

Estimating Price and Income Elasticities of Sub-Saharan African Exports

Sam Olofin Ph.D
Department of Economics,
University of Ibadan,
Ibadan, Nigeria.
E-mail: soolofin@yahoo.com

Musibau Adetunji Babatunde
Department of Economics,
University of Ibadan
Ibadan, Nigeria
E-mail: tunjyusuf19@yahoo.com

Abstract

Several studies on the determinant of export performance assume that exports are determined by supply-side variables, such as domestic prices (official or market determined), the growth of gross domestic product (GDP), index of variable cost and capacity utilization. Fewer studies have focused on the demand-side determinants of exports, such as the income and price in the competitors' countries. This gap in the literature seems to have arisen because the typical developing country is assumed to be small, and to face an infinitely elastic demand for its exports, so that changes in foreign demand can influence exports only through changes in world prices. Consequently, this study attempts to estimate income and price elasticities of Sub-Saharan African exports. Using a panel of 20 countries in SSA, over the period 1980 to 2003, the study estimated a fixed effect model and disaggregated exports into manufactures and agricultural export. Econometric evidence revealed that relative prices and trading partners' income are important factors that explain SSA export performance. The exports of SSA have performed poorly because the demand for African exports has low elasticity in relation to changes in world income and in most cases are uncompetitive in world market. The estimated long run income elasticity ranges between 0.48 and 1.30 while the long run price elasticity ranges between -0.01 and -0.17.

Key words: Export Demand, Fixed Effect, Elasticity, Sub-Saharan Africa

I. Introduction

Several studies on the determinant of export performance assume that exports are determined by supply-side variables, such as domestic prices (official or market determined), the growth of gross domestic product (GDP), index of variable cost and capacity utilization. Fewer studies have focused on the demand-side determinants of exports, such as the income of prices in the competitor countries. This gap in the literature seems to have arisen because the typical developing country is assumed to be small, and to face an infinitely elastic demand for its exports, so that changes in foreign demand can influence exports only through changes in world prices.¹

¹ For example, while the small country hypothesis may be acceptable for many countries, it should not be generalized for all developing countries. For example, cocoa exports from Cote d'Ivoire, Cooper from Congo

The lack of attention to the influences of export demand may also be traced to the almost total concentration on exports from individual countries rather than from groups of countries. If the focus is on a group of developing countries, two important differences arise. In the first case, the small country hypothesis is no longer relevant and thus the assumption that demand is infinitely elastic is inappropriate for a group of developing countries. Secondly, it is likely that pricing policies may not have the desired effect. Developing countries within a group that produce a product whose market price elasticity is low, may have to allow a considerable price fall for any increased supply to be absorbed. In addition, given the presence of tariffs and other restrictions in the export markets of developing countries, it is unlikely that even a small developing country can sell all it wants to at any given market price. Consequently, it would be incorrect to assume as it is often done, that the export demand of developing countries is perfectly elastic.

Furthermore, many of the empirical studies have consistently ignored the composition of exports from SSA countries. An important consideration given is that the composition of exports varies across countries and that income and price elasticities vary across commodities. As a result, reliance on aggregate elasticity estimates of exports is likely to produce systematic errors if used to forecast export performance of a group of countries. These errors would be more serious the greater the dispersion across countries in their export composition. Thus, as a way of improving on past studies, this study attempts a disaggregated analysis of export performance in SSA.

To the best of our knowledge, there is no study that has focused exclusively on SSA as a group and addressed the issue. The study shall cover a period of twenty-four years for 20 SSA countries. This is between 1980 and 2003. The sampled SSA countries in the study are selected on regional basis. We divide SSA into four regions namely, West Africa, East Africa, Central Africa and the Southern Africa region. Five countries were selected per region. The countries are Benin Republic, Cote d'Ivoire, Ghana, Nigeria, Senegal (West Africa); Burundi, Cameroon, Central African Republic, Congo Rep., and Gabon in the Central African region. Kenya, Tanzania, Uganda, Mauritius and Ethiopia were selected from the East Africa region while South Africa, Botswana, Malawi, Zambia and Zimbabwe are selected for the Southern Africa region. The choice of the period as well as the choice of the countries was guided by data availability

Democratic Republic and uranium exports from Niger constitute a sizable proportion of the total market for these exports.

considerations. Also, the choice of the period corresponds with the adoption of significant trade policy reform measures in most of the SSA countries.

The sequence of this study is clear. A brief review of the literature is conducted in section II while the theoretical foundation on which the models are predicated is developed in section III. In addition, the specification of the various equations is presented in this section. The estimation technique is discussed in section IV while the results are presented and discussed in section V. The study is rounded up with concluding summary in section VI.

II. A Brief Review of the Evidence

The first major attempt to examine the demand determinants of exports performance of developing country is by Houthakker and Magee (1969). The study focused on how changes in aggregate demand were transmitted from industrial developing countries through the link between real income growth in the industrial countries and export growth in groups of developing countries. Houthakker and Magee (1969), using simple demand equations, observes that real income in importing countries and price competitiveness in exporting countries are the principal determinants of exports of a number of developing countries. Estimates of income elasticities of importing countries with respect to exports of individual developing countries (excluding Europe and Israel) range from 0.34 (for Brazil) to 2.01 for (Peru). In addition, the mean income elasticity, calculated over individual developing countries is about 0.9.

Khan (1974) using two-stage least square estimation procedure, recorded a similar result with Houthakker and Magee (1969). The income elasticities recorded by Khan is however, lower. Khan's estimates range from 0.2 (for Columbia) to 1.12 (for Peru). The mean income elasticity by Khan is about 0.5. However, it is possible that Houthakker and Magee's estimate is probably biased upward because supply variations are excluded from their equation. Similarly Hicks et al (1976) examined trade links between developing and developed countries. They specify both demand and supply equations for groups of developing countries and analyzed the impact of alternative policies of importing industrial and oil-producing countries. Evidence from their study reveals that slackening growth in the industrial countries is shown to be more detrimental to developing countries than the direct effects of the higher price of petroleum. Nevertheless, estimates for competitor price elasticities for non-oil developing countries are not nearly as robust as estimates for income elasticities.

As an improvement over past studies, Goldstein and Khan (1978) addressed the simultaneous relationship between the quantity of exports and their prices using quarterly aggregate export data for eight industrial countries over the 1955 – 1970 period². The study introduced models of export demand and supply which are then simultaneously estimated to eliminate any bias arising from the two-way relationship between export quantities and export prices. The result from their study indicates that the estimated price elasticity of demand for export is greater than unity in six countries (Belgium, France, Italy, The Netherlands, United Kingdom, and The United States). On the export supply side, the estimated export price elasticities of supply with the exclusion of Japan ranges from 1.1 for Italy to 6.6 for the United States.

In their estimation of the export demand framework, Warner and Kreinin (1983) argued against the use of a composite relative price variable but suggest a separation into its components (domestic price, import price in foreign currency, and the exchange rate) which yield more accurate results. Empirical evidence reveals that the exchange rate and the exports price of competing countries are important determinants of a country's exports. On the contrary, Bond (1985) presented a model of export quantity flows from groups of exporting non-oil developing countries to groups of importing countries in order to calculate the effects of both world recession and domestic pricing policies on export growth. In relation to the Goldstein and Khan (1978) study, the model separated the export model into export demand and export supply model. The empirical evidence demonstrates that the real effective exchange rate, the GNP in importing countries, and output in exporting countries (measured by deviations from trend) plays important role in the determination of exports of groups of non-oil developing countries. Using the simultaneous approach, Arize (1987) investigates the price responsiveness of export demand and supply separately in eight African countries³. On the demand side for exports, the estimated price elasticity ranges from -2.1 for Upper Volta (now Burkina Faso) to 0.15 for Kenya. The impact of this result indicates that the response of export demand to export prices may be weak in Africa. In addition, a positively sloped function of export supply is found to exist for a majority of countries in the sample. The disequilibrium model is however, found to be more appropriate for export supply than demand.

² The countries are Belgium, France, Germany, Italy, Japan, Netherlands, United Kingdom, and United States.

³ The countries are Ivory Coast, Tunisia, Morocco, Kenya, Upper-Volta (now Burkina Faso), Zambia, Mauritius and Malawi.

As a way of showing deficiencies of past studies, Marquez and McNeilly (1988) reveal that existing analysis in the export performance analysis rests on very restrictive assumptions that undermine the usefulness of their findings for addressing practical questions. For example, they argued that the aggregate elasticity calculated would be useful for implementing country-specific policies only to the extent that income elasticities are similar across importing countries, an empirical question that has been neglected by most of the studies of LDC exports. In addition, many of the empirical studies ignore the commodity composition of non-oil exports from developing countries. This is an important consideration given that this composition varies across industrial countries and that income and price elasticity varies across commodities. The result obtained by Goldstein and Khan (1978) was challenged by Riedel (1988) in a study of Hong Kong exports of manufactures. The study found high price elasticities and insignificant income elasticities with market share and export growth being determined by supply-side factors. However, different studies have sought to expand the analysis of export performance in different direction using the export demand framework. For example, Singer and Gray (1988) queried the assertion that trade policy influences export performance. Using empirical data, they showed that changes in world demand carried greater weight in determining export performance than changes in trade policy.

Athukorala and Riedel (1990) while focusing on Korean exports of machine tools also found high price elasticities and insignificant income elasticities thus confirming the Riedel (1988) study. The results of Riedel (1988), and Athukorala and Riedel (1990) were in turn challenged by Muscatelli et al. (1992) study of Hong Kong in which an alternative analysis finds lower price elasticities and higher income elasticities than did Riedel (1988). Nevertheless, Muscatelli et al (1995) study of newly industrialised economies (NIEs)⁴ put forward supportive claim to the Muscatelli et al (1992) study.

In a similar manner, Senhadji and Montenegro (1999) estimated export demand elasticities for a large number of developing and industrial countries using time-series techniques that account for non-stationarity in data. The average long-run price and income elasticities are found to be approximately -1.0 and 1.5 respectively. The study concluded that exports do react to both trade partners' income and to relative prices. Africa faces the lowest income elasticities for its exports while Asia has both the highest income and price elasticities. Adopting the Singer and

⁴ The NIEs are Hong Kong, Taiwan, Thailand, Singapore, Malaysia and Korea.

Gray (1988) approach, Bleaney (1999) uses panel data techniques to estimate an export demand function for ten Latin American countries and the result confirms that assumed positive relationship between trade policy reforms and exports. In the same manner, Santos Paulino (2000) analyses the impact of trade liberalisation and export performance in selected developing countries using the export demand framework and applying dynamic panel data models. The results from her study revealed that trade liberalization is a significant determinant of export performance but its effect varies across continents. Export duties have a small detrimental effect on export growth, while relative price changes and world income growth have negative and positive impact on exports respectively. Pacheco-Lopez (2004), Pacheco-Lopez and Thirlwall (2004) and Cosar (2002) adopting the export demand approach put forward supportive evidence that trade policy reforms positively influences export performance. Extending the imperfect substitutes model, Edwards and Alves (2005) result reveals a price elasticity of export demand of -10.0 and income elasticity of 4.0 for export demand for South Africa's manufactured exports. A similar result is obtained for the manufacturing sub-groups with an implied price elasticity of export demand of -4 to -10 for natural resource based industries. On the export supply side, the estimated supply elasticity is 1.8 in the short run and 2.5 in the long run.

III. Theoretical Framework

This study adopts a variant of the imperfect substitutes model developed by Goldstein and Khan (1985), in which the underlying assumption is that neither imports nor exports are perfect substitutes for domestic goods. The framework is adopted because the imperfect substitutes model is the standard approach in the literature for specifying and estimating foreign trade equations for both developed and developing countries. The framework is separated into two: export demand and export supply.

Following the specification of Algieri (2004), we assume that the exporting country (SSA) has only one trading partner (the rest of the world). Hence, SSA exporters' export demand (x_t) will be the same as the import demand of the rest of the world (q_t^*). The model assumes the existence of a representative agent in the rest of the world, who lives forever and maximizes his utility by choosing how much to consume of his domestic endowment (s_t^*) and of the imported good (q_t^*). In addition, the model assumes that there is no production sector, because production often involves the combination of intermediate inputs by using factors of production and

therefore makes no distinction between intermediate and final products. The infinitely-lived representative consumer in the rest of the world maximizes an inter-temporal utility function overtime and this is expressed as:

$$\underset{\{s_t^*, q_t^*\}_{t=0}^{\infty}}{\text{Max}} u_t = \underset{\{s_t^*, q_t^*\}_{t=0}^{\infty}}{\text{Max}} E_t \cdot \left\{ \sum_{t=0}^{\infty} (1 + \delta)^{-t} \cdot u(s_t^*, q_t^*) \right\} \quad (1)$$

Subject to the budget constraint:

$$b_{t+1}^* = (1 + i) \circ b_t^* + (r_t^* - q_t^*) - p \circ q_t^* \quad (2)$$

and to a transversality condition, which does not include Ponzi-games, that is, the fact that a consumer can freely consume all lifetime resources, by borrowing forever without extinguishing his debt. Thus,

$$\lim_{T \rightarrow \infty} \frac{b_{T+1}^*}{\pi (1 + i)^{-T}} = 0 \quad (3)$$

The starred variables denote the rest of the world (the importing country) while the non-starred variables refer to SSA countries.

In the framework, $E\{\cdot\}$ is the expectation operator at time t , the consumer's rate of time preferences, that is, the subjective discount rate, is denoted by δ . In addition, agents are free to borrow and lend at the same world interest rate i , that yields interest on capital; b_{t+1}^* indicates the next period stock of SSA countries bonds held by the rest of the world if positive and the next period stock of rest of the world's bond held by SSA if negative; p_t is the price of the SSA countries good in terms of foreign commodity; r_t^* is the stochastic endowment which follows an auto-regressive (AR (1)) process of the form:

$$r_t^* = \mu \cdot r_{t-1}^* + (1 - \mu) \cdot \bar{r}^* + \varepsilon_t^* \quad (4)$$

$$0 \leq \mu \leq 1 \quad \varepsilon_t^* \approx (0, \sigma^2)$$

with an unconditional mean \bar{r}^* and an unconditional variance $\sigma^2 / (1 - \mu^2)$; ε_t^* is an independent and identically distributed shock to the stochastic endowment with zero mean and variance σ^2 ; the degree of persistence of the endowment stock is determined by μ . The first order conditions for the individual's problem are given as:

$$\frac{\partial G_t}{\partial s_t^*} : u_{s^*}(t) - \lambda_t = 0 \quad (5)$$

$$\frac{\partial G_t}{\partial q_t^*} : u_{m^*}(t) - \lambda_t \cdot p_t = 0 \quad (6)$$

$$\lambda_t = (1 - \delta)^{-1} \cdot E_t(1 + r) \cdot \lambda_{t+1} \quad (7)$$

Where G is the Lagrangian and λ_t is the Lagrange multiplier associated with the budget constraint. However, if we consider the case in which the individual utility function u is of the addi-log type which is similar to Ogaki (1992), Clarida (1994), Senhadji and Montenegro (1998) and Algieri (2004), the specific form of the instantaneous utility function is:

$$u_t(s_t^*, q_t^*) = \frac{C_t \cdot (s_t^*)^{1-\alpha}}{1-\alpha} + \frac{D_t (q_t^*)^{1-\beta}}{1-\beta} \quad (8)$$

$$C_t = e^{a_0 + \theta C, t} \quad (9)$$

$$D_t = e^{b_0 + \theta D, t} \quad (10)$$

Where C_t and D_t are exponential stationary random shocks, which cause variations in the preferences of the representative agent, $\theta_{C,t}$ and $\theta_{D,t}$ stationary stocks, α and β are called curvature parameters and their inverse can be interpreted as long-run inter-temporal elasticities of substitution between the domestic and the imported good. Substituting equation (8) into (5) and (6) yields:

$$s_t^* = \lambda_t^{-1/\alpha} \cdot (e^{b_0 + \theta C, t})^{1/\alpha} \quad (11)$$

$$m^* = \lambda_t^{-1/\beta} \cdot (e^{b_0 + \theta D, t})^{1/\beta} \cdot p_t^{-1/\beta} \quad (12)$$

For non-oil exports, the possibilities of inferior goods, and of domestic complements for imports (exports of country i in country j) are typically excluded, so that income elasticity is assumed to be positive whereas the own-price elasticity of demand for export is expected to be negative. We also made the additional assumption that the consumer has no money illusion, so that the doubling of money income and all price leaves demand constant, that is, $\frac{\alpha}{\beta} = 0; \frac{1}{\beta} = 0$.

In addition, only current income matters for export demand, and no distinction is made between secular or cyclical income movements or between transitory or permanent income.

Taking the logs of equations (11 and 12), and solving equation (11) for λ and substituting it in equation (12) yields:

$$\log q_t^* = \frac{\alpha}{\beta} \log s_t - \frac{\alpha}{\beta} \log p_t - \frac{a_0}{\beta} - \frac{\theta_{C,t}}{\beta} + \frac{b_0}{\beta} + \frac{\theta_{D,t}}{\beta} \quad (13)$$

Where $c_0 = \frac{1}{\beta}(b_0 - a_0)$ and $\theta_t = \frac{1}{p}(\theta_{D,t} - \theta_{D,t})$ leads to the standard export demand function of the imperfect substitutes model:

$$\log = q_t^* = \log x_t^* = c_0 + \frac{\alpha}{\beta} \log s_t - \frac{1}{\beta} \log p_x + v_t \quad (14)$$

Goldstein and Khan (1985) posit that such homogeneity of the demand function is expressed by dividing the right hand side of equation 14 by P_w (the price of foreign substitutes) so that the two arguments of the demand function become the level of real income $\left(\frac{S}{P_w}\right)$ and the relative price of exports $\left(\frac{P_x}{P_w}\right)$. This yield:

$$\log x_t^d = \alpha_1 + \alpha_2 \log S_t - \alpha_3 \log(P_x / P_w) \quad (15)$$

Where $S_t = s / P_w$; $\alpha_1 = c_0$; $\alpha_2 = \frac{\alpha}{\beta}$; and $\alpha_3 = -\frac{1}{\beta}$. Nevertheless, the conventional practice in the empirical literature in specifying export demand equations is to assume that the dominant relative price competition occurs among exporters. Thus, the only relative price term that typically appears is the ratio of the export price (P_x) to competitors' export prices (P_w) adjusted for exchange rate change, that is, $(P_x / P_w \circ e)^5$. The export demand equation then takes the form:

$$\log x_t^d = \alpha_1 + \alpha_2 \log S_t - \alpha_3 \log(P_x / P_w \circ e) \quad (16)$$

The implicit assumption made in equation (16) is that the adjustment of export demand to changes in relative prices and income is instantaneous such that $x_t^d = x_t$. In other words, there are no differences between short and long-run elasticities. In reality, it is more reasonable to assume lagged adjustment. Exports are therefore assumed to adjust to the difference between demand for exports in period t and the actual flow in the previous period.

$$\Delta \log X_t = \gamma [\log X_t^e - \log X_{t-1}] \quad (17)$$

⁵ This is because a country's total exports face competition not only from domestic producers in the importing region but also from "third country" exporters to that region.

Where γ is the coefficient of adjustment (assumed positive) and Δ is a first-difference operator, $\Delta \log X_t = \log X_t - \log X_{t-1}$. The adjustment function in equation (17) assumes that the quantity of exports adjusts to conditions of excess demand in the rest of the world, and therefore, the price of exports is determined in the exporting country. Substituting equation (16) into (17), we obtain an estimating equation for export demand of the form:

$$\log x_t^d = \phi_1 + \delta_t + \alpha_1 \log S_t + \alpha_2 \log(P_x / P_w \circ e) + \alpha_3 \log x_{t-1} + \varepsilon_t \quad (18)$$

Where ϕ_1 and δ_t are the country-specific and year specific effects. Export demand is therefore positively affected by income of the trading partners and the lagged value of exports but is negatively affected by relative price. We expect $\alpha_1 > 0, \alpha_3 > 0$ and $\alpha_2 < 0$. The long-run price

and income elasticities are given as $\frac{\alpha_2}{(1-\alpha_3)}$ and $\frac{\alpha_1}{(1-\alpha_3)}$. For each SSA countries economy, x is

defined as exports and measured as the real quantity of exports; px is relative price of exports measured by the real effective exchange rate and S is the trade weighted average real income of SSA countries major trading partners. Trade weights are computed as the share of trade to each of these trading partners relative to SSA countries total trade.

IV. Estimation Technique

The combination of a cross section and time series data is quite useful for some reasons. The use of panel data analysis allows the expansion of the sample size, and is also very useful when analyzing performance in a region such as SSA since the export performance of developing countries varies substantially overtime. The fixed effects estimation technique is adopted for this study. Since both cross-section and time series data are available, we estimate the cross-country regression equation using the form:

$$x_{it} = Y_{it}\beta + Z_i\delta + \varepsilon_{it} \quad (1a)$$

Where Y is a matrix of explanatory variables that vary across time and countries; Z is matrix of variables that vary across individual countries but are constant for each individual country across the periods and x_{it} is the dependent variable. In addition,

$$\varepsilon_{it} = \alpha_i + \eta_{it} \quad (2a)$$

We also make the following assumption about the nature of the error term:

$$E[\eta] = 0 \quad E[\eta\eta'] = \sigma_\eta^2 I\eta T \quad (3a)$$

$$E[\alpha_i\alpha_j] = 0, \text{ for } i \neq j \quad E[\alpha_i\alpha_i] = \sigma_\alpha^2 \quad (4a)$$

$$E[\alpha_i\eta_{it}] = 0 \quad E[\alpha_i] = 0 \quad (5a)$$

where all expectations are conditional on Y and Z . Letting $W_{it} = [Y_{it} Z_{it}]$, we now assume that

$$E[W_{it}' \varepsilon_{it}] \neq 0 \quad (6a)$$

The major concern is that the independent variables are likely to be correlated with α which violates the orthogonality assumption. However, the failure of this orthogonality assumption has important consequences. If we consider the OLS estimation on only the first-period data:

$$x_{it} = Y_{it}\beta + Z_{it}\delta + \varepsilon_{it} \quad (7a)$$

A consequence of equation (5a) is that OLS estimates will be biased. However, the extent and direction of the bias will depend on the precise nature of the relationship between the individual specific effect and the other explanatory variables. For example, if we run the following regression on the population:

$$\alpha_i = W_{it}\pi + \text{error} \quad (8a)$$

The population coefficients π of this linear projection represent the bias. By way of illustration, if $\hat{\beta}_2$ is the OLS coefficient on the second explanatory variable from equation (5a) and π_2 is the population parameter from the same explanatory variable in the linear projection described in equation (7a), then we can write:

$$p \lim \hat{\beta}_2 = \beta_2 + \pi_2 \quad (9a)$$

Where β_2 is the true population value of the coefficient on the second explanatory variable. Adopting the same approach, we encounter the same problem with the OLS regression using only the second-period data:

$$x_{i2} = Y_{i2}\beta + Z_{i2}\delta + \varepsilon_{i2} \quad (10a)$$

If equations (6a) and (8a) are valid representations of the world, then any linear combination of the relationships is also true. Specifically,

$$x_{i1} = Y_{i1}\beta + Z_{i1}\delta + \varepsilon_{i1} \quad (11a)$$

$$x_{i2} = Y_{i2}\beta + Z_i\delta + \varepsilon_{i2} \quad (12a)$$

$$x_{i2} - x_{i1} = (X_{i2} - X_{i1})\beta + (Z_{i2} - Z_{i1})\delta + (\varepsilon_{i2} - \varepsilon_{i1}) \quad (13a)$$

$$\Delta x = \Delta X\beta + \Delta Z\delta + \Delta\varepsilon \quad (14a)$$

where Δ is the difference operator. For example, if $\Delta X = X_{i2} - X_{i1}$, then equation (13a) is equivalent to:

$$\Delta x = \Delta X\beta + \Delta\eta \quad (15a)$$

where the time-invariant terms Z_i and α_i drop out after the application of the difference operator. The major difference between equation (15a) and the untransformed versions of equations (7a) and (10a) is that the necessary orthogonality condition now holds on the transformed data. Specifically,

$$E[\Delta X' \Delta\eta] = 0 \quad (16a)$$

The consequence of the observation in equation (16a) is that the OLS regression on the transformed data yields unbiased estimates of the coefficients on the Y variables. This is the essence of the fixed effects model. The fixed effects estimator is robust to the omission of any relevant time-invariant regressors. With fixed effects estimation, the regression has minimized the informational requirement necessary to satisfy the orthogonality condition. Although, the adoption of a standard within-group estimator may likely generate estimates that are inconsistent as the number of periods is kept fixed in a dynamic model. However, given that the number of time periods used in this study is relatively high (for panel data), it is likely that the bias generated by the inclusion of a lagged dependent variable will be very small. The data for this study were sourced from World Bank World Development Indicators CD ROM and African database.

V. Presentation and Discussion of Results

As can be observed in column 1 of Table 1, there is a clear relationship between aggregate merchandise export, relative prices and SSA's trading partners' income. The sign from the coefficients confirm our a-priori expectation. The short run income and price elasticities (0.378 and -0.05) are both significantly different from zero (at the 1% and 5% level respectively). Relative prices and trading partners' income therefore emerge as significant factors in aggregate merchandise export demand model in SSA. The calculated long run income

elasticity is 1.33, whilst the calculated long run price elasticity is -0.17. This low price elasticity implies a low response of exports to changes in relative prices. In addition, such low income and price elasticities of demand raise concerns about the possibility of losing export revenues in the process of SSA countries seeking to make themselves more competitive (for example, through the devaluation of the real effective exchange rate). A plausible explanation for the low price elasticities recorded could be the over-dependence of SSA countries on a narrow range of primary commodities as exports, which are of declining relative importance in world trade.

Table 1: Fixed Effects Regression of Export Demand Model in Sub-Saharan Africa

EXPLANATORY VARIABLES	MERCHANDISE EXPORT(1)	MANUFACTURED EXPORT(2)	AGRICULTURAL EXPORT(3)
<i>Constant</i>	-1.597* (3.068)	-0.132 (0.157)	-0.839 (1.562)
<i>INC</i>	0.378* (6.909)	0.176* (2.360)	0.353* (6.552)
<i>PRC</i>	-0.048*** (1.550)	-0.165* (2.942)	-0.002 (0.077)
<i>X_{t-1}</i>	0.715* (22.936)	0.814* (33.274)	0.623* (18.339)
<i>INC_{LR}</i>	1.30	0.95	0.94
<i>PRC_{LR}</i>	-0.17	-0.89	-0.005
Adj. R-square	0.999	0.999	0.999
S.E. of Regression	0.091	0.179	0.101
No of observation	460	460	460
No of countries	20	20	20

Note: (1) INC_{LR} AND PRC_{LR} are the calculated long run income and price elasticities respectively. (2) Absolute t-statistics are in parentheses. (3) * denotes significant at 1%; ** denotes significant at 5%; *** denotes significant at 10%. (4) All regressions use the fixed cross-section effects cross-section weights standard errors & covariance (d.f. corrected).

The result for manufactured exports is presented in column 2 of Table 1. The short run price and income elasticities (-0.17 and 0.18) are both significantly different from zero. The calculated long-run income elasticity is 0.95, whilst the long run price elasticity is -1.22. A similar result is recorded for the demand for agricultural exports in SSA. However, only the short-run income elasticity (0.35) is significantly different from zero (at the 1% level of significance). The short-run price elasticity, although with the correct sign is not statistically significant. The calculated long run price and income elasticities are 0.94 and -0.005 respectively.

The coefficient of the one-year lag value of exports (merchandise, manufactured and agricultural) is significantly different from zero in all the three cases (merchandise, manufactured and agricultural exports) implying a degree of dynamic adjustment for SSA export product. A similar result is obtained across the four regions of SSA. The results are presented in Tables 1, 2, 3 and 4 for West, Central, East and Southern African region respectively. The short-run price elasticities vary from -0.055 (West Africa Region) to -0.224 (Southern African region) whilst the calculated long run price elasticities vary from -0.12 (West Africa Region) to -0.79 (Southern Africa Region) in the case of aggregate merchandise exports. The short run income elasticities vary from 0.16 (Southern Africa) to 0.55 (West Africa), the calculated long-run income elasticity vary from 0.58 (West Africa) to 1.54 (Central Africa). A similar result is recorded in manufactured and agricultural exports across the four regions.

Table 2: Fixed Effects Regression of Export Demand Model in West Africa

EXPLANATORY VARIABLES	MERCHANDISE EXPORT (1)	MANUFACTURED EXPORT (2)	AGRICULTURAL EXPORT (3)
<i>Constant</i>	-1.893** (1.963)	1.700 (1.177)	-2.273** (2.001)
<i>INC</i>	0.546* (4.546)	0.181 (1.352)	0.479* (3.788)
<i>PRC</i>	-0.055 (1.245)	-0.319* (3.224)	0.020 (0.498)
<i>X_{t-1}</i>	0.554* (7.368)	0.621* (8.781)	0.632* (8.486)
<i>INC_{LR}</i>	1.24	0.48	1.30
<i>PRC_{LR}</i>	-0.12	-0.84	-0.054
Adj. R-square	0.999	0.998	0.997
S.E. of Regression	0.098	0.246	0.111
No of observation	115	115	115
No of countries	5	5	5

Note: (1) INC_{LR} AND PRC_{LR} are the calculated long run income and price elasticities respectively. (2) Absolute t-statistics are in parentheses. (3) * denotes significant at 1%; ** denotes significant at 5%; *** denotes significant at 10%. (4) .All regressions use the fixed cross-section effects cross-section weights standard errors & covariance (d.f. corrected).

Table 3: Fixed Effects Regression of Export Demand Model in Central Africa

EXPLANATORY VARIABLES	MERCHANDISE EXPORT (1)	MANUFACTURED EXPORT (2)	AGRICULTURAL EXPORT (3)
<i>Constant</i>	-3.548** (2.245)	2.143 (0.927)	3.940 (1.904)
<i>INC</i>	0.543* (4.133)	0.027 (0.158)	0.045 (0.293)
<i>PRC</i>	-0.189 (1.561)	-0.159 (0.823)	-0.020 (0.127)
<i>X_{t-1}</i>	0.648* (8.677)	0.802* (15.030)	0.409* (4.649)
<i>INC_{LR}</i>	1.54	0.14	0.08
<i>PRC_{LR}</i>	-0.54	-0.80	-0.03
Adj. R-square	0.999	0.998	0.996
S.E. of Regression	0.103	0.163	0.114
No of observation	115	115	115
No of countries	5	5	5

Note: (1) INC_{LR} AND PRC_{LR} are the calculated long run income and price elasticities respectively.
(2) Absolute t-statistics are in parentheses. (3) * denotes significant at 1%; ** denotes significant at 5%; *** denotes significant at 10%. (4) .All regressions use the fixed cross-section effects cross-section weights standard errors & covariance (d.f. corrected).

Table 4: Fixed Effects Regression of Export Demand Model in East Africa

EXPLANATORY VARIABLES	MERCHANDISE EXPORT(1)	MANUFACTURED EXPORT(2)	AGRICULTURAL EXPORT(3)
<i>Constant</i>	-2.779* (2.783)	-2.658 (1.451)	-0.595 (0.728)
<i>INC</i>	0.409* (3.711)	0.371** (2.109)	0.402** (4.450)
<i>PRC</i>	-0.070 (1.038)	-0.015 (0.145)	-0.004 (0.054)
<i>X_{t-1}</i>	0.814* (15.673)	0.819* (16.361)	0.554* (8.600)
<i>INC_{LR}</i>	2.19	2.05	0.90
<i>PRC_{LR}</i>	-0.38	-0.08	-0.008
Adj. R-square	0.999	0.998	0.999
S.E. of Regression	0.084	0.150	0.151
No of observation	115	115	102
No of countries	5	5	5

Note: (1) INC_{LR} AND PRC_{LR} are the calculated long run income and price elasticities respectively.
(2) Absolute t-statistics are in parentheses. (3) * denotes significant at 1%; ** denotes significant at 5%; *** denotes significant at 10%. (4) .All regressions use the fixed cross-section effects cross-section weights standard errors & covariance (d.f. corrected).

Table 5: Fixed Effects Regression of Export Demand Model in Southern Africa

EXPLANATORY VARIABLES	MERCHANDISE EXPORT (1)	MANUFACTURED EXPORT (2)	AGRICULTURAL EXPORT (3)
<i>Constant</i>	0.413 (0.386)	-3.660 (2.198)	-1.237 (0.914)
<i>INC</i>	0.164** (2.187)	0.584* (3.644)	0.362* (2.846)
<i>PRC</i>	-0.224** (2.311)	-0.236** (2.047)	-0.019 (0.218)
X_{t-1}	0.719* (12.578)	0.722* (13.558)	0.668* (10.732)
INC_{LR}	0.58	2.10	1.09
PRC_{LR}	-0.79	-0.85	-0.06
Adj. R-square	0.999	0.999	0.999
S.E. of Regression	0.072	0.120	0.089
No of observation	115	115	115
No of countries	5	5	5

Note: (1) INC_{LR} AND PRC_{LR} are the calculated long run income and price elasticities respectively. (2) Absolute t-statistics are in parentheses. (3) * denotes significant at 1%; ** denotes significant at 5%; *** denotes significant at 10%. (4) .All regressions use the fixed cross-section effects cross-section weights standard errors & covariance (d.f. corrected).

These price and income elasticity results are similar to the results obtained by other studies. For example, Reinhart (1994) and Senhadji and Montenegro (1999) found a negative relationship between exports and relative prices in the case of Africa. In a similar vein, a positive relationship is recorded between exports and income of trading partners. The short run price elasticity recorded by the Reinhart (1994) and the Senhadji and Montenegro (1999) studies are -0.266 and -0.02 respectively. In addition, the short run income elasticities recorded by the two studies are 1.253 and 0.51 respectively for Africa. This result compares with the short run price and income elasticities estimated by this study. A more detailed comparison is made with the Santos-Paulino (2000) study. The results reveals that the short-run price and income elasticity recorded by her study are -0.11 and 2.09 respectively for aggregate merchandise exports of selected developing countries. In addition, the calculated long run price and income elasticity are -0.11 and 2.15 respectively. Nevertheless, the region specific estimates from the Santos-Paulino's result provide more diverse results.

The result reveals that the short-run price and income elasticities are -0.11 and 2.09 respectively in the case of merchandise exports for a group of selected developing countries. In addition, the calculated long run price and income elasticity are -0.11 and 2.15 respectively.

However, in the case of Africa, the short run price and income elasticities from the study are -0.35 and 1.39 respectively. Furthermore, the calculated long-run price and income elasticities are -0.36 and 1.44 respectively for Africa. The slight difference recorded in the magnitude of the price and income elasticities (short run and long run) between this study and other studies may be attributed to the difference in the periods of analysis, sample size and the methodology adopted. In summary, although price and income elasticities are low in SSA and across the regions of SSA, they are statistically significant. This points to the important roles of relative prices and the income of SSA countries trading partners in the determining the demand for SSA exports.

VI. Concluding Summary

The results of the empirical analyses of the export demand model indicate that import growth is dependent on the economic prosperity of SSA's trading partners and ability to compete in the export market. The consequence of this result is that export volumes are determined by its profitability. The empirical results however reveal that price and income elasticity of demand for exports are low in SSA. For example, the short run income elasticity of exports varies between 0.176 for manufactured exports and 0.353 for merchandise exports while the short run price elasticity of exports varies between -0.002 for agricultural exports to -0.165 for manufactured exports. The calculated long run price elasticity varies from -0.005 for agricultural exports to -0.017 for aggregate merchandise export. In addition, the calculated long run income elasticity varies between 0.94 for agricultural exports and 1.33 for merchandise exports. This is positive for the four regions (West Africa, Central Africa, Southern Africa and the East African region). The implication of this result is that many SSA countries have experienced poor export performance because the demand for their exports is not very responsive to world incomes.

While the study gives some useful guidance to policy makers, a number of points could be clarified by further work, and this should give greater specificity to policy guidelines. For example, the analysis has been mainly cross-sectional at a relatively high level of aggregation. This approach precludes in-depth analyses of many country-specific and firm-specific issues that may be important. The analysis conducted here could thus be supplemented by detailed study of the individual countries, at best using a unified analytical approach.

REFERENCES

- Algieri, B (2004) "Price and Income Elasticities of Russian Exports" *The European Journal of Comparative Economics*, Vol. 1, n. 2, 2004, pp. 175-193
- Arize, A. (1987) "The Supply and Demand for Imports and Exports in a Simultaneous Model" *Applied Economics*, 19, 1233-1247.
- Athukorala, P. and J. Riedel, (1996). Modelling NIED exports: aggregation, quantitative restrictions and choice of methodology. *Journal of Development Studies*, **33** (1), pp.81-98.
- Bleaney, M. (1999) 'Trade Reform, Macroeconomic Performance and Export Growth in Ten Latin American Countries, 1979-95" *Journal of International Trade and Economic Development*, 8,1, March 89-105
- Bond, M.E. (1985), "Export Demand and Supply for Groups of Non-Oil Developing Countries", *IMF Staff Papers*, March, 56-77.
- Clarida, R. (1994), 'Co-integration, Aggregate Consumption, and Demand for Imports: A Structural Econometric Investigation', *American Economic Review*, 84, 298-308.
- Cosar, E.E., (2002) "Price and Income Elasticities of Turkish Export Demand : A Panel Data Application," *Central Bank Review*, Research and Monetary Policy Department, *Central Bank of the Republic of Turkey*, Vol. 2(2), pages 19-53.
- Edwards and Alves (2005) South Africa's Export Performance: Determinants of Export Supply." Africa Regional Working Paper Series No.95. The World Bank, Washington D.C.
- Goldstein, M. and Khan, M.S. (1978), "The Supply and Demand for Exports: A Simultaneous Approach", *The Review of Economics and Statistics*, 60, 275–286.
- Goldstein, Morris and M.S. Khan, (1985), 'Income and price effects in foreign trade', in *Handbook of International Economics*, by Ronald Jones and Peter Kenen (eds.), Amsterdam: North-Holland
- Khan, M.S. and M.D. Knight (1988), "Import Compression and Export Performance in Developing Countries", *The Review of Economics and Statistics*, 70, 315-21.
- Marquez, J. and C. McNeilly, (1988), "Income and Price Elasticities for Exports of Developing countries", *The Review of Economics and Statistics* 70, 306–314.
- .Muscatelli, V.A., Stevenson, A.A. and Montagna, C. (1995), "Modelling aggregate manufactured exports for some Asian newly industrialized economies", *The Review of Economics and Statistics* 77, 47–55.

Muscатели, V.A., T.G. Srinivasan and D. Vines (1992), "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong". *The Economic Journal*, 102, 1467-77.

Ogaki, M. (1992). "Engel's Law and Cointegration. *Journal of Political Economy*, 100, 1027-1046.

Penelope Pacheco-López, (2004). "[Does the Impact of Trade Liberalisation on Exports, Imports, the Balance of Payments and Growth: the Case of Mexico,](#)" [Studies in Economics](#) 0401, *Department of Economics, University of Kent*.

Pacheco-López, P., and A. P. Thirlwall. (2004). "Trade Liberalisation in Mexico: Rhetoric and Reality." *Banca Nazionale del Lavoro* Quarterly Review No. 229 (June): 141-67.

Reinhart, C., (1994), "Devaluation, Relative Prices, and International Trade: Evidence from Developing Countries," Working Paper No. 94/140. *International Monetary Fund*. Washington

Riedel, J. (1988), "Strategy wars: the state of debate on trade and industrialisation in developing countries", *Paper Presented at a Symposium in Honour of J. N. Bhagwati*, ERASMUS University, Rotterdam, November 1988.

Santos-Paulino, A.U. (2000) "Trade Liberalization and Export Performance in Selected Developing Countries" *Department of Economics, Studies in Economics, No. 0012*_University of Kent, Canterbury.

Senhadji, A.S and Montenegro, C.E (1999). "Time Series Analysis of Export Demand Equations: A Cross-Country Analysis," *IMF Staff Papers* – Vol.46, No.3- September-December.

Senhadji, A. and C. Montenegro (1998), 'Time Series Analysis of Export Demand Equations: A Cross-Country Analysis', *IMF Working Paper*, No.149.

Singer and Gray (1988) "Trade Policy and Growth of Developing Countries: Some New Data". *World Development*. March. Volume 16(3) Pp.395-403.

Warner, D. and M.E Kreinin (1983) "Determinants of International Trade Flows," *Review of Economics and Statistics*, Vol. 65, No. 1, pp. 96-104.