analysis of the revenue implications of trade liberalization". *World Development,* 30: 1431–44.

Kusi, N. K. (1998). *Tax Reforms and Revenue Productivity in Ghana.* AERC Research Paper No. 74. African Economic Research Consortium, Nairobi.

Lopez, R. E & Thomas, V., (1990). "Import Dependency and Structural Adjustment in Sub-Saharan Africa," *World Bank Economic Review,* 4(2), 195-207,.

Mansfield, C.Y. (1972). "Elasticity and buoyancy of a tax system: A method applied to Paraguay". *IMF Staff Papers,* 19(2): 425–46.

Muriithi, M.K. and E.D. Moyi (2003). *Tax Reforms and Revenue Mobilization in Kenya.* AERC Research Paper No. 131. African Economic Research Consortium, Nairobi.

Mwega, .FM. (1993)."Import Demand Elasticities and Stability during Trade Liberalization: A Case Study of Kenya", *Journal of African Economies,* vol.2. no.3:381-416.

Oduro, A.D. (2000). "Performance of the external trade sector since 1970". In E. Aryeetey, J. Harrigan and M. Nissanke, eds., *Economic Reforms in Ghana.* New Jersey: Africa World Press.

Osoro N.E. (1993). *Revenue Productivity Implication of Tax Reform in Tanzania.* AERC Research Paper No. 20. African Economic Research Consortium, Nairobi.

Singer, N.M. (1968). "The use of dummy variables in estimating the income elasticity of state income tax revenues". *National Tax Journal,* 21: 200–4.

Suliman, K.M. (2005). "The impact of trade liberalization on revenue mobilization and stability in Sudan". Global Development Network. http://www.gdnet.org/pdf2/gdn_library/global_research_projects/macro_low_income/Suliman.pdf. Accessed 2 May 2007

Tanzi, V. (1989). "The impact of macroeconomic policies on the level of taxation and the fiscal balance in developing countries". *IMF Staff Papers*, 36(3): 633–56.

UNECA. (2004). *Economic Report on Africa 2004*. Addis Ababa: United Nations Economic Commission for Africa.

WTO. (2001). *Trade Policy Review Ghana*. No. 81. Geneva: World Trade Organization. Switzerland. http://www.wto.org/english/tratop_e/tpr_e/tp157_e.htm. Accessed 2 May 2007