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An Econometric Estimation of the Aggregate Import Demand Function for COMESA

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A B S T R A C T

This paper investigates the behaviour of aggregate import demand for COMESA using times series data for the period 1970-2006. The newly developed bounds testing approach, an Autoregressive Distributed Lag (ARDL) modeling process is employed to capture the effect of gross domestic product, unit value of import prices, prices of domestically produced goods, foreign exchange reserves and import liberalization on aggregate import demand. The estimation of an error correction model enables the separation of the short- and long-run elements of this relationship. The results suggest that there exists a unique cointegrating relationship between aggregate import demand and its determinants. In the long run, gross domestic product, prices of domestically produced goods, unit value of import prices, and Import liberalization are the major determinant of COMESA's aggregate imports demand. The short run dynamics suggest that gross domestic product have the highest influence on aggregate import demand in COMESA. The price of domestically produced goods is also found to be a strong determinant of imports in thelong-term but insignificant in the short-term. Unit value of import prices in the long and short run move contemporaneously in an almost one-for-one fashion. Foreign exchange reserves is positive however insignificant in both the long and short runs. Import liberalization is found to have an impact on aggregate import demand. Furthermore, the estimated error correction coefficient of -0.65635 suggests that the aggregated import demand corrects from the previous period's disequilibrium by 66% per year. That is, it takes one year to fully realign any disequilibrium that occurs. This study provides the only assessment of COMESA aggregate import demand including a precise estimate for the short-run relationship, especially an estimate of the short-run adjustment term. This information will provide further input to support policy decisions relating to the management of the trade balance or policy in correcting COMESA's trade deficits and promoting intra-regional trade.

Introduction

In recent years, because of the popularity of globalization, the interdependence among regions at world level has increased. Every region including COMESA wants to achieve rapid pace of economic development through getting the maximum benefits from international trade. The Common Market for Eastern and Southern Africa (COMESA) is a regional trade integration group initially consisted of 21 (as defined by its Treaty) African sovereign states. It is a regional intergovernmental organization founded in 1993 as a successor to the Preferential Trade for Eastern and Southern Africa (PTA), which was established in 1981.COMESA was aimed to create Africa's largest economic community through sub-regional economic organization, promote regional integration through trade and development and to develop their natural and human resources for the mutual benefit of their peoples.

COMESA's current strategy can thus be summed up in the phrase 'economic prosperity through regional integration' as it forms a major market place for both internal and external trading. However,within the international trade literature, it is not uncommon to find arguments about whether trade relationships are stable over time or not. It is a matter of concern to policy makers, trade economists, researchers, and practitioners to investigate this issue on international trade. In view of this, Goldstein and Khan (1985) suggested that trade relationship are subject to either gradual or sudden changes over time. Changes as a result of import control measures in COMESA member countries tend to reflect the conflicting objectives which governments desired to achieve from time to time. Such measures by design are artificial barriers to the free trade doctrine of international trade.

Nelson and Plosser (1982) provided a widely known empirical testing for the stability of economic time series data. They concluded that most of the time series are not stationary. As most trade relationships are not stable over time due to many non-stationary macro-economic variables in nature, it is paramount to investigate the aggregate import demand behavior of the COMESA, given its importance and potential in supporting prosperity in member countries and other nations by extension. The import demand specification is momentous for informed policy analysis in many areas (Tang, 2003; Emran and Shilpi, 2008). Whereas a large number of studies have been done on estimating the aggregate import demand functions for different countries and/or regions, none of the existing studies have looked on aggregate import demand function for COMESA region. With such background, the objective of this paper is, therefore, to investigate the determinants of aggregate import demand for COMESA and whether there exists long-run and short-run relationship between aggregate import and its determinants on the basis of annual data for the period 1970-2006. It is crucial to know the marginal propensities of the determinants of import. The hypothesis of the existence of a cointegrated relationship is tested using the Autoregressive Distributed Lag (ARDL) methodology.The Error Correction Model (ECM) is applied to estimate the short run elasticities and information about the long run speed of adjustment.This is in contrast to the traditional formulation of import demand function which relates the quantity of import demanded to domestic real income and relative price only.

The stability of import demand function is very important for the effectiveness of trade policy (Arize and Afifi, 1987). Effective trade policy formulation requires that the change in import demand as a result of changes in national income, prices of domestically produced goods, unit value of import prices, foreign exchange reserves, and import liberalization that explain imports do not change significantly over a long period. To achieve efficient policy formulation, it is necessary for the relevant authorities to know not only the signs, but also the magnitude and stability of the response of the relevant variables that are required for policy decision making. The derived estimates can be used not only as an analytical tool in decision making, but also as an instrument for economic forecasting (Ajayi, 1975). Moreover, the investigation of import demand function has important implications for macroeconomic policy issues (Tang, 2003) some of which are the impact of expenditure switching through exchange rate management and commercial policy on a nation's trade balance; the international transmission of domestic disturbances where import demand elasticities are a crucial link between economies; and the degree to which the external balance constraint affects nation's growth.

Import Liberalization in COMESA

Trade liberalization in COMESA started with the establishment of the Preferential Trade Area (PTA) for Eastern and Southern Africa in 1982. The trade liberalization program, which commenced in July 1984, was intended to reduce and eventually eliminate tariffs and non-tariff barriers on intra-PTA trade, leading to the establishment of a Free Trade Area (FTA) by 1992.

To appreciate the prospects and challenges arising out of import liberalization in COMESA, it is essential to look into some of the historical trends in terms of the import orientation ratio (IOR) and import penetration ratio (IPR). The data relates to five years before liberalization (1987-91) and five years after (1992-1996). The import orientation ratio which is measured as the average ratio of aggregate imports to GDP is shown in table 1. There is a higher import orientation ratio during the 1992-96 periods (28.20%) than that in the 1987-91 periods (26.72%). Another outcome-based measure of import liberalization is the import penetration ratio shown in table 2 which is the average ratio of aggregate imports to aggregate consumption. It is probably a more reliable indicator of restrictive trade policy than the import orientation ratio since in most developing countries, COMESA inclusive, it is imports of consumption goods that are the most stringently restricted (Andriamananjara and Nash, 1997). There is a slightly higher import penetration ratio during 1992-1996 (33.4%) than that in the period 1987-91 (33%). The results indicate more reliance on imports in 1992-1996 than 1987-91.

The demand for imports in an economy is a crucial macroeconomic relationship with significant implications for the design and conduct of economic policy. At the same time, the contribution of international trade to economic growth and development has been of interest to many economists. Imports are a key part of international trade and vital to stimulating economic growth. In view of the importance of trade to the growth process of economies, especially in developing countries, a number of empirical studies on the determinants of import demand functions have been conducted especially in Asia and Latin America, while largely ignoring African countries. Many developing countries rely heavily on import controls for achieving adjustments in the balance of payments. In spite of that, most of the empirical analyses of imports of these countries have failed to address explicitly the issue of quantitative restrictions. It is also essential for policy makers to understand how imports react to changing economic conditions for the effective implementation of trade policies. It is generally believed that imports react more rapidly than exports to trade liberalization. Therefore, it is necessary to predict imports demand more accurately to achieve the maximum benefits from the growing world economy.

There are several and different econometric methods of modeling demand for imports and exports. The appropriate model depends on many factors: the objectives of what the model is constructed that is whether model is for hypothesis-testing or forecasting; data availability and the level of disaggregation; the type of traded goods(homogeneous or highly differentiated goods); the end use to which the traded commodity is put (final consumption or as a factor input) and the required degree of explanation. For example, Houthakker and Magee (1969) explained that the import demand behaviour can be fully explained by income and relative price of import variables. They first estimated demand elasticities for both imports and exports with respect to income and price for a number of countries. The traditional formulation of import demand model normally relates the quantity of import demanded to domestic real income and relative prices (ratio of import prices to domestic prices) (Gafar 1988). Economic theory has further suggestedthree leading theories that explain demand for imports. First is the theory of comparative advantage (also known as neoclassic trade theory), second is the perfect substitute's model or Keynesian trade multiplier, and thirdly is the imperfect competition also known as the new trade theory. Out of the three theories, there are two trade models that have been widely used in the international trade literature: the imperfect substitutes model and the perfect substitutes model. If the trade studies deal with aggregate imports (exports), the two models could be viewed as competitors. If, however, disaggregation is allowed, the two models could be viewed as complements – one dealing with trade for differentiated goods, and the other with trade for close – if not – perfect substitutes.

Theory of comparative advantage is rooted in the Heckscher-Ohlin framework with a focus on how the volume and direction of international trade are affected by changes in relative prices. The volume and direction of trade are explained by differences in factor endowments between countries. This theory is not concerned with the effects of changes in income on trade as the level of employment is assumed to be fixed and output is assumed to be on a given production frontier.

The thrust of the perfect–substitutes model is the relationship between income and import demand at the aggregate level (and in the short term). In this framework, employment and relative prices are assumed to be variable and rigid respectfully. Some international capital movements are assumed and adjust to restore trade balance. The relationship can be defined by a few ratios such as the average and marginal propensity to import and the income elasticity of imports. It is based on the assumption that traded goods are perfectly substitutes. It assumes perfect substitutability between domestic and foreign goods. It further assumes that each country would be only an exporter or an importer of a traded good but not both. Since this is not observed in the real world, this model has attracted very little attention in the empirical studies than the imperfect substitutes model (Goldstein and Khan, 1985). The imperfect–substitutes model has been and is the center of empirical work on trade equations. It focuses on intra-industry trade. It is mostly used in studying imports of manufactured goods and aggregate import. The theory explains the effects of economies of scale, product differentiation, and monopolistic competition on international trade. The theory uses three approaches to try and define effects of imperfect competitive on international trade. These include the Marshallian, Chamberlinian and Cournot approaches. In the first approach, the Marshallian assumes constant returns at the firms' level but increasing returns at the industry level while the Chamberlinian approach assumes that an industry consists of many monopolistic firms and new firms are able to enter the market and differentiate their products from existing firms so that any monopoly profit at the industry level is eliminated. The Cournot approach assumes a market with only a few imperfectly competitive firms where each firms outputs is taken as given. The imperfect–substitutes model is considered more appropriate in this research due to the fact that neither exports nor imports are perfect substitutes for domestic goods.

Learner and Stern (1970) noted that there are no well-defined criteria for choosing a particular functional relationship/ specification. Rather it is the researcher who decides what functional form to use (influenced by the theoretical position chosen), provided the choice is not harmful to the results obtained. They included a country's international reserves (IR) in the import function specification as an indication of the strictness of import controls. This study used foreign exchange reserves as one of the variables to determine its significance to designing import policy in COMESA. Moran (1987) used pooled cross section time series data to estimate a general import model. The results suggested that the import model used by Moran (1987) explains import behaviour better than the traditional and Hemphill (1974) models (which exclude relative import prices and income).Mwega(1993) also investigates the short-run dynamic import function in Kenya using an error correction model. Import demand was found to exhibit low elasticities with respect to relative price and income.Thursby and Thursby (1984) cited in Egwaikhide (1999) examined the appropriateness of alternative specifications, using five countries (Canada, Germany, Japan, United Kingdom and the United States) as case studies. They explored nine different models of aggregate imports demand from which 324 alternative specifications were derived. They established that there is no single functional form that is universally appropriate across countries over time. In support of findings by Khan and Ross (1977), Thursby and Thursby (1984) further established that logarithmic functional form is more appropriate. Mosteller and Turkey (1977) argue forcefully that many applied researchers forget that the interpretation of specific regression coefficient depends not only on the corresponding explanatory variable, but also on every other explanatory variables included in the model.

A relatively recent alternative approach to cointegration analysis has been put forth in a series of studies by Pesaran and Pesaran (1997), Pesaran and Smith (1998), Pesaran and Shin (1999), and Pesaran et al. (2001). This approach employs ARDL procedure using the bounds test for cointegration analysis. This approach has been advocated to correct for the small sample bias (Pesaran and Shin, 1999). The bounds test procedure has the advantage that it can be applied irrespective of whether the variables are I(0) or I(1) (Pesaran and Pesaran, 1997). Another advantage is that the model captures the data generating process within the model (Laurenceson and Chai, 2003). This approach presents the ease of estimating the reduced form equation through the OLS or through FMOLS method. It has been utilized in many empirical studies for import demand: Tang and Nair (2002) for Malaysia, Bahamani and Kara (2003) for nine industrial countries, Constant and Yue (2010) for Cote D'Ivoire,Ho (2004) for Macau and Narayan and Narayan (2005) for Fiji. This study utilized bound test approach to cointegration. For example,Ivohasina and Hamori (2005) analyzed the long-run relationship among the variables in the aggregate import demand functions of Madagascar and Mauritius. They used the UECM-based bounds test to investigate cointegration and concluded that there exists cointegration relationship between the variables.Even though a lot of literature exits on aggregate import demand function for both developed and developing countries, There is no known study that has investigated on aggregate import demand function for COMESA as a region. There is, therefore, a need for an empirical investigation of the determinants of import demand for COMESA.

Model Specifications, Data Sources and Econometric Methodology

Model Specifications

The imperfect substitute's theory was employed in this study due to the fact that neither exports nor imports are perfect substitutes for domestic goods. It is to more realistic as compared to the perfect substitute model (Xu 2002)and comparative advantage theory. Just like any other demand model, the standard specification of the aggregate import demand model treats quantity of import demanded as regressand and its determinants as regressors. Since COMESA imports are a relatively small fraction of the total world imports, it may be quite realistic to assume that the world supply of imports to COMESA is perfectly elastic. This assumption seems to be realistic because the rest of the world may be able to increase its supply of exports to this region even without an increase in prices. Infinite import supply elasticity assumption reduces our model to a single equation model of an import demand function. In this model, income (GDP),prices domestically produced goods and import prices among are crucial, because the effectiveness of import trade policy is highly dependent upon the size of their elasiticities. Other econometric investigations of import demand postulate that the quantity demand for imports is a function of relative prices and real income (Houthakker and Magee (1969), Leamer and Stern (1970), Murray and Ginman (1976), Goldstein and Khan (1985) andDornbusch (1988)). It has also been hypothesized that quantity of imports in any region is largely dependent upon the availability of international reserve to finance imports. The reserves are basically held to achieve a balance between demand for and supply of foreign currencies, for intervention, and to preserve confidence in the region/country's ability to carry out external transactions. Foreign exchange reserve was therefore considered as one of the regressors in the aggregate import demand model for COMESA.

In the area of international trade the most commonly encountered functional forms for import and export demand relationships are either linear or log-linear formulations Khan (1974), Magee (1975). Recent studies by Doroodian et al. (1994), Sinha(1997), and Raijal et al. (2000) used the Box and Cox (1964) procedure and showed that log–log specifications are more preferable to the linear specification. Since economic theory does not provide a priori criteria for selecting the appropriate functional form, the question of choice then becomes an empirical problem. The logarithm formulation is preferable in modeling import demand function for two main reasons. First, it allows imports to react proportionately to rise and fall in the explanatory variables, Khan (1975). Second, it gives direct estimation of import elasticity. Moreover, the use of the log-linear formulation constrains the price and income elasticity estimates to be constant over the estimation period while the linear form of the import demand equation implies decreasing price elasticity and an income elasticity tending towards one. Thus the variables used in this study are in natural logarithms.

Accordingly, this study first specified a five variable basic aggregate import demand model within the imperfectsubstitutes framework as follows:

$$M_t = f\left(Y_t, P_t^m, P_t^d, R_t\right) \ldots\ldots\ldots(1)$$

M_t is the real quantity of aggregate import demanded by COMESA in time period (t), Y_t is the real gross domestic product (GDP) of COMESAin time period (t), P_t^m is unit value of import prices of COMESA in time period (t), P_t^d is the price index of domestically produced goods of COMESA in time period (t) AND R_t is foreign exchange reserves of COMESA in the time period (t).

From equation (1),it is postulated that the aggregate demand for imports takes the following form:

$$\ln M_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln P_t^m + \beta_3 \ln P_t^d + \beta_4 \ln R_t + u_t \ldots\ldots(2)$$

Where:-

$\ln M_t$ is Natural logarithm of real quantity of aggregate import demanded by COMESA in time (t), $\ln Y_t$ is Natural logarithm of real gross domestic product (GDP) in time (t), $\ln P_t^m$ is Natural logarithm of unit value of import prices in time (t), $\ln P_t^d$ is Natural logarithm of the price index of domestically produced goods in time (t), $\ln R_t$ is Natural logarithm of foreign exchange reserves in the time period (t) and u_t = Stochastic term with its usual classical properties.

The stochastic term is assumed to be randomly and normally distributed with constant variance expressed as $\mu \sim N(0, \sigma_\mu^2)$.

The constant term "β_0" is included due to the fact that there will be some imports even if all other variables are zero. Through u_t, the residual term, it has been shown that imports are also affected by other variables which are not included in the model.

According to our theoretical priors, the quantity of imports to a domestic country/region ought to increase as the real income rises and vice versa. So we expect the coefficient of domestic real GDP to be positive $(\beta_1 > 0)$. However, if the rise in real income is due to an increase in production of import substitutes goods, imports may decline as income increases in which case $(\beta_1 < 0)$.Domestic prices of COMESA is expected to have a negative sign $(\beta_3 < 0)$ and asthe usual procedure, the average unit value of import prices is assumed to be negative $(\beta_4 < 0)$. The coefficient of foreign reserves is expected to be positive $(\beta_5 > 0)$, because as the foreign exchange constraint is relaxed, imports of a larger quantity are expected to flow into each country and hence the region as a whole.

In equation (2), instead of using relative price ratio, two separate price terms that is unit value import price (P_t^m) and price index of domestically produced goods (P_t^d) are used to capture the price effects on imports. We then applied the idea of Murray and Ginman (1976) who argued that relative price specification in the traditional import demand model is inappropriate for estimating aggregate import demand parameter. They suggested a simple modification of the traditional import demand equation that estimates the effects of imports and import competing prices separately. Urbain(1993) further suggested that the use of two separate price terms were preferable to the use of one term. He stated that modeling the dynamics of import demand by using relative prices implies identical dynamic response of imports to changes in import prices and domestic prices. The situation is difficult to justify, as economic agents use different information set to form their expectation about domestic and foreign (import) prices. To some extent, the import price depends on exchange rates.

Since the quantity of imports demanded depends upon price of imports in domestic currency as well as the price of domestically produced substitutes and the data required on the price of domestically produced substitutes are simply not available, researchers uses more general price index that is the consumer price index(CPI),the wholesale price index (WPI), or the GDP deflator. And therefore, the range of goods covered in the domestic price index could differ substantially from those in the import unit value index.

With the adoption of the a Structural Adjustment Program (SAP) which marked a major shift in the trade policies of COMESA, a dummy variable was included in the model to capture the effect of the import liberalization policy on import demand. Import liberalization, through easing access to imports, is likely to result in a larger aggregate import demand by the economy. Thus it is finally postulated that the aggregate demand for imports takes the following form:

$$\ln M_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 \ln P_t^m + \alpha_3 \ln P_t^d + \alpha_4 \ln R_t + \varpi D + u_t \quad \ldots\ldots\ldots\ldots(3)$$

Where D is a dummy variable with values 0 for 1970-91and 1 for 1992-2006 to capture the effect of import liberalization. The expected sign of the coefficient of the dummy variable does not have any theoretical support. However, if the coefficient is statistically significant, then the trade reform exercise of liberalization since 1992 has a significant effect on the demand for imports depending on the sign. The random term u obeys the classical assumptions of IID $(0, \sigma^2)$, while other variables in the equation are as previously defined. Equation (3) may be referred as“Clive Mairura model” for ease reference. It is a consistent and empirically implementable model of aggregate imports for COMESA and other developing nations/regions.

Variable Descriptions and Data Sources

In this paper, secondary data are employed. The nominal values of each variable have been converted into real ones. The nominal values of aggregate imports are deflated by unit value index of imports so as to obtain the real quantity of imports. The foreign exchange reserves are deflated by the GDP deflator to obtain real foreign exchange reserves. Consumer price index is chosen to represent aggregate price index of domestically produced goods. For econometric analysis, annual data for 37 years (1970-2006) of the COMESA region are used. The data used in this research study included COMESA's real quantity of aggregate imports, real gross domestic Product (GDP), unit value of import price, price index of domestically produced goods, and real foreign exchange reserves collected from African Development Indicators (2008/2009) which is a publication of World Bank. Africa Development indicators 2008/2009 provided the most detailed collection of data covering 53 African countries with a CD-ROM, covering about 1,400 indicators from 1965 to 2006. Additional data was collected from latest World Bank's World Development Indicators and Global development finance, Statistics from the COMESA secretariat available online, International Financial Statistics (IFS), COMESA Banks Statistical Bulletin and earlier editions of Africa development indicators.

Estimation Method

This study utilizes the autoregressive distributed lag (ARDL) bounds testing procedure developed by Pesaran, et al. (2001) to examine the cointegration relationship between aggregate import demand and its determinants. It was developed to examine a level relationship among variables on the basis of VAR (*p*) under a conditional modeling technique that focuses on the scalar variable. Proper transformation of the underlying VAR (*p*) model may yield an expression of the conditional error correction model (ECM). Alternatively, the conditional ECM can also be derived from the Autoregressive Distributed Lag (ARDL) model of orders $(p, p,.,., p)$ where the number of p is the sum of dependent and independent variables. The conditional ECM is used to examine whether there exists a stable level relationship between variables under investigation by computing F-statistic to test the significance of the lagged level variables. It is essentially based on the estimation of the unrestricted error correction model (UECM) or error correction version of autoregressive distributed lag (ARDL) model. Other than its simplicity as opposed to other multivariate cointegration techniques such as Johansen and Juselius (1990), it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. The bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as the JJ and EG cointegration procedures. It is for reason this procedure is employed to determine both long-run and short run coefficients of aggregate import demand function. According to Pesaran et al. (2001, p.315), it can be employed without any prior knowledge whether the underlying regressors are I(0), I(1) or mutually cointegrated. It is therefore not necessary that the order of integration of the underlying regressors to be ascertained prior to testing the existence of a level relationship between two or more variables. Another advantage of this approach is that the model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai 2003). Moreover, the ARDL approach is known to have superior small sample properties (Pattichis (1999) and Mah(2000)) whereas the conventional cointegration methods developed by Engle and Granger (1987), Johansen (1988), and Johansen & Juselius (1990) suffer from small sample bias. Given that our sample size covers 37 years for 21 COMESA Countries with six variables, this approach is the most appropriate procedure for establishing static long run coefficients and short-run dynamics. It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai 2003). Furthermore, Tang (2005) states the procedure is also applicable when the explanatory variables are endogenous and is sufficient to simultaneously correct for residual serial correlation. The procedure will however crash in the presence of I(2) series.

Following Pesaran et al (2001) as summarized in Choong et al (2005), bounds test procedure is employed by modelingMairura's model (3) as a general vector autoregressive (VAR) model of order p, in z_t:

$$z_t = c_0 + \alpha t + \sum_{i=1}^{p} \gamma z_{t-i} + \varepsilon_t, \ \mathrm{t} = 1,2,3,4,............T \quad ....(4)$$

Where $c_0 =$ (k+1)-vector of intercepts (drift) and $\alpha =$ (k+1)-vector of trend coefficients. Pesaran et al (2001) further derived the following vector equilibrium correction model (VECM) corresponding to equation (4):

$$\Delta z_t = c_0 + \alpha t + \Pi z_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta z_{t-i} + \varepsilon_t, \ \mathrm{t} = 1,2,3,4,.............T \quad ....(5)$$

Where the $(k+1) \times (k+1) =$ matrices $\Pi = I_{k+1} + \sum_{i=1}^{p} \mathrm{H}_i$ and $\Gamma = -\sum_{j=i+1}^{P} \mathrm{H}_j$ $\mathrm{i} = 1,2,3,4,....., \mathrm{p}-1$ contain both long-run multipliers and short-run dynamic coefficients of the VECM. z_t is the vector of variables x_t and m_t. m_t is an I(1) dependent variable defined as $\ln M_t$ and $x_t = [\ln Y_t, \ln P_t^m, \ln P_t^d, \ln R_t]$ is a vector matrix of 'forcing' I(0) and I(1) regressors as already defined with a multivariate identically and independently distributed (i.i.d) zero mean error vector $\boldsymbol{\varepsilon}_t = (\boldsymbol{\varepsilon}_{1t}, \boldsymbol{\varepsilon}'_{2t})'$, and a homoscedastic process.

Further assuming that a unique long-run relationship exists among the variables, the conditional VECM (5) now becomes:

$$\boldsymbol{\Delta} m_t = c_{m0} + \alpha t + \boldsymbol{\delta}_{mm} m_{t-1} + \boldsymbol{\delta}_{xx} x_{t-1} \sum_{i=1}^{p-1} \boldsymbol{\lambda}_{\mathbf{i}} \Delta m_{t-i} + \sum_{i=0}^{p-1} \boldsymbol{\xi}_{\mathbf{i}} \boldsymbol{\Delta} x_{t-1} + \boldsymbol{\varepsilon}_{mt} \quad ....(6)$$

From equation (6), the conditional VECM of interest can be specified as follows:

$$\Delta \ln M_t = \vartheta_0 + \sum_{i=1}^{l} \zeta_1 \Delta \ln M_{t-i} + \sum_{i=1}^{l} \zeta_2 \Delta \ln Y_{t-i} + \sum_{i=1}^{l} \zeta_3 \Delta \ln P_{t-i}^m + \sum_{i=1}^{l} \zeta_4 \Delta \ln P_{t-i}^d +$$
$$\sum_{i=1}^{l} \zeta_5 \Delta \ln R_{t-i} + \psi_1 \ln M_{t-1} + \psi_2 \ln Y_{t-1} + \psi_3 \ln P_{t-1}^m + \psi_4 \ln P_{t-1}^d + \psi_5 \ln R_{t-1} + \varpi D + \varepsilon_t \quad ....(7)$$

Where l = the lag length, Δ = the difference operator for all variables, i = the number of lags, $t-1$ = the time level lag of variable, ψ_i = the long run multipliers and ε_t = White noise errors

This equation is called unrestricted error correction model (UECM) or error correction version of autoregressive distributed lag (ARDL) model.

The first step in bound testing procedures starts with estimating equation (7) by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables for the null hypothesis of no cointegration i.e., $H_0 : \psi_1 = \psi_2 = \psi_3 = \psi_4 = \psi_5 = 0$ against the alternative hypothesis of the existence of cointegration

$H_1 : \psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq \psi_5 \neq 0$ using Wald test ($F-$test). Each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions. For instance, the dependent variable $\ln M_t$ is denoted as $F_{\ln m_{t-1}}(\ln M_{t-1} / \ln Y_{t-1}, \ln P^m_{t-1}, \ln P^d_{t-1}, \ln R_{t-1})$

The asymptotic distribution of the $F-$statistic for the bound test is non-standard under the null hypothesis among the examined variables, irrespective of whether the variables are I(d) (where 0≤d≤1): a lower value assuming the regressors are I(0), and an upper value assuming purely I(1) regressors. Pesaran et al. (2001)and Narayan (2004) developed two bounds of critical values for the different model specifications (intercept and/or trend) where the upper bound applies when all variables are I (1) and the lower bound applies when all variables are I (0). If for a chosen significant level, the computed $F-$statistic exceeds the upper bound, the null hypothesis of no cointegration is rejected. Conversely, if the $F-$statistic is inferior to the lower bound, the null hypothesis of no cointegration cannot be rejected. When the F- statistic falls between the two bounds, conclusive inference cannot be made; and the order of integration of the variables must be known before any decision can be made.

In the second step of bounds testing procedure, the long-run coefficients are estimated using an ARDL model given the evidence of cointegration. The conditional ARDL$(p_1, q_1, q_2, q_3, q_4)$long run model for $\ln M_t$ is specified as:

$$\ln M_t = \xi_0 + \sum_{i=1}^{p} \xi_1 \ln M_{t-1} + \sum_{i=0}^{q_1} \xi_2 \ln Y_{t-1} + \sum_{i=0}^{q_2} \xi_3 \ln P^m_{t-1} + \sum_{i=0}^{q_3} \xi_4 \ln P^d_{t-1} + \sum_{i=0}^{q_4} \xi_5 \ln R_{t-1} + \omega D + u_t \text{........(8)}$$

Where, all variables are as previously defined. This involves selecting the orders of the ARDL $(p_1, q_1, q_2, q_3, q_4)$ model in the five variables. ARDL approach obtains the optimal lag length of each variable using either Schwartz-Bayesian information Criteria (SBIC) or Akaike's Information Criteria (AIC).

SBC is known as the parsimonious model, selecting the smallest possible lag length, whereas AIC is known for selecting the maximum relevant lag length. In this stepSBIC is used.

In the third and final step, this study obtains the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates.

Error Correction Model (ECM)

The Error term lagged one period (i.e., EC_{t-1}) integrates short-run dynamics in the long-run aggregate import demand function. This leads us to the specification of a general error correction model (ECM):

$$\Delta \ln M_t = \alpha + \sum_{i=1}^{p} \theta_i \Delta \ln M_{t-1} + \sum_{i=0}^{q} \pi_i \Delta \ln Y_{t-1} + \sum_{i=0}^{q} \rho_i \Delta \ln P^m_{t-1} + \sum_{i=0}^{q} \varphi_i \Delta \ln P^d_{t-1} + \sum_{i=0}^{q} \varpi_i \Delta \ln R_{t-1} + \upsilon D + \phi EC_{t-1} + \varepsilon_t$$

…(9)

Where:

$\theta, \pi, \rho, \varphi,$ and ϖ are short are the short-run dynamic coefficients of the model's convergence to equilibrium

Δ = the difference for all variables.
i = the number of lags that can be up to p or q
$t-1$ = the level lag of variable
EC_{t-1} = error correction term lagged one period

$$EC_{t-1} = \ln M_t - \psi_1 \ln Y_t - \psi_2 \ln P^m_t - \psi_3 \ln P^m_t - \psi_4 \ln R_t - \zeta D - \theta C$$

ϕ = the speed of adjustment or the proportion of disequilibrium in real import in one period corrected in the next period. It indicates the speed of adjustment back to the long run equilibrium after a short run shock.

To ascertain the goodness of fit of the ARDL model, the diagnostic and the stability tests are conducted. The diagnostic tests examine the serial correlation, functional form, misspecification, normality, and heteroscedasticity associated with the model.

Stability Tests

Stability test determines whether the estimated aggregate import demand function has shifted or not over the time period included in the study. Appropriate procedures for studying the stability over time of regression relationships were employed. Emphasis is placed on the use of graphical methods. Recursive residuals from the aggregate import demand function, defined to be uncorrelated with zero means and constant variance, is used in the analysis. In order to test for long-run parameter stability or constancy suggested by Pesaran and Pesaran (1997), the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals of square (CUSUMSQ) tests proposed by Brown et al (1975) to the residuals of the estimated ECMs are employed. In both CUSUM and CUSUMSQ, the related null hypothesis is that all coefficients are stable. The CUSUM test uses the cumulative sum of recursive residuals based on the first observations and is updated recursively and plotted against break point. It is more suitable for detecting systematic changes in the regression coefficients. It is based on the cumulative sum of the recursive residuals and plots the cumulative sum together with the 5% critical lines over time. CUSUM test finds parameter instability if the cumulative sum goes outside the area between the two critical lines. The CUSUMSQ employs the squared recursive residuals. It is more useful in situations where the departure from the constancy of the regression coefficients is haphazard and sudden.

Discussion on Empirical Results

Summary Statistics

Data on macro-economic variables ($\ln M_t$, $\ln Y_t$, $\ln P^m_t$, $\ln P^d_t$ and $\ln R_t$)used in the aggregate import model for the 1970-2006 period are shown in Appendix1(table 6) as are theirmeans, standard deviations (SD), coefficient of variations (CV), minimum values, maximum values, skewness, and kurtosis.

COMESA Macroeconomic Time Series

To set the stage, five annual macroeconomic data are plotted on semi logarithmic graphs for the period under consideration. We use the realization to draw inferences about the underlying stochastic process. Figure 1 is a plot of $\ln M_t$, $\ln Y_t$ and $\ln R_t$ while figure 2 represents $\ln P_t^m$, $\ln P_t^d$ of the time series in levels. These series seem to be trending upwards, although the trend is not smooth especially in the foreign reserves.The series tend to depict a non-stationary pattern.

Unit Roots Tests

The ARDL approach to cointegration theoretically does not require prior testing of the series for unit roots. However, some recent empirical studies have indicated that testing for unit root is necessary to avoid the problem of spurious results (Shrestha and Chowdhury, 2005; and Jalil et al, 2008).This is to ensure that the variables are not I(2) stationary. According to Ouattara (2004) in the presence of I(2) variables the computed F-statistics provided by Pesaran et al. (2001) are not valid because the bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variables is integrated of order 2 or beyond.

The DF, ADF, PP and DF-GLS unit root tests were conducted on both in levels and first-differences for all the five variables. DF-GLS performs a modified Dickey-Fuller $t-$test for a unit root in which the series has been transformed by a generalized least-squares regression. This study used the critical values of the non-standard dickey-fuller unit root distribution for testing $\phi = 1$ rather than the standard normal distribution ($t - test$).

Tables 1, 2 and appendix 2 (table 8)show summarized results from of the standard Augmented Dickey-Fuller (ADF) (Said and Dickey 1984), Phillips and Perron(1988) and DF-GLS unit root tests respectively where a unit root null hypothesis is tested against a stationary alternative.

The results indicate that for all DF-ADF, PP and DF-GLS unit root tests, the null hypothesis of the presence of a unit root for all the variables in levels is upheld.However, when taking their first differences, all the variables display stationarity in the three tests. A time series is said to be stationary if there is no systematic change in mean (no trend), if there is no systematic change in variance and if strictly periodic variations have been removed. It can be summarized that all variables in this study are non-stationary at level form (they contain a single unit root) but stationary at first difference. They are I(1) and their first differences are I(0). Empirically, $\ln M_t$, $\ln Y_t$, $\ln P_t^m$, $\ln P_t^d$, and $\ln R_t$ are integrated of order 1.

95% critical value for the augmented Dickey-Fuller statistic (with an intercept but not a trend) and (an intercept and a linear trend) are -2.9499 and -3.5426 respectively.

Time series plots for variablesin first difference are shown in figures 3 and4. Notice how the series at the differences seem to have a relatively constant mean and do not show any trend. This type of pattern is generally an additional confirmation that these series is stationary

Bounds Tests for Cointegration

The analyzed bound test on the model is transformed into an interpretable form presented in table 3. This table reports the results of the calculated F- statistics for each variable considered as a dependent variable (normalized) in the ARDL-OLS regressions. In this procedure, OLS regression for the first differences in the first part of equation (7) were first estimated followed by a test for the joint significance of the parameters of lagged level variables when added to the first regression. According to Pesaran and Pesaran (1997, p.305), "OLS regression in first differences are of no direct interest" to bounds cointegration test. The F-statistic tests the joint analysis that the coefficients of the lagged level variables are zero (i.e. there exists no long-run relationship between them).

The calculated F-statistics $F_{\ln m_{t-1}}(\ln M_{t-1} / \ln Y_{t-1}, \ln P_{t-1}^{m}, \ln P_{t-1}^{d}, \ln R_{t-1}) =$ 4.5186is higher than the upper bounds critical value of 3.805 at the 5 percent significant level. Therefore, the null hypothesis $H_0 : \psi_1 = \psi_2 = \psi_3 = \psi_4 = \psi_5 = 0$) of no cointegration relationship was rejected and accepted alternative hypothesis; $H_1 : \psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq \psi_5 \neq 0$ that indicates that aggregate import demand and its determinants are cointegrated at 5 percent significant level. When the regression was normalized on $F_{\ln R_{t-1}}(\ln R_{t-1} / \ln Y_{t-1}, \ln P_{t-1}^{m}, \ln P_{t-1}^{d}, \ln M_{t-1})$, the computed F-statistics = 3.5211 was inconclusive at 1 and 5% significant level. Similarly, the computed F-statistics for the other variables suggest either an inconclusive or no cointegrating relationships at 1 or 5 percent significant level. This results shows that there is one cointegrating relationship. Based on the import demand theory, real aggregate import $(\ln M_t)$ remains as the regressand.

Having confirmed that aggregate import demand is cointegrated with its determinants,long run coefficients are estimated using autoregressive distributed lag (ARDL) single equation estimation method.

*Static Long-R*un Coefficients

The optimal lag length of 4 for the ARDL model is chosen using SBIC and estimated Equation (8) and got obtained the following ARDL (3,4,3,1,0,2)specification. The results obtained by normalizing real aggregate import $(\ln M_t)$ in the long run are reported in table 4

Thus estimates for equation (8) from table 4is written as follows:

$$\ln M_t = -8.7781 + 1.6532 * \ln Y_t + 0.27513 * \ln P_t^m - 0.58712 * \ln P_t^d + 0.05371 \ln R_t + 0.30806 D$$

t (-5.3895) (11.5437) (4.4564) (-6.0524) (0.94676) (5.8566)....(4.)

The regression fit remarkably well (adjusted R-squared of 0.99) and pass the iagnostic tests against serial correlation, non-normality, heteroscedasticity in the error term and functional-form misspecification.

This results show that elasticity estimates of real GDP as major determinant have significant impact on COMESA's aggregate imports in the long-run.The positive elasticity estimate of GDP in the regression equation indicates that an increase in income leads to increase in imports in long run and vice versa. Its numerical magnitude of 1.65 leads us to conclude safely that income elasticity is greater than unity and is line with Goldstein-khan range (1.0, 2.0) for typical income elasticity (Goldstein and Khan 1985). The findings are in contrary to the belief that developing economies have low income elasticity. A 1% increase in of gross domestic product (GDP) leads to approximate increase of 1.65 in aggregate imports, ceteris paribus. Thus COMESA's imports are highly responsive to income with the highest coefficient among other determinants. The results suggest that increased growth will likely result in a substantial increase in aggregate imports in the long run. This shows that income increases are likely to be reflected in higher consumption in COMESA member countries and given the limited range of consumption and investment goods produced domestically, the stronger demand is likely to translate into higher aggregate imports. Thus there a potential degree of trade-off between economic growth and the trade balance which may worsen balance of payments with high economic growth in some member countries.

The long-run coefficient for the price of domestically produced goods was the second largest with a value of -0.59. It shows the expected sign is consistent with other previous studies and is statistically significant at 1% level. It is therefore a determinant for COMESA's aggregate import demand in the long run. The sign show an inverse relationshipbetweenprice of domestically produced goods and aggregate imports in the long run. A 1% increase may lead to a decline of goods and services by 0.6%. The low coefficient indicates that the aggregate imports are less inelastic with respect domestic price in the long run.

The long-run low coefficient of the unit value of import prices of 0.28 is not in line with the Goldstein-Khan (1985) ranges of (-0.50, -1.00) for typical price elasticity. Though statically significant at 1 % level, it does not show the expected sign. The response of aggregate imports to change in import prices is small and inelastic.The positive sign is a little counter- intuitive. The policy to promote import may have distorted the importing behaviour and contributed to the positive unit price in the aggregate import demand estimation for COMESA. It also important to note that unit values are not price indices since their changes may be due to price and (compositional) quantity changes and hence a potential bias in a unit value index. However, they are used in economic analysis by many countries as surrogates for price indices and there is no distinct conceptually useful area of analysis for which they are designed and solely used.

The consistency among the different cointegration techniques that there is a unique cointegrating relationship among the variables in the COMESA import demand function signified the relevance of including foreign exchange reserves. Foreign exchange reserves as an explanatory variable indicated the strictness of import control. The introduction of this variable in the specification model increased the fit as adjusted $(\overline{R^2})$ increased to 0. 99. The significance foreign exchange reserves were expected to increase the flow of quantities into COMESA countries. This variable has the expected positive sign of 0.05 but statistically insignificant. This suggests that COMESA's aggregate imports are not responsive to foreign exchange reserves.

The policy dummy variable (1970-1991 D=0, 1992-2006 D=1), capturing the effect of import liberalization on import quantity has emerged as significant determinant of the import demand function for COMESA. It has a positive coefficient of 0.31 and significant at 1% level. Thus the trade reform exercise of liberalization since 1992 has a significant effect on the demand for aggregate imports.

Error Correction Representation and Short-run Dynamics

After estimating long run coefficients, equation is estimated to determine, was imperative to test for the short run adjustment of aggregate import demand to its long run equilibrium. The Error Correction Model (ECM) was applied to estimate the short run elasticities and information about the long run speed of adjustment. It explains the short run discrepancy from long run behaviour in the adjustment processes. This analysis followed Hendry's (1995) general to specific modeling approach guided by the short span of data of 37 years and used of SBIC with maximum lag order of 4 for conditional ARDL-VECM. In the process of further analyzing equation (d) and gradually eliminate insignificant variable(s), the following model is found to fit the data best for short run dynamics in table5.

The estimated coefficient of the error correction ECM_{t-1} (-0.66)indicate a rapid speed of adjusted to equilibrium, while 1% statistical significance with the expected negative sign is an indication and a feature necessary for model stability. This suggests the validity of the long run equilibrium relationship among the variables in equation (3.33). Diagnostics test statistics show no evidence of misspecification of functional form, no serial correlation, nor any problem of heteroscedasticity. The adjusted ($\overline{R^2}$) of 0.83560 explains the strength of the relationship in the model. The size of the error correction term (ECM_{t-1}I(0)), which is explanatory power of the ECM model, indicates the speed of adjustment of any equilibrium towards a long-run state. This coefficient suggests that the convergence to long run equilibrium after short run deviation is equal to 0.656 which is a high adjustment process. In other words, the system corrects its previous year period's disequilibrium by 66% a year.

A basic assumption in the long run is that importers are always on their demand schedules such that demand for imports always equals the actual level of imports. However, it is generally recognized that imports do not immediately adjust to their long run equilibrium level following a change in any of their determinants (See Min et al, 2002 and rimpong and Oteng-Abayie 2006). Factors such as the costs of adjustment, delivery lags, etc., cause the slow adjustment by economic agents to the changes in the determinants of import demand. Thus, after long run analysis, it was imperative to test for the short run adjustment of import demand to its long run equilibrium. The presence of a cointegration between imports and its determinants provides support for the estimation of a short-run dynamic model for import demand.

In the estimated model , Real GDP, real GDP (lagged one and two years), real aggregate imports (lagged one year), and the dummy variable capturing the effect of import liberalization on import quantity have emerged as significant determinants of the import demand function for COMESA.

The most prominent factor determining aggregate imports in the short-run appears to be domestic income. The coefficient on the real GDP term of 0.93 is close to one indicating that in the short run imports have grown close to one-for-one with output growth in the COMESA economy. A one percent increase in GDP would cause imports to increase by around 0.93 percent, confirming the pace of domestic demand as a very important factor. This is in line with various studies (Frimpong and Oteng-Abayie (2006), which have shown domestic activity to be the principal determinant of imports in other countries. The value of income elasticity of demand for imports lagged one and two years is greater than unity (1.68 and 1.56 in the model), implying that the demand for imports increases more than proportionately to the increase in real aggregate imports. The coefficient estimate of the dummy variable, capturing the effect of import liberalization policy, is low (0.097) and is statistically significant above 5% per cent level. It was found to be significant both in long-run and short run.

Serial correlation refers to the LM statistic that tests the null hypothesis of no residual serial correlation against the alternative hypothesis of serial correlation of order 1. Functional form refers to the regression specification error test (RESET) which tests whether the correct functional form is chosen, i.e., testing the null hypothesis that the error term is normally distributed with, the Jarque-Bera test against the alternative hypotheses that the error term is not normally distributed. Heteroscedasticity refers to the LM statistic that tests the null hypothesis of homoscedasticity against the alternative hypothesis of heteroscedasticity.

Stability Test

Structural stability of aggregate import demand function is very important for the effectiveness of trade policy.In stability test, we see whether the estimated aggregate import demand function has shifted or not over the time period included in the sample of the study. We applied CUSUM and CUSUM of Squares (Brown, Durbin and Evans, 1975) Tests and Recursive coefficients to establish the stability of the import demand function. The CUSUM test is based on the cumulative sum of the recursive residuals.Figure5 shows that aggregate import demand function is stable between 1970 and 2006 because the cumulative sum does not go outside the 5% two critical lines. The CUSUM of Squares Test (Brown, Durbin and Evans, 1975) is based on the test statistic.

For CUSUMSQ test, figure 6 indicatesthat residual variance is stable over the sample period because cumulative sum of squares line does not go outside the 5% critical lines.The Recursive Coefficient test enables us to trace the evolution of estimates for any coefficient as more and more of the sample data are used in the estimation. In this test two standard error bands are plotted around the estimated coefficients. If the coefficient displays significant variation as more data is added to the estimating equation, it is a strong indication of instability. Figure 7 consists of graphs of each recursive coefficient estimates (and a 95-percent confidence interval, i.e., a two-standard error band)over the time period included in the sample of the study. Visual examination of the graphs shows that allthe estimated coefficients in the aggregate imports demand function are stable

Conclusion

In this study we employed the recently - developed bounds testing (ARDL) approach (proposed by Pesaran et al. (2001)) to cointegration to examine the long-run and short run relationships between the demand for aggregate imports and it's determinants for COMESA over the period 1970-2006.The bounds test results suggest that there is a cointegrating relationship between import demand and its determinants. This is further confirmed by the negative(-0.66) and statistically significant coefficient of the lagged error correction term EC_{t-1} in the short run dynamic model. The coefficient also suggests a fast adjustment process. The dominance of the three regressors, the real GDP, price of domestically produced goods and the policy dummy found to be the major determinants of COMESA aggregate import demand with the $\overline{R}^2 = 83.6\%$ calls for distinct policy prescriptions relating

COMESA over different time horizons. In thelong run, GDP has the highest influence on aggregate import demand in COMESA, followed by prices of domestically produced goods, the policy dummy variable and unit value import prices respectively.

Table.1 DF and ADF Unit Root Test for Stationarity

		DF		ADF(1)		Inference
Variables	Level/first difference	with Intercept but Without Trend	With Intercept and Linear Trend	with Intercept but Without Trend	With Intercept and Linear Trend	
$\ln M_t$	level	0.12324	-1.1404	-0.20059	-1.8143	I(1)
	First Diff.	-4.4537	-4.4041	-4.8215	-4.7830	I(0)
$\ln Y_t$	level	-0.54086	-1.8871	-0.51436	-1.9460	I(1)
	First Diff.	-5.9038	-5.8377	-4.3467	-4.3236	I (0)
$\ln P_t^m$	level	-4.1638	-3.1995	-3.1261	-3.2851	I(1)
	First Diff.	-2.8135	-3.0264	-3.3811	-3.8487	I(0)
$\ln P_t^d$	level	-1.5861	-0.87234	-1.7775	-0.29748	I(1)
	First Diff.	-7.0637	-7.7311	-4.6121	-5.3763	I(0)
$\ln R_t$	level	-0.10575	-1.4575	-0.41973	-1.9579	I(1)
	First Diff.	-4.0040	-3.9557	-3.8350	-3.8055	I(0)

Table.2 Phillips-Perron Unit Root Test for Stationarity

Variables	Level/first difference	Intercept	p-value	Intercept with trend	p-value	Inference
$\ln M_t$	level	0.361	0.9800	-1.270	0.8951	I(1)
	First Diff.	-4.380	0.0003*	-4.367	0.0025*	I(0)
$\ln Y_t$	level	0.748	0.9908	-3.335	0.0606**	I(1)
	First Diff.	-5.113	0.0000*	-5.224	0.0001*	I (0)
$\ln P_t^m$	level	-3.345	0.0130*	-2.534	0.3111	I(1)
	First Diff.	-2.992	0.0357**	-3.290	0.0680**	I(0)
$\ln P_t^d$	level	-1.471	0.5477	-0.709	0.9725	I(1)
	First Diff.	-2.992	0.0357**	-3.290	0.0680**	I(0)
$\ln R_t$	level	0.145	0.9690	-2.123	0.5331	I(1)
	First Diff.	-4.176	0.0007*	-4.218	0.0042*	I(0)

* and ** shows the level of significance at 1% and 5% respectively.

Notes:

Null hypothesis: The variable has a unit root.
The critical values of PP tests with intercepts and with trend and intercept at 1% 5% and 10% levels of significance are: -3.675, -2.969 , -2.617, and -4.279, -3.556, -3.214 respectively. This are Mackinnon critical values for rejection of hypothesis of a unit root k =1

Table.3 Results from ARDL Bounds Test for Cointegration

Regressand	SBIC lags	F-Statistic	Inference
$F_{\ln m_{t-1}}(\ln M_{t-1} / \ln Y_{t-1}, \ln P^m_{t-1}, \ln P^d_{t-1}, \ln R_{t-1})$	2	4.5186	Cointegration
$F_{\ln Y_{t-1}}(\ln Y_{t-1} / \ln M_{t-1}, \ln P^m_{t-1}, \ln P^d_{t-1}, \ln R_{t-1})$	2	1.3292	No cointegration
$F_{\ln p^m_{t-1}}(\ln P^m_{t-1} / \ln Y_{t-1}, \ln M_{t-1}, \ln P^d_{t-1}, \ln R_{t-1})$	2	2.6934	Inconclusive
$F_{\ln P^d_{t-1}}(\ln P^d_{t-1} / \ln Y_{t-1}, \ln P^m_{t-1}, \ln M_{t-1}, \ln R_{t-1})$	2	1.9809	No cointegration
$F_{\ln R_{t-1}}(\ln R_{t-1} / \ln Y_{t-1}, \ln P^m_{t-1}, \ln P^d_{t-1}, \ln M_{t-1})$	2	3.5211	No Cointegration

Notes: Asymptotic critical values bounds test are obtained from Microfit 4.0, Windows version publication (Pesaran and Pesaran, 1997 p.478), table F in appendix C, Case II: intercept and no trend for $K = 5$.
Lower bound I(0) = 2.649 and Upper bound I(1) = 3.805 at 5 % significance level while Lower bound I(0) = 3.516 and Upper bound I(1) = 4.781 at 1% significance level
i.e., 5% [2.649, 3.805], 1% [3.516, 4.781].
K = Number of lagged regressors.

Results from Bounds Tests on Equation (7)

Table.4 Estimated Long Run Coefficients using the ARDL Approach

Regressor	Coefficient	Standard Error	T-Ratio	T-Prob.
$\ln Y_t$	1.6532*	0.14321	11.5437	0.000
$\ln P^m_t$	0.27518*	0.061749	4.4564	0.001
$\ln P^d_t$	-0.58712*	0.097006	-6.0524	0.001
$\ln R_t$	0.05371	0.05673	0.94676	0.360
D	0.30806*	0.0526	5.8566	0.001
C	-8.7781*	1.6288	-5.3895	0.001
R-squared	0. 99709	Mean dependent var	10.6485	
Adjusted R-squared	0. 99336	S.D. dependent var	0. 26944	
S.E. of regression	0. 021956	Akaike info criterion	74.3398	
Residual Sum of Squares	0. 006749	Schwarz criterion	60.1230	
Log likelihood	93.3398	Durbin-Watson stat	2.3609	
Note: *,**, ***imply significant at the 1,5 and 10 percent levels respectively.				
Diagnostic Tests				
Test Statistics		LM statistic Version	F statistic Version	
Serial Correlation		0.45705 [0.499]	0.33078 [0.570]	
Functional Form		0.9728E-3 [0.975]	0.6948E-3 [0.979]	
Normality		1.7909 [0.408]	Not applicable	
Heteroscedasticity		0.71713 [0.397]	0.69030 [0.412]	

Notes:

Serial correlation refers to the LM and F statistic that tests the null hypothesis of no residual serial correlation against the alternative hypothesis of serial correlation of order 1.
Functional form refers to the regression specification error test (RESET) which tests whether the correct functional form is chosen, i.e., testing the null hypothesis that the error term is normally distributed with, the Jarque-Bera test against the alternative hypotheses that the error term is not normally distributed.
Heteroscedasticity refers to the LM and F statistic that tests the null hypothesis of homoscedasticity against the alternative hypothesis of heteroscedasticity.
The p-values are given in parenthesis. The symbols *, ** and*** denote significance at 1, 5 and 10% levels respectively.

ARDL(3,4,3,1,0,2) selected based on Schwarz Bayesian Criterion. The regressand is $\ln M_t$

Table.5 Error Correction Representations for the selected ARDL for Dynamic Import Demand Model of COMESA: Import as Regressand ($\Delta \ln M_t$)

Regressor	Coefficient	Standard Error	T-Ratio	T-Prob.
$\Delta \ln M_{t-1}$	0.33317*	0.12332	2.7017	0.015
$\Delta \ln M_{t-2}$	-0.40381*	0.13244	-3.049	0.007
$\Delta \ln Y_t$	0.92849**	0.38166	2.4328	0.026
$\Delta \ln Y_{t-1}$	1.6804*	0.41467	4.0523	0.001
$\Delta \ln Y_{t-2}$	1.5647*	0.41603	3.7611	0.000
$\Delta \ln P_t^m$	0.20557**	0.10743	1.9136	0.072
$\Delta \ln P_t^d$	0.010591	0.068708	0.15414	0.879
$\Delta \ln R_t$	0.035252	0.300031	1.1739	0.256
ΔD	0.097103**	0.042084	2.3074	0.033
ΔC	-5.7615*	1.299	-4.4355	0.000
ecm_{t-1}	-0.65635*	0.18107	-3.6248	0.002
$R^2 =$ 0.92807	$\overline{R}^2 =$ 0.83560	DW-statistic = 2.3609		
Serial correlation	1.81(0.18)			
Functional Form	0.27(0.60)			
Normality	6.30(0.043)			
Heteroscedas ticity	2.67(0.10)			

$$ecm = \ln M_t - 1.65632 \ln Y_t - 0.27518 \ln P_t^m + 0.58712 \ln P_t^m - 0.053710 \ln R_t + 0.30806D + 8.7781C$$

Notes: * Indicates significance at 1%, while ** indicate significance at 5%

Table.6 Import Orientation Ratio within COMESA Region, 1987-1996

Year	Imports, constant price (2000 $ millions	GDP, constant prices(2000 $ millions)	Imports as % GDP
1987	33992.94	125068.64	27.18
1988	35710.56	129843.27	27.50
1989	36131.23	134822.67	26.80
1990	36464.27	139640.20	26.11
1991	36602.95	140678.12	26.02
1992	38463.95	142403.94	27.01
1993	40116.03	143498.58	27.96
1994	42462.82	147007.44	28.88
1995	44438.58	153759.54	28.90
1996	45911.02	162506.96	28.25
	Periodic Averages		
1987-1991	35780.39	134010.58	26.72
1992-1996	42278.48	149835.29	28.20

Table.7 Import Penetration Ratio in COMESA region, 1987-1996

Year	Imports, constant price (2000 $ millions	Aggregation consumption constant prices (2000 $ millions)	Imports as % of aggregation consumption
1987	33992.94	99215.98	34.26
1988	35710.56	103351.30	34.55
1989	36131.23	106528.00	33.92
1990	36464.27	115157.80	31.66
1991	36602.95	119569.10	30.61
1992	38463.95	115383.30	33.34
1993	40116.03	122657.80	32.71
1994	42462.82	126156.40	33.66
1995	44438.58	131356.20	33.83
1996	45911.02	137088.10	33.49
	Periodic Averages		
1987-1991	35780.39	108764.44	33.00
1992-1996	42278.48	126528.36	33.40

Source: African Development Indicators, World Bank, Statistical abstracts, Development plans, International Financial Statistics (IFS), COMESA Banks Statistical Bulletin

Table.8 Summary Statistics of Variables Used

Variable	Description	Mean	SD	CV	Min.	Max.	Skewness	Kurtosis
$\ln M_t$	Real gross domestic product	10.5835	0.3169	33.3970	10.0344	11.2559	0.2329	-0.3129
$\ln Y_t$	Real quantity of aggregate imports	11.7287	0.4036	29.0602	11.0292	12.4362	-0.1099	-1.0194
$\ln P_t^m$	Unit value of import prices	4.4550	0.4092	10.8871	3.3396	4.9328	-1.6083	1.7601
$\ln P_t^d$	Price index of domestically produced goods	3.4333	1.0947	3.1363	1.6107	4.8858	-0.3079	-1.3319
$\ln R_t$	Foreign exchange reserves	8.6924	1.2062	7.2064	6.9136	10.7514	0.1995	-1.6282

Source: Authors' calculation based on African Development Indicators and International Financial Statistics (various issues)

Table.9 DF- GLS Unit Root Test

Variables	Level/first difference	Intercept	Intercept with trend	Inference
$\ln M_t$	level	0.512	-1.950	I(1)
	First Diff.	-4.667	-4.933	I(0)
$\ln Y_t$	level	0.391	-2.288	I(1)
	First Diff.	-4.258	-4.502	I (0)
$\ln P_t^m$	level	-0.773	-2.154	I(1)
	First Diff.	-3.407	-3.731	I(0)
$\ln P_t^d$	level	0.444	-0.861	I(1)
	First Diff.	-3.550	-4.379	I(0)
$\ln R_t$	level	0.110	-1.994	I(1)
	First Diff.	-4.160	-4.169	I(0)

Notes: Null hypothesis: The variable has a unit root
DF-GLS unit root test was performed using Stata 11.0
The critical values of DF-GLS tests with intercepts and with trend and intercepts at 1% 5% and 10% levels of significance are: -2.641, -1.950, -1.605 and -3.770, -3.190, -2.890 respectively. These are critical values for rejection of hypothesis of a unit root k =1

Figure.1 In M_t, In Y_t and In R_t, COMESA,1970-2006 (annually)

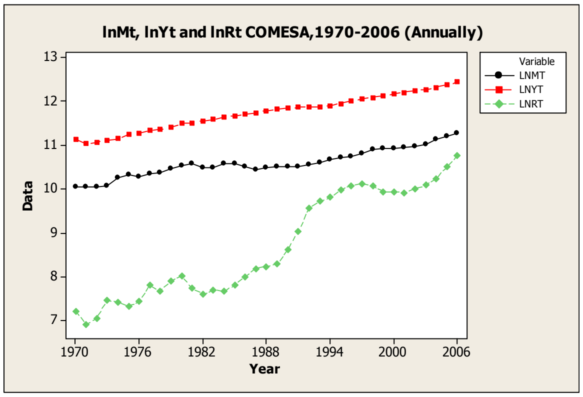


Figure.2 $\ln P_t^m$ and $\ln P_t^d$ **COMESA,1970-2006 (annually).**

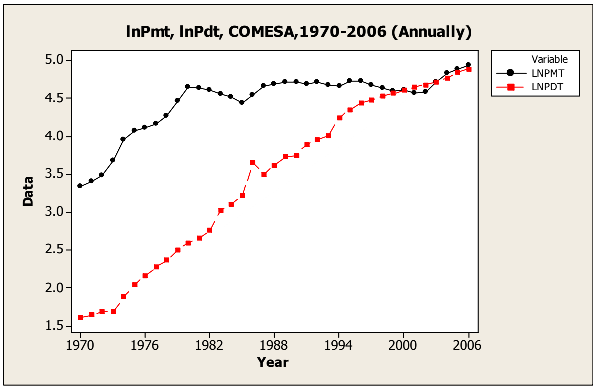


Figure.3 First difference of (log) Levels of the COMESA region forReal quantity of imports ($D\ln M_t$), Real gross domestic product ($D\ln Y_t$) and Foreign exchange reserves ($D\ln R_t$) from 1970-2006

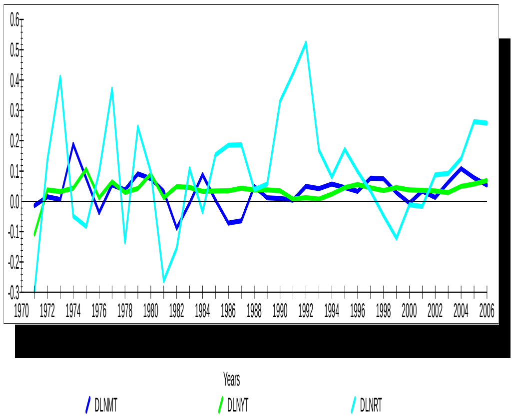


Figure.1 First difference of (log) Levels of the COMESA for price index of domestically produced goods (P_t^d) and unit value of import prices(P_t^M) from 1970 – 2006

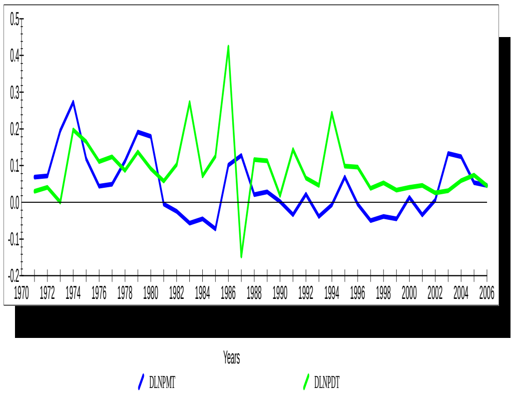


Figure.5 Plot of Cumulative Sum of Recursive Residuals

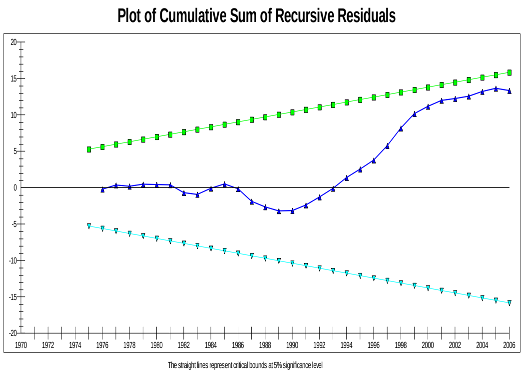


Figure.6 Plot of Cumulative Sum of Squares Recursive Residuals

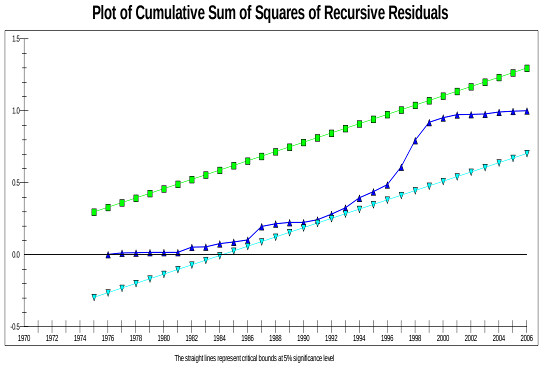
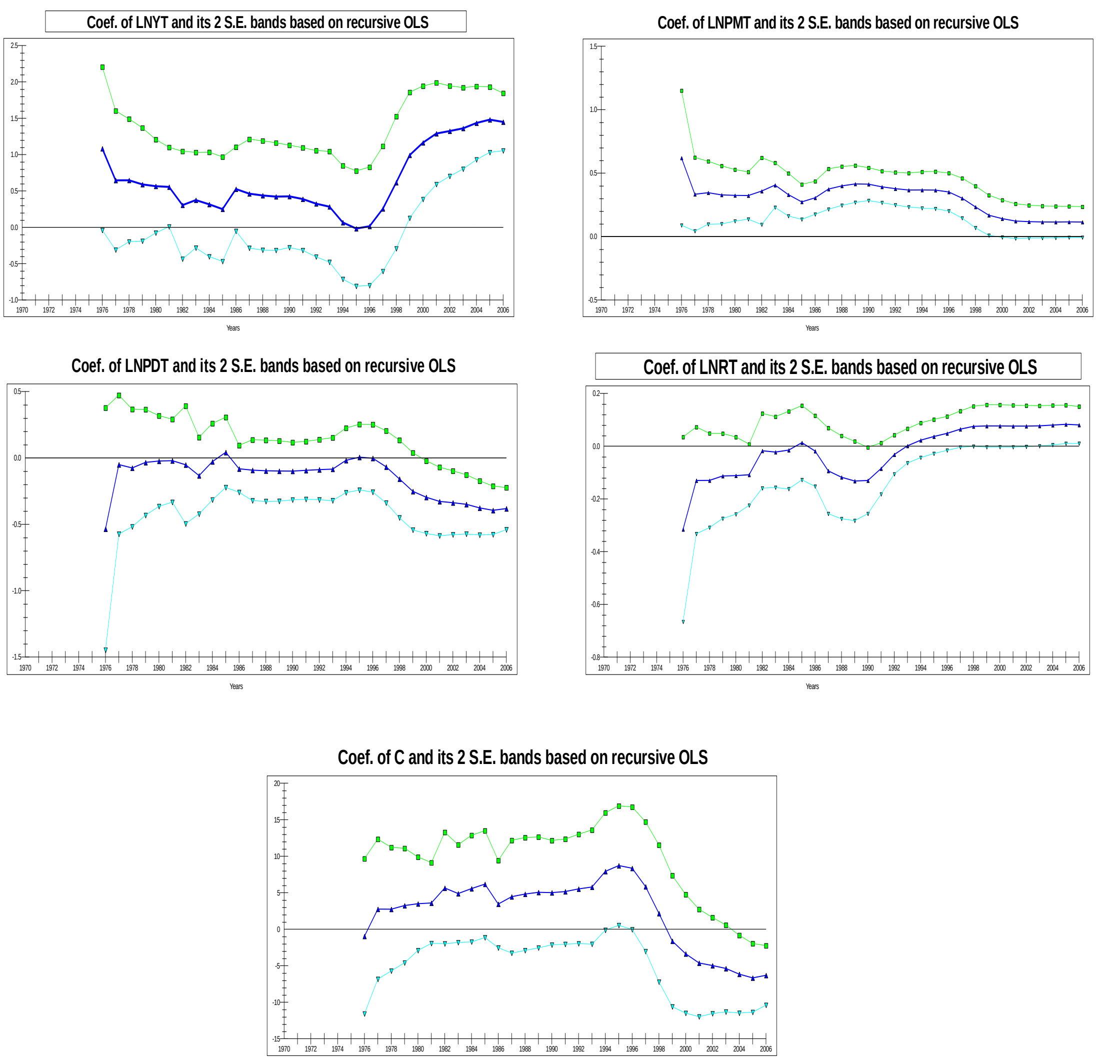


Figure.7



A 1% increase in incomethat induce a 1.65% increase in aggregate imports seems to suggest that the COMESA member countries have the potential to become engines of global economic growth given their economic growth and even faster import growth. This is however likely to have negative impacts on their balance of payments in the long run. In other words, there is likely to be a long-run trade-off between economic growth and balance of payments for member countries if the growth of income is not accompanied by the growth of exports. The Inelasticlow unit value of import price isunusually significantly positive to aggregate imports whereas importation flows are inversely associated with prices of domestically produced goods and services. These findings may imply that trade negotiations that aim to lower or remove tariff and nontariff barriers in COMESA will not necessarily lead to a proportionate rise in the flow of imports and demand of imports is less sensitive to import prices. The policy dummy introduced to measure the effect of structural shift (SAP 1986) in policy and trade liberalization exerts influence on aggregate imports in long run. Influence of foreign exchange reserve is found insignificant to the quantity of aggregate import. It was however positive because as foreign exchange constraint is relaxed, aggregate imports in larger quantities are expected to flow into each COMESA member nations.The short run dynamics suggest that GDP is most prominent factor in determining aggregate imports. The results reveal that real GDP (1.68) lagged one year has the highest influence on aggregate import demand in COMESA region, followed by real GDP (lagged two years) with a coefficient of 1.57. This means the demand of COMESA imports increases more than proportionately to the increase in real GDP. The income estimates are in line with Goldstein-Khan ranges of [$\approx$1.0, 2.0] for typical income elasticity.The POLICY dummy for trade exertslittle but significant influence on imports whereas the domestic price is insignificant. The low coefficient of unit value import price in the short run implies little influence on aggregate import demand. Diagnostic teststatistics show no evidence of misspecification of functional form, no serial correlation, nor any problem of heteroscedasticity.The stability of the aggregate import demand function suggests that the trade policy is appropriate for the COMESA economy. Findings from the study will provide policy-makers further insight on how to improve the trade balance deficit.

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