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Modelling the Determinants of Import Demand in Sub-Sahara Africa

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ABSTRACT

This study employed panel data from 1995 to 2012 to model the determinants of imports in sub-Sahara Africa. Also, it assesses the long-run and short-run elasticities of aggregate imports and their components and considers the impact of trade liberalization. Fixed effects and Random effect estimation were done for the model. The results indicate that domestic income, foreign exchange reserves and trade liberalization all play significant roles both in the short-run and long-run import demand levels in sub-Sahara Africa. Therefore, trade policy authorities who aim at reducing imports to correct balance-of-payments imbalances in the long run should focus their efforts on policies that will reduce purchasing power at the macroeconomic level and implement policies that will ensure an increased domestic supply.

Keywords: Import demand; Relative Prices; Income; Determinants, Sub-Sahara Africa.

1. INTRODUCTION

The Bretton Woods institutions jointly devised and implemented structural adjustment programmes (SAPs) in most developing countries, Africa inclusive of which trade liberalization was a component. These programmes and policy measures sought to reduce external disequilibrium while strengthening production capacity (Harvey 2011). Among the principal measures to bring about external balance, the policies attempted to influence imports. The authorities also in these countries became more preoccupied with mobilizing

external financial assistance, thereby incurring debt. The debt burden, however, has engendered a decrease in public investment spending and an increase in budgetary deficits. Some countries have also undergone real devaluation and undertaken substantial trade liberalization in an effort to improve their balance-of-payments situation. A general consensus in public finance is that income from external trade dominates government revenue in developing countries (Egwaikhide, 1999) especially the ones in Africa.

Both exports and imports of developing countries are subject to periodic fluctuations in the world market, and revenue from this source tends to fluctuate accordingly. Thus, it was not surprising that the collapse of commodity export prices in the early 1980s engendered fiscal crises in most African countries, as reflected in their huge budget deficits. Also, this led to the adoption of economic reform programmes. Economic reform is expected to affect imports being part of the strategies to restore external balance. According to Moran (1989), this policy decision is significantly harmful to investment and output in developing countries as there is much reliance on imports for domestic production in these economies. More so, it reveals the role played by foreign exchange availability in the growth process. However, unless policy makers know what the major components of imports are and how they are determined, such a policy decision can be harmful to investment and output if domestic production relies on imports. This has necessitated knowledge of the determinants of import demand and how each determinant influences import demand.

1.1 Objectives of the study

The broad objective of this study is to examine the determinants of aggregate imports in the Sub- Saharan Africa. The specific objectives are twofold. These are to:

i) Examine the determinants of import in SSA?
ii) Examine how import demand responds to these determinants?

1.2 Justification

A series of works has been carried out on import demand determinants. Most of the works that avail have been done for one unit using time series data. An instance is the work by Egwaikhide (1999) who estimated a dynamic specification of an import demand function for Nigeria and found among other things that, short-run changes in industrial output, foreign exchange availability and movements in relative prices had significant influence on the import of raw materials. Moreso, various methodologies have been used including cointegration and Error Correction Mechanism (Egwaikhide, 1999), bound testing and Ordinary Least Square method (Babatunde, 2006). However, a few have employed a panel approach in estimating import demand for a pooled data.

A few who have done this kind of work for pooled data. An example is Mohammed and Othman (2001) who did it for five ASEAN countries; Bahamani and Kara (1998) did it for nine industrial countries; Shahe and Forhad (2007) in their work focused on only India and Sri Lanka; and Yoichi and Shigeyuk (2009) focused on least developed countries (LDC). Amongst the few works of this kind existing, one with a particular focus on the SSA is yet to emerge. This is the major motivation for this piece of enquiry.

1.3 Scope of the Study

The study captures the import demand determinants of countries in the sub-Saharan Africa. The sub Saharan Africa is sub divided into West Africa, East Africa, Central Africa and South Africa. Specifically, countries selected are Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Congo Republic, Cote d'Ivoire, Ethiopia, Gabon, The Gambia, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Seychelles, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda and Zambia. An annual time series data of countries is examined over a period of 18

years. (1995 -2012). The number of countries and the time span considered are based on data availability.

1.4 Outline of the study

The outline of this work is hereby presented. Section 1 discussed the problem statement, objective of study, purpose and scope of the study. Section 2 captured a review of literatures on import demand. Section 3 contained the model estimation and analysis. Discussion of results and policy import of this research were submitted in Section 4. Lastly, the summary and conclusion were presented in Section 5.

2. LITERATURE REVIEW

A review of relevant literatures is carried out in this section. This review considers a number of studies previously done using various models, methodology and with different scope of coverage.

Dipendra S. (1997) estimated import demand models of both absolute and relative price specification for Thailand. Annual data of 1953-1990 were used. Variables used were aggregate import, income, domestic prices and foreign prices. Applying cointegration technique, it is found out that aggregate import demand is price inelastic, cross price inelastic and income inelastic in the short run. However, in the long run, aggregate import demand becomes highly elastic with respect to income only while it remains inelastic with respect to others variables. This result thus showed the feasibility of exchange rate policy in correcting Thailand's Balance of Payments problems.

Senhadji (1998) estimated an import demand function for 77 countries, including some oil-exporting countries using time series non stationarity technique. GDP minus exports was the activity variable, he found that most of the coefficients have the expected sign and are significant. The elasticity with respect to this measure of income is relatively small for the oil

exporting countries. In fact, this elasticity is below unity for all oil exporting countries and even below 0.1 for the case of Norway, possibly because export revenues account for a notable part of national income in these countries.Bahmani-Oskooee and Niroomand (1998) using annual data (1960-1992) examined the import demand functions of 30 countries through the aggregate model by using the Johansen-Juselius (JJ) cointegration tests. The results show that twenty six of these countries had cointegrating relationships between the import demand function and its determinants in the long run. In most cases, the price elasticities and income elasticities were high. The study however did not investigate the short run dynamics.

Egwakhide (1999) investigated the determinants of imports in Nigeria using a time series data of 1953-1989. He modelled an import demand function using the Balance of Payments framework and the consumer theory model. He applied the cointegration and error correction technique on aggregate import M, income Y, domestic prices Pd, and price of foreign imports Pf. He found that foreing exchange dynamics affect imports decisions. He finally recommended a relaxation of constraints on foreign exchange, hence devaluation. Mohammed and Tang (2000) also using the Johansen-Juselius (JJ) cointegration methodology studied the determinants of aggregate import demand for Malaysia, over the period 1970-1998. Their results revealed that all the disaggregated components had an inelastic effect on import demand in the long run with investment expenditure and consumption expenditure having the largest impact on import demand i.e. 0.78 and 0.72 respectively.

Stephano Chiarlone (2000) worked on import demand with product differentiation. He estimated sectoral demand functions for Italian import demand from European Union countries, Japan, Canada and US. The imperfect substitute model is used. Activity variable such as income, domestic price of tradables and import price were included in the model. Partial adjustment models were estimated for the short run. Trade flows were classified into horizontal differentiated and vertical differentiated or homogenous to enhance estimation through dummy

variables. Results showed that elasticity relative to price and to activity variable are significant and show right signs in all sectors. The strong reaction to income suggests the possibility of trade-balance constraint for Italian economic growth. The elasticities to price suggest that in some Italian firm could be very sensitive to foreign price competition and generally to price differentials.

Similarly, Mohammad and Othman (2001) examined the long-run relationship between imports and expenditure components of five ASEAN countries (Malaysia, Indonesia, the Philippines, Singapore and Thailand). Using the same methodology with a disaggregated model and annual data for the period 1968-1998 (except Singapore, with a shorter period 1974-1998), they concluded that the import demand was cointegrated with its determinants for all five countries.

Bahamani and Kara (2003) estimated the import and export demand function for nine industrial countries like Australia, Canada, Denmark, US and etc. By using quarterly data for the period 1973-98 they used ARDL approach for estimation. Their results show that long-run income elasticities are greater in import demand function than in the export demand functions are relatively inelastic .They fail to provide any specific answer to the policy question that which policy has the quickest impact on trade. According to them, trade flows of different countries do react differently. Narayan and Rusell (2005) investigated the determinants of import demand in Brunei Darusallam and the effect of population and oil prices on import demand. ECM and cointegration were applied with bounds testing. The variables were exchange rate, real GDP, population and world oil prices. Results showed that aggreagate imports are inelastic in the short run and long run with respect to income and world petroleum prices, but are price inelatic with respect to population.

Tuner and Buongiorno (2004) estimated both dynamic and static model of the derived demand for each of the 10 major forest products. The models were estimated with panel data from 64 countries for 1970-1987, by pooled ordinary least squares, first differencing, fixed effects, random effect and the Arellano-Bond approach. Based on multiple criteria, the best results

were obtained with the dynamic model estimated by the Arellano-bond method. For most products, the demand for imports was found to be inelastic with respect to price. For all products, the demand for imports was elastic with respect to income.

Aruna Kumar Dash (2005) worked on aggregate demand function for India using 1975 – 2003 data. His objective was to investigate the aggregate import demand for India. The imperfect model substitute was used in specifying their model. Johansen Juselius multivariate cointegration and error correction techniques were used to analyse the relationships between GDP, unit value of import prices, price of domestically produced goods and foreign exchange reserves. Findings showed that cointegration relationship exists among these variables. More than one cointegration relationship was got meaning mere stability in the system. Econometric estimate for aggregate import for India suggests that import demand is dominated by the domestically produced goods, GDP, lag of import and foreign exchange reserves. Claudia Stirböck (2006) carried out a study to estimate the impact of export and other demand components on German import demand. Evidence was taken from Euro (intra) and non-euro (extra) area import demand for 1980-2004 period and

1993-2004 period. Single equation error correction estimation was used to explain German import. Findings showed that German import demand is mainly driven by domestic demand and foreign import is low. Price sensitivity of intra imports is not only high but, unlike that of extra imports, is also significant and has increased at the current end.

Babatunde (2006) repeated a work of this kind for Nigeria titled 'Import demand in Nigeria' for data from 1970 to 2006. The consumer theory was used to specify the import demand function. His variables were income, aggregate import, price of domestic goods and price of imports. The bound test approach was used in the model estimation and it was found that import demand is strongly determined by the selected variables. Michael and Zhang (2006) investigated the impact of multiple risk that importing firms encounter on their import demand for U.S grains. The model specification was the modified version of Hooper and

Kohlhagan's trade model which assumes demand for grain imports are derived demand. Included variables include exchange rate, tariff, soya beans price and ocean freight cost on import demand with forward future markets. Two way fixed effects and random effects models were estimated with both short-term and long-term measures of multiple volatilities. It was found out that the volatility of the exchange rate impacts import demand positively and volatility of soybean price has a negative effect.

Shahe and Forhad (2007) estimated import demand function in developing countries. Focus was on India and Sri Lanka. They used a structural econometric model of a two good representative agent economy that incorporates binding foreign exchange constraint at the administered prices of imports. Although there was problem of availability of data, a theoretically consistent parameterization of the virtual relative price of imports circumvents the data problem and thus enables the estimation of income and price responses to cointegration approach. The price and income elasticity estimates for India and Sri Lanka have correct signs and high statistical significance and plausible magnitudes.

Nicholas and Nuzrate (2008) investigated the determinants of import demand in Bangladesh for 1980 – 2006 data. Part of their quest was also to find out the impact of liberalisation on trade. The conventional import demand model was estimated as well as latest models in the literature which helps to examine the impact of export on import demand. They employed the cointegration error correction modelling to investigate short run dynamics of import demand. The result showed that Real GDP and relative import prices are statistically significant and show expected sign. Relative import price is an important determinant of import in the short and long run. The hypothesis of unit coefficient of income in the aggregate import demand is opposite in Bangladesh data. Trade liberalisation could not make any special difference in the import demand of the country. It was finally concluded that demand for Bangladesh exports determine her import demand.

Havrila and Gunwardana (2009) estimated import demand for Australia. His conventional model specification related import demand to relative prices, income and effective rate of assistance for clothing. Annual time series data for the period from 1970 to 2005 was analysed using the unrestricted error correction approach. Result showed that in the short run, price of imports relative to domestic price of clothing and Australia's real income are the significant determinants of import demand. In the long run, the significant determinants of import demand are relative price of imports, Australia's real income and effective rate of assistance to Australia's clothing industries. Shaista Alam et al. (2010) estimated the import demand function for Pakistan employing ARDL approach. The result from ARDL analysis supported the hypothesis that in Pakistan there exist a long run relationship among, import demand, real economic growth, and relative price of imports, real effective exchange rate and volatility of real effective exchange rate. It found that aggregate import demand is positively affected by real gross domestic product suggesting that import demand in Pakistan is growth driven. Further it found that relative price of imports may not decrease the import demand, which is quite obvious for growth driven economy. It also found that real depreciation of local currency and volatility of real effective exchange rate has no effect to decrease import demand in Pakistan in the long run. The evidence based on short run dynamics tend to indicate that real economic growth, relative price of imports, real effective exchange rate and real effective exchange rate volatility Granger cause import demand in the short-run.

Yoichi and Shigeyuk (2009) carried out an empirical analysis of import demand behaviour of least developed countries. Their objective is to examine the long run stability of import demand function in least developed countries (LDCs) using recently developed panel cointegration techniques. Cointegration test for two data sets was done –annual data for 15 countries from 1965-2004 and annual data for 22 countries from 1984-2004. It was found that cointegration

was present and that there is indeed a stable import demand function in these economies. The income elasticity ranges from 1.26 to 1.69 and price elasticity ranges from -0.72 to -0.75.

Mohammed Aljebrin (2012) empirically estimated the critical parameters of import demand determinants for GCC countries using 1994 – 2008 time series data. Applying panel Seemingly Unrelated Regression (SUR) model. The empirical results confirmed that, in both long run and short run, there are positive and significant relationships between the demand for imports and real income, private consumption, international reserves and gross capital formulation. On the other hand, there are negative and significant relationships between the relative price of import to domestic price and govermnent consumption in the long run, but negative and insignificant relationship in the short run.

Kaouther and Besmir (2012) estimated import demand functions for 6 oil exporting countries using a panel cointegration approach for data between 1982 -2008. Real import was the variable to be explained while real demand, domestic demand and export, and oil prices were the explanatory variables. Result showed that import demand depends on domestic demand and exports, the real exchange rate and oil prices while the current account balance tends to reduce demand for imports. Among all the works reviewed, quite a number of them were done for one country and others done for more than one countries but none of them specifically focused on the SSA. This therefore creates a gap that this study emerged to fill.

3. THEORETICAL FRAMEWORK AND METHODOLOGY

The model adopted in this work is based on consumer demand theory in the context of import for a country. Khan 1974, Hemphill 1974 and Moran 1989 provide a theoretical basis. This theoretical foundations is hereby reviewed leading to the estimation procedure The major strands of the import demand model can be classified according to three distinct groups: The traditional (benchmark) import model, the import-exchange model and the monetarist model. The traditional import model formed the main theoretical framework for initial studies on

import demand. The model suggests an analysis of import demand relations based on the consumer theory of demand. The traditional formulation of an aggregate import demand equation relates the real quantity of imports demanded by a country to the ratio of import prices to domestic prices (assuming a degree of substitutability between imports and domestic goods) and to domestic real income, all in period *t* (Arize and Afifi, 1987). Khan (1974, 1975) did the leading work on this model. From economic theory, the import demand function can be written as:

$$M_{it} = f(Y_t, PM_{it}, PD_{it}) \qquad (4.1)$$

Where Y_{it} denotes the real gross domestic product; *Mit* denotes the quantity or volume demanded of the *ith* commodity; PM_{it} the price of the *ith* import commodity; PD_{it} denotes the price of the *ith* domestic commodity. Traditional models work on the assumption that standard demand functions are homogenous of degree zero in prices and income, implying the absence of money illusions. In order to estimate Equation (1), two types of formulations are considered: Linear and log-linear. Many studies have shown that the log-linear specification is preferable (Khan, 1974; Arize and Afifi, 1987) because of two main reasons:(i) The log-linear specification allows imports to react in proportion to a rise and fall in the explanatory variables; and (ii) assuming constant elasticities avoids the problem of drastic falls in the elasticities as imports rise (Khan, 1974). Generally, two versions of this basic model are considered in the literature: The equilibrium model, and the disequilibrium model. Khan (1974) first developed the equilibrium model. This model has the following basic hypothesis: There is no delay in the system so the adjustment of imports and prices to their respective equilibrium values is instantaneous. Thus, the adjustment is realized entirely within a year. The import demand can then be written as follows:

$$ln\ Mit = \alpha 0 + \alpha 1i\ ln\ Yit + \alpha 2i\ ln\ Pit + eit \qquad (4.2)$$

where P_{it} denotes relative import price i.e $(PM/PD)_t$; *ln* denotes the natural logarithm Y_t denotes real gross domestic product; *t* denotes the time subscript; *i* denotes commodity subscript; e denotes the error term assumed to be randomly and normally distributed, and $\alpha_{1i}>0$ and $\alpha_{2i}< 0$. For the estimation of Equation 2, two specific assumptions are made associated with the problem of aggregation and measurement errors (Khan, 1974): Importers always adhere to their demand functions, i.e., demand for imports equals actual imports, and supply price elasticities are infinite. The disequilibrium model approach takes into account the potential sources of bias by specifying a partial adjustment process. Therefore, the change in imports is related to the difference between import demand in period *t* and actual imports in period *t-1*. This adjustment introduces the following equation:

$$\Delta ln\ Mt = \lambda(ln\ Mt - Mt\text{-}1) \qquad (4.3)$$

where $0 < \lambda < 1$.

Equation (3) demonstrates a distributed lag structure with geometrically declining weights into the determination of imports. The λ is the adjustment coefficient. If the difference is 0, then the adjustment coefficient equals λ and the short-run elasticity becomes the equilibrium elasticity. Equation (3) takes into account the costs involved in the adjustment of imports to a desired flow and the fact that only part of the adjustment is achieved within a period. Similarly, many imports are associated with contracts extending over a period of time and may not respond immediately to changes in demand. Equation 3 assumes that import prices are determined abroad, that is, the price of imports relative to the domestic price level is exogenous to the importing country and quantities are adjusted domestically (Khan, 1974; Arize and Afifi, 1987). Substituting equation 2 for equation 3 and solving for imports in period *t* yields equation 4, where $\lambda a1$ and $\lambda a2$ are the short- run price and income elasticities respectively.

$$lnMt = \lambda\alpha 0 + \lambda\alpha 1\ ln\ (PM/PD)\ t + \lambda\alpha 2 ln\ yt + (1-\lambda)\ ln\ Mt\text{-}1 \qquad (4.4)$$

The strength of this model lies in its simplicity and intuitive appeal. However, the traditional model has some weaknesses and, based on casual empirical work, various alterations have been made to the benchmark model. The traditional model implicitly assumes the absence of binding import quota restrictions and the income variable can be used to approximate the role of expenditure (domestic absorption). However, empirical economists have defended the existence and impact of import quotas. Quantitative restrictions do affect the magnitude of both price and income elasticity of import demand, as well as import levels (Bertola and Faini, 1991). Relevant indicators used in the literature include, among other things, the following proxies for foreign exchange constraints: Import duties, debt, export receipts; international reserves; and parallel market premia (Sachs, 1981 and 1982).

These weaknesses led to the proposition of the import-exchange framework. Hemphill (1974) first proposed the import-exchange framework which was further developed by Chu et al. (1983), Winters and Yu (1985), Sundararajan (1986) and Moran (1989). The development of the framework attests to the growing inability of the traditional framework to track and explain the slowdown in imports of developing countries that have a foreign exchange shortage (Mirakhor and Montiel, 1987). Hemphill (1974) argued that import demand functions are related to foreign exchange constraints. In the model's reduced form, the lagged level of international reserves and foreign exchange receipts in real terms are the principals of import demand. The justification for the relationship is usually that demand for foreign exchange exceeds supply at the existing exchange rate, and that the stock of reserves is small (Hemphill, 1974). In these circumstances, if export earnings fall or if capital inflows are reduced, the authorities have little choice other than to tighten restrictions on imports in the short run; similarly, the restrictions on imports may be eased if exports or capital inflows were increased. According to this framework, Hemphill (1974) specified the model as:

$mt = \beta o + \beta 1ft + \beta 2rt\text{-}1 + \beta 3mt\text{-}1 + ut$ (4.5)

where m_t, f_t, r_{t-1}, m_{t-1} and u_t are the current volume of imports, foreign exchange receipt, lagged level of international reserves, lagged level of imports and error term, respectively. The Hemphill model ignores relative prices and domestic income, which are important determinants of imports in developing countries such as the ones in the sub Saharan Africa. Moran (1989) expanded this approach by introducing traditional variables, i.e., domestic income and relative prices, to explain import demand. The essence of Moran's approach is to alleviate biases due to the omission of relevant variables and to interpret the interaction of variables that affect import demand and the country's capacity to import. In addition to the inclusion of the additional variables, Moran re- specifies the model in a log-linear form as:

$$ln\ m_t = \beta_o + \beta_1\ lnf_t + \beta_2\ lnr_{t-1} + \beta_3\ lnm_{t-1} + \beta_4\ ln(PM/PD)_t + \beta_5\ lny_t + u_t \quad (4.6)$$

where *(PM/PD)* and yt are relative price and domestic income, respectively. Thus, Moran developed an important model of import demand for and supply of a given country. From Moran's import equation, we can conclude that the traditional and Hemphill models are special cases of the general import model. The two models, the standard function and the relation based on exchange receipts, would effectively coincide. The Moran (1989) model seems to be more realistic and a more complete import demand model for developing countries such as the ones in the SSA, because it includes the foreign exchange constraints typical of these countries. This study thus draws from this model.

3.1 Model Specification

Following the analytical review and the extensive review of hypothesised determinants of import demand in sub-Saharan Africa, the interest in this sub-section is to attempt to model import demand taking the objectives and scope of our study into consideration. In order to achieve our objective of analysing the effect of trade liberalization, we include a trade openness index in the

final model. Thus, the aggregate import demand equation, based on Moran (1989), can be written as

$$logM = \beta 0 + \beta 1 log\ Mt\text{-}1 + \beta 2\ log(Pd/Pf) + \beta 3 log\ yt + \beta 4 logFERt + \beta 5\ 0PEN + et \qquad (4.7)$$

In the specification above, M_t and M_{t-1} denote real imports and lagged real imports respectively; PM/PD denotes relative import prices; Y_t denotes real income; FER_t denotes current foreign exchange reserves and $OPEN_t$ denotes total trade as percentage of GDP. This traditional model is thus estimated in this work.

3.2 Data sources and measurement

The data set for the analyses comprises of import, income, exchange rate and domestic price level and foreign prices. These data are obtained from officially recognised international sources such as World Development Indicators (WDI) which is the primary World Bank database for development data and the United Nation Commission for Trade and Development (UNCTAD).

Import data are obtained from UNCTAD while the WDI provides data for the remaining variables. Import data are total of all products in US$ while the gross domestic product (GDP) figures at constant US$(2005) are used as a proxy for income. GDP deflator is used as a proxy for domestic price index while import value index is used as a proxy for foreign prices. Foreign exchange reserves (FER) are measured as foreign assets held by the monetary authorities in the previous year. Trade liberalization (OPEN). This is measured as total trade, the sum of total exports and total imports, as a percentage of GDP. This is in line with Brafu-Insaidoo and Obeng (2008), who posit that trade liberalization basically consists of the liberalization of quantitative import restrictions, tariff liberalization, and the reduction or elimination of taxes on exports.

Data for Sub-Saharan African (Eastern Africa, Middle Africa, Southern Africa and Western Africa) countries are employed. On the focused data, thirty countries from Sub-Saharan Africa are randomly selected based on data availability. For holistic study of the region, all the geographical regions of Sub-Saharan Africa are represented.

3.3 Estimation and Evaluation Technique

This study adopts the fixed effect and random effect estimation technique. The choice of these techniques suits the structure of the panel data available for this work which is characterised by a relatively short time dimension but a rather large number of units. The fixed effect estimator takes into account the individual effect of each cross section by assuming that the slope coefficients are constant across individuals but allowing the intercept to vary for each individual. This is achieved by using different dummy variables to represent each individual or cross section.

The random effect estimator on the other hand treats the individual effects as random disturbances, estimating the variance components for individual and error, assuming the same intercept and slopes. Summary statistics and the correlation matrix of the variables are also shown. The analyses are done using the Eviews econometric application package.

3.4 Robustness of the Checks

For the reliability and validity of the results, several econometric tests were carried out. The redundancy test is carried out. This enables the check that all variables in the model are relevant. The Hausman test is also used to compare the fixed effect and the random effect estimates. It checks if the individual effects are uncorrelated with the other regressors in the model.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis

Table 5.1 below shows the summary statistics of the variables drawn for the study. Deviations of variables used in the estimation did not show much variation. The results further revealed that the average import over the period was about 14.26%, with a maximum 18.64% and minimum of 11.29% and, respectively. The GDP averaged 22.43% with a maximum of 26.45% and minimum of 22.46%. The sub-Saharan Africa economies have been fairly open at an average openness index of about 0.38 over the study period. The foreign exchange reserves was at the average of 20.12%. It fluctuated between the upper limit of 24.7% and a lower limit of 10.61%.

Table 4. 1: Summary Statistics of Data

	LFER	LGDP	LIMPORT	LRP	OPEN
Mean	20.12	22.43	14.26	-0.21	0.38
Median	20.20	22.46	14.23	-0.35	0.28
Maximum	24.70	26.45	18.64	3.11	6.51
Minimum	10.61	19.88	11.29	-7.22	0.05
Std. Dev.	1.74	1.27	1.32	1.06	0.47
Sum	10868.26	12111.94	7698.74	-114.86	205.69
Sum Sq. Dev.	1628.67	871.76	933.79	610.59	119.95
Observations	540	540	540	540	540

Source : Authors'computation

Note: *limport, lgdp, lrp, lfer, and open* are the log of *import, gross domestic product, relative prices, foreign exchange reserves and degree of openness respectively.*

4.2 Correlation Analysis

Correlation indicates the degree of association between variables; it assesses the extent and the strength of the association between two variables. Table 5.2 presented the correlation matrix of the explanatory variables employed for the analysis. The table presented all the possible combinations of import demand and its determinants in SSA. This helped to ascertain patterns of linear association that exists between the current account balance and its determinants aiding the understanding of the econometric results and other analyses that were

latter carried out in this study. Import demand has a linear relationship with G.D.P, relative prices, foreign exchange reserves and lagged imports with positive linear relationship all through. However, import demand did not correlate with degree of openness. The degree of association between GDP, foreign exchange reserve and lagged import was quite high and almost perfect. The only variable that witnessed a low association with import demand is relative prices.

Table 4. 2: Sample Correlation Matrix

	LIMPORT	LGDP	LRP	LFER	OPEN	LIMPORT(-1)
LIMPORT	1	0.903	0.085	0.826	0.004	0.987
LGDP	0.903	1	0.130	0.744	-0.021	0.904
LRP	0.085	0.130	1	0.045	0.0303	0.101
LFER	0.826	0.744	0.045	1	-0.173	0.824
OPEN	0.004	-0.021	0.0303	-0.174	1	-0.005
LIMPORT(-1)	0.987	0.904	0.101	0.824	-0.005	1

Source: Authors' computation

4.3 Estimation Result

The estimation results are presented in Table 5.3. The results of the pooled model are in the first set of columns, while those of fixed effects and random effects models are in second and third set of columns.

4.3.1. The pooled Regression Results

The result generated by the model is significant as revealed by the adjusted R^2 which shows that 97% variation in the import demand are explained by all the explanatory variables in the model. All the variables are significant at 1%. The probability value of 1% shows that the variables are strongly significant in explaining import demand in all the sub-Sahara African countries pooled together. The dynamics of import as captured by the lagged values of import shows that previous year demand for import influences current year import demand in the SSA. The coefficient shows that 1% change in previous year import accounts for 0.9% increase in the current year import. GDP is also strongly significant but with a weaker explanatory power as

1% change in income leads to approximately 0.07% increase in import demand. Foreign exchange reserves also emerged significant. The explanatory power shows that there will be 0.03% change in import demand as a result of 1% change in foreign exchange reserve. Change in relative price would cause an increase of 0.02% in import demand while a change in degree of openness will cause an increase approximately 0.1% in import demand. However, the main problem of the pooled model is that it does not allow for heterogeneity or endogeneity effect of countries. It does not estimate country specific effects and assumes that all countries are homogenous. It is a restricted model. Hence, the consideration of fixed effect model.

4.3.2 Fixed Effect estimation

Fixed effects model introduces heterogeneity by estimating country specific effects. It is an unrestricted model as it allows the intercept and other parameters to vary across trading partners. The F-test statistic was performed to test whether countries are pool-able and the results indicates that the null hypothesis of equality of individual effects is rejected. This means that a model with individual effects must be selected. Like the fixed effects, the random effects model also acknowledges heterogeneity in the cross-section. However, it differs from the fixed effects model in the sense that the effects are generated by a specific distribution. Although it assumes that there is heterogeneity in the cross-section, it does not model each effect explicitly. This prevents the loss of degrees of freedom which happens in fixed effects model. The LM test was performed and the null hypothesis of equality of the effects is rejected in favour of random effect specification.

The Hausman statistic is used to test the null hypothesis that the regressors and individual effects are not correlated in order to distinguish between fixed effects model and random effects model. Failure to reject the null hypothesis implies that the random effects model will be preferred. If the null hypothesis is rejected, the fixed effects model will be appropriate. The Hausman test statistic shows that the null hypothesis is rejected and this indicates that country

specific effects are correlated with regressors. This suggests that the fixed effects model is appropriate, and the random effects estimates are not consistent. Since the fixed effects model is the appropriate one, interpretation of the results will focus on the fixed effects model.

The fixed effect estimation result shows a positive sign for GDP (which is the proxy for income) coefficient. This is in consonance with the a priori expectation. GDP is significant in explaining import demand at 1% level of significance. It is rather inelastic in the short run but elastic in the long-run.

The result shows a positive sign for relative price coefficient. This implies that import dependence in the SSA is inevitable irrespective of rise in price as most economies in the SSA are of less developed status, that is, import is a necessity in the sub-Sahara Africa. Despite the rising import prices, sub-Sahara African countries still depend significantly on import.

The probability values reveal foreign exchange reserve to be significant in explaining import demand in sub-Sahara Africa. This aligns with the findings of Egwaikhide (1999) who found that availability of foreign exchange reserves is crucial to the import of consumer goods. The model shows a significant probability value for lagged import. Previous years' rate of imports therefore significantly count for variations in total import demand in the current year.

Trade openness is also highly significant in explaining import demand in the sub-Sahara Africa. This captures the effect of trade liberalization on the import demand behaviour of the sub-Sahara African countries although the explanatory power is quite low. This is in consonance with the findings of Harvey and Sadegah (2011) who found that trade liberalisation played a significant role in both long run and short run elasticities of import demand.

The joint significance shows that the model explains import demand with a probability value of 1% significance. The high adjusted R^2 indicates that variations in import demand is highly explained by changes in the selected variables.

Table 4. 3: Panel Estimation Results

Dependent Variable: Import Demand

Independent Variables	Pooled OLS			Fixed Effects			Random Effects		
	Coefficient	Std. Error	t-Statistic	Coefficient	Std.	t-Statistic	Coefficie	Std. Error	t-Statistic
C	-0.82	0.20	-4.1*	-6.64	1.19	-5.60*	-0.82	0.19	-4.23*
LIMPORT(-1)	0.90	0.02	46.7*	0.74	0.03	23.10*	0.90	0.02	48.13*
LGDP	0.06	0.02	4.13*	0.41	0.07	6.02*	0.07	0.02	4.25*
LFER	0.03	0.01	3.67*	0.05	0.01	3.97*	0.04	0.01	3.77*
LRP	0.02	0.01	2.47*	0.04	0.02	2.32**	0.02	0.01	2.55*
OPEN	0.06	0.02	2.62*	0.12	0.04	3.36*	0.06	0.02	2.71*
	No. of Observation (510)			No. of Observation (510)			No. of Observation (510) Hausman X^2 test (47.87) *		

Source: Results were obtained from data analysis using EViews econometric software.
Note: *, ** and *** indicate significance at 1%, 5% and 10% respectively.

4.4. Redundancy Test

Appendix III reveals the result of the redundancy test. The overall significance shows also that the model was well specified with the overall significance at a probability value of 1%. All the variables are significant except exchange rate.

5. SUMMARY AND POLICY RECOMMENDATION

This section presents the summary of the major findings in this research. It entails the findings from the descriptive statistics, correlation analysis, pooled OLS, Fixed effects estimation and

random effect estimation employed in examining the relationship between import demand and the variables selected.

All the variables were not haphazardly distributed given their mean, median, minimum and maximum observation points. The macroeconomic variables in the model: Income, price of import, foreign exchange reserves, degree of openness and the previous year import therefore explain changes in the total import of goods SSA. Statistical result of the pooled OLS random effect and the fixed effect estimation showed all variables to be highly significant and positively related to import demand.

The relative price only was shown to be significant at 5% by the fixed effect estimation. Relative price of import has a positive relationship with import demand which implies that there is high import demand at higher import prices. This is contrary to theory in traditional literature on import demand but it is meaningful for poor developing countries in general, SSA in particular. High production costs cum low level of technology in developing countries make import demand for most manufactured good inevitable. As prices rise, total import expenditure rises for these countries. The result also showed that the level of aggregate import is determined by income in the long run.

5.1 Policy Recommendation

The results of the aggregate import demand and the components studied have some important policy implications. First, policies aimed at raising reducing import by raising import prices through tariff will prove ineffective in the Sub-Sahara Africa. Other restriction methods such as ban should be employed. An expenditure dampening policy will be effective to reduce import demand while one that is directed at increasing the domestic production would ease the shortage. Also, export promotion and removal of other international trade barriers to encourage exports will increase exports and raise export revenue to finance the ever-increasing imports.

Finally, policy authorities who aim at reducing imports to correct balance-of-payments imbalances in the long run should target the efforts at policies that will reduce spending power at the macroeconomic level, and implement policies that will ensure increased domestic supply. These will reduce the dependence on imports and reduce import demand.

5.2 Limitation of the Study and Suggestion for Future Research

Having come thus far we cannot rule out the fact that there are limitations inherent in this research. First, sample countries and data chosen for this study were influenced by data availability. The unavailability of data such as import value index and foreign asset for some SSA countries to a large extent affected the robustness of our results. These data are central in analyzing the determinants of import demand behaviour of an economy.

In spite of this limitation, it is obvious that this research has contributed to the increasing literature of import demand determinants. However, to increase the frontier of knowledge, study could be carried out on import determinant for disaggregated import in the Sub-Saharan Africa. This can capture the import demand behaviour of the sub- Sahara African economies for specific goods. Moreover, other panel methodologies such as General Moment Method (GMM) could be employed where there is availability of data for a longer time dimension

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