An Econometric Estimation of the Aggregate Import Demand Function for Sierra Leone

David Bathalomew

Abstract

This paper investigates the behaviour of aggregate import demand for Sierra Leone using times series data for the period 1977-2008. An Autoregressive Distributed Lag (ARDL) modeling process is employed to capture the effect of final consumption expenditure, government expenditure, investment expenditure, export expenditure and relative prices on import demand. The results suggest that there exists a cointegrating relationship between import demand and its determinants. In the long run, government expenditure, exports and consumption expenditures are the major determinant of Sierra Leone's aggregate imports demand. The short run dynamics suggest that consumption and government expenditures have the highest influence on aggregate import demand in Sierra Leone. Relative price is however insignificant in both the long and short runs. These results imply that expenditure-reducing policies are more effective than exchange rate policy in correcting Sierra Leone's trade deficits.

JEL Classification Codes: F10, F41, C22

Keywords: Import Demand, ARDL Approach, Sierra Leone

The contribution of international trade to the growth process of economies has been of interest to many economists. Imports are a key part of international trade and the import of capital goods in particular is vital to stimulating economic growth, especially in countries characterized by limited productive capacity. 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 country’s trade balance; the international transmission of domestic disturbances where import demand elasticities is a crucial link between economies; and the degree to which the external balance constraint affects a country’s growth. A relatively large price elasticity would suggest that exchange rate policies are likely to be favorable in improving a country’s trade or balance of payments situation (Sinha, 1997). Hence over the years, a substantial amount of research has been

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devoted to studying the aggregate demand for imports in developing countries as available evidence suggests that most developing countries have registered persistence unfavorable trade balances over the past three decades (Egwakhide, 1999).

The case of Sierra Leone is not different; the economy has experienced a long period of unfavorable current account deficits. The external sector has been characterized by structural trade deficits since the 1960s. The government, recognizing this adverse situation, embarked on import substitution industrialization (ISI) in the late 60’s as a faster means to achieve economic development. The first few years of the ISI development strategy were successful as the economy grew at an annual average growth rate of nearly 4 percent combined with low inflation and healthy international reserves. However, apart from the creation of infant industries (such as Sierra Leone Brewery, Aureole Tobacco Company, etc) that never grew up, the ISI strategy failed due to fact that the infant industries created were mostly inefficient as they weren't exposed to internationally competition, coupled with the low political will by government officials to support the strategy. Hence, the terms of trade deteriorated and inflation rose significantly from about 21% on average per annum in the 1970s to over 60% in the 1980s.

In 1989, trade reforms were introduced as part of a broad Structure Adjustment Programme (SAP). Despite the liberal trade and exchange rate policies introduced under the SAP, the balance of payments position continued to worsened (Korsu and Baima, 2009). To ease this growing pressure on the balance of payments, the government introduced a broad and outward-looking export-oriented industrial policy that saw the establishment of the Sierra Leone Export and Investment Corporation (SLEDIC) in 1993; which was transformed to the Sierra Leone Investment and Export Promotion Agency (SLIEPA) in 2007. The objective of establishing these institutions was to assist and inform investors and exporters about investment and export opportunities in the country. In spite of the measures taken to bring about pragmatic changes in the trade balance, the declining trend could not be reversed. Rather the trade balance as a percent of GDP deteriorated from an average of -2.24% between 1986-1990 to -3.72% between 1991- 1995. This worsened to -14.33% between 1996- 2000 and then further deteriorated to -18.69% between 2001-2005. The ratio averaged -11.83% between 2006-2008.

Appendix I shows the trends in three key trade ratios that are related to export, import, output and domestic demand. The import orientation ratio (IOR) – measured as a ratio of imports to nominal gross domestic product (GDP) – was moderately high during the 1970s, but peaked in 1981(39.7%) and later adjusted downwardly, before trending upwards again in the 2000s with the highest (43.9%) in 2004. The import penetration rate (IPRate) shows to what degree domestic demand is satisfied by imports, and it is computed as a ratio of imports to domestic demand. The downward trend of the IPRate
in the first half of the 1980s indicated the existence of high import barriers which was prevalent before trade liberalization. This was further confirmed by the export orientation ratio, EOR, (total exports divided by GDP) which was relatively lower in the same period. Both IPRate and EOR were relatively stable during the 1990s. The IPRate however trended upwards while EOR declined in the 2000s.

The trend in IOR is an indication of Sierra Leone’s heavy reliance on imports especially as the country’s productive capacity is limited. The low export performance as indicated by the EOR trend further exacerbates the problem. Not surprisingly therefore, the country has been confronted with the problem of persistent trade deficit over the years. Most economies have implemented macroeconomic stabilisation and adjustment policies to correct current account imbalances. Controlling imports has been shown to be the crucial component of conventional stabilisation policies. Foreign exchange rate adjustment (expenditure switching) and reductions in domestic absorption (expenditure reduction) with appropriate fiscal and monetary measures are two inevitable policy instruments that have been mostly used in curbing import bills.

In order to design a successful import demand management policy, it is crucial to know the marginal propensities of the determinants of import. The aim of this paper is, therefore, to investigate the determinants of aggregate import demand for Sierra Leone. The Autoregressive Distributed Lag (ARDL) methodology is used for the period 1977 to 2008. The study contributes to existing literature by disaggregating real domestic income (final expenditure) into consumption expenditure on private and public sectors, investment expenditure, and exports. This is to enable us investigate the different effects of the various demand components on aggregate import. This is in contrast to the traditional formulation of import demand function which relates the quantity of import demanded to domestic real income.

The rest of the paper is organized as follows: Section 2 discusses the literature, Section 3 describes the model specifications and the econometric methodology used. Section 4 analyses the results and Section 5 concludes the paper.

**LITERATURE REVIEW**

**Theoretical Literature**

The international trade literature suggests three major theories of the import demand function: the theory of comparative advantage, the Keynesian trade multiplier, and the new trade theory (also known as the imperfect competition theory of trade) (See Hong, 1999). The function of income and prices in the determination of trade are explained differently in each of these theories. In the neoclassic trade theory of comparative advantage which is embedded in the Heckscher–Ohlin framework, the focus is on how
the volume and direction of international trade are affected by changes in relative prices, which in turn are explained by differences in factor endowments between countries. Here, the 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 always on a given production frontier.

While the neoclassic import demand function is based on the assumptions of the neoclassic microeconomic consumer behaviour and general equilibrium theory, the Keynesian import demand function on the other hand is based on macroeconomic multiplier analysis. In the Keynesian framework, relative prices are assumed to be rigid and employment is variable. Also, some international capital movements are assumed and they passively adjust to restore the trade balance. The thrust of this framework is the relationship between income and import demand at the aggregate level (and in the short term). The relationship can be defined by a few ratios such as the average and marginal propensity to import and the income elasticity of imports.

The relatively recent school is the new trade theory, or the imperfect competition theory of trade, which focuses on intra-industry trade, a concept that is not well explained by the theory of comparative advantage. The new trade theory explains the effects of economies of scale, product differentiation, and monopolistic competition on international trade. There are three approaches that are usually used in defining the imperfect competitive market effects on international trade: Marshallian, Chamberlinian, and Cournot approaches. The Marshallian approach assumes constant returns at the firms level but increasing returns at the industry level, the Chamberlinian approach on the other hand 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 can be eliminated. The Cournot approach assumes a market with only a few imperfectly competitive firms where each takes each others’ outputs as given. With any one of these three market structures, an opening of international trade will lead to larger market size, decreasing costs and more output and trade. Hence the new trade theory suggests a new link between trade and income as the role of income in determining imports goes beyond that defined in both the neoclassic and in the Keynesian import demand functions, where income only affects purchasing power.

Within these trade theories in the theoretical literature, two models are commonly used in estimating the conventional import demand equation. These are the imperfect substitute model and the perfect substitute model (Xu 2002). The key assumption of the imperfect substitutes model is that neither imports nor exports are perfect substitutes for domestic goods of the representative countries. This model is mostly used in studying imports of manufactured goods and aggregate import. Perfect substitutes model, on the other hand, assumes perfect substitutability between domestic and foreign goods. One of
the key assumptions of the perfect substitutes model is 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 much less attention in the empirical studies than
the imperfect substitutes model (Goldstein and Khan, 1985).

Another important concept in the import demand literature relates to the use of the
disaggregated components of total domestic income to estimate aggregate import
demand as oppose to the traditional approach which uses aggregated domestic income.
The aggregated import demand model implicitly assumes that the import contents of all
components i.e. Consumption (C), Investment (I), and Export (X) in the final expenditure demand are the same. If this assumption does not hold, using a single
demand variable will lead to aggregation bias (Giovanetti, 1989). Frimpong and Oteng-
Abayie (2006) indicated that using the disaggregated import demand model has two
advantages over the traditional aggregated import demand model. By disaggregating the
final demand, the disaggregated model avoids the problem of aggregation bias, and also
unbiasely estimate the separate effects of each component(C, I and X) on import
demand. Additionally, by avoiding aggregation problems, the disaggregated model has
better forecasting powers than the traditional import demand models (Narayan and
Narayan, 2005).

In summary, the three theories i.e. the neoclassic trade theory, the Keynesian trade
multiplier, and the new trade theory assume that in a market economy, import demand
can be fully modelled by income and relative prices. All other factors can be theoretically sub-
modelled within these two factors (see Tang 2003 and Hong 1999).

**Empirical Literature**

A large body of empirical literature exists on the study of import demand function for
both developed and developing 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. 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 disaggregate 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.

Dutta and Ahmed (2001) used the Johansen-Juselius (JJ) cointegration tests to investigate
the behaviour of import demand for India during the period 1971-1995. They concluded
that the aggregate import volume is price-inelastic with elasticity of -0.47; whiles income elasticity of demand for imports was elastic with a coefficient of 1.48. Abbott and Seddighi (1996) also using the Johansen-Juselius (JJ) approach but with a disaggregate model, estimated the import demand function for the UK. They concluded that import demand was cointegrated with its determinants with consumption expenditure having the largest impact on import demand (1.3). 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 disaggregate 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. Ho (2004) though using the same methodology, estimated the import demand function of Macao by testing both the aggregate and disaggregate import demand models. His studies which used quarterly data for the period 1970-1986, observed that cointegrating relationships exist in the disaggregate model whiles no cointegration was found in the aggregate model of Macao’s import demand function. He concluded that the disaggregate model is more appropriate in explaining the import demand of Macao.

Other empirical studies have used the ARDL bounds test approach to investigate import demand functions. For example, Tang and Nair (2002) evaluate the stability of the import demand function in Malaysia using the bounds test. Import demand, income, and relative price are found to be cointegrated. Their study derived long-run income and relative price elasticities of 1.5 per cent and -1.3 per cent, respectively. Tang (2003) estimated China’s import demand for 1970-1999 using the bounds testing approach to cointegration. In the long run, he found expenditure on exports having the biggest correlation with imports (0.51), followed by investment expenditure (0.40). He concluded that the relative price variable had little impact on the demand for imports. Narayan and Narayan (2005) have also applied the bounds testing approach to cointegration to estimate the long-run disaggregated import demand model for Fiji using relative prices, total consumption, investment expenditure, and export expenditure variables over the period 1970 to 2000. Their results revealed a long run cointegration relationship among the variables with import demand elasticities of 0.69 for both export and consumption expenditures and 0.38 for relative prices. With the same methodology, Chang et al (2005) examined the relationships between the demand for imports and it’s determinants for South Korea over the period 1980-2000. Their results show that the volume of imports, income, and relative prices are all cointegrated. The estimated long-run (short-run) elasticities of import demand with respect to income and relative price were 1.86 (0.86) and -0.2 (-0.05), respectively.

Many studies have also been conducted on import demand functions for Sub-Saharan African Countries. Egwaikhide (1999) estimates the determinants of aggregate imports and its components in Nigeria between 1953 and 1989. Using the Engle-Granger two-
step procedure, his results revealed that the variables were cointegrated and the quantitative estimates indicated that foreign exchange earnings, relative prices and real income all significantly determine the behaviour of total imports for Nigeria. 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. He revealed that foreign exchange reserves appeared to be the main determinant of imports. Gumede (2000) examines aggregated and disaggregated import demand for South Africa in a framework of cointegration analysis. Using the two-step Engle–Granger technique, he concluded that income elasticity was much larger than price elasticity. 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.

Frimpong and Oteng-Abayie (2006) studied the behaviour of Ghana’s imports demand during the period 1970-2002 using disaggregated model and the bounds test approach to cointegration. They found cointegration among elements of the import demand relationship. Their study revealed an inelastic import demand for all the expenditure components and relative price. They asserted that in the long-run, investment and exports were the major determinant of in imports in Ghana but in the short run, household and government consumption expenditures were the major determinant of import demand. They claimed that import demand was not very sensitive to price changes. Yue and Constant (2010) examined the disaggregated import demand model for Cote d’Ivoire using annual data for the period 1970-2007. Using the same methodology, they investigated the effects of final consumption expenditure, investment expenditure, export expenditure and relative prices on import demand. They found a long run cointegration relationship between the variables and revealed that there was an inelastic import demand for all the expenditure components and relatives prices. They concluded that in the long run, investment and exports were the main determinant of Cote d’Ivoire imports. Whiles in the short run, all of the components of expenditure were the major determinants of Import demand.

Even though this large body of literature exists on the study of aggregate demand function in both developed and developing countries, no study that examines the causal factors of import demand for Sierra Leone was found. Hence there is a need for an empirical investigation of the determinants of import demand for Sierra Leone.
MODEL SPECIFICATION, ARDL APPROACH AND DATA

Model Specification
The traditional formulation of import demand equation relates the quantity of import demanded to domestic real income and relative prices (ratio of import prices to domestic prices) (Gafar 1988). Theory has suggested two trade models: the imperfect substitutes model and the perfect substitutes model. Perfect substitutes model, on the other side, assumes perfect substitutability between domestic and foreign goods, this assumption implies that each country would be only an exporter or an importer of a traded good but not both. The imperfect substitutes model on the other hand assumes that imports and exports are not perfect substitutes for domestic goods, this ensures that the market is neither filled completely by domestic nor foreign goods when each good is produced under constant (or decreasing) costs. Hence the imperfect substitutes model is widely used in the empirical studies of imports demand.

Standard models of total imports usually include an aggregate demand for imports (M^d), an aggregate supply of imports M^s and an equilibrium condition (M^d = M^s). However, in order to estimate imports by a single demand equation, these models generally assume that the supply elasticities are infinite and thus the import prices can be viewed as exogenously given. Therefore, the basic import demand model within the imperfect substitutes framework is of the form:

\[ M_I = f(Y_n, P^n_d, P^m_t) \]  

Where \( M_I \) is the real import demand of country I, \( Y_n \) is the nominal income, \( P^n_d \) is the import price index in local currency, and \( P^d \) is the price index for domestically produced goods. Due to the possible multicollinearity between the two prices in equation (1) and under the assumption of homogeneity, equation (1) is usually expressed as:

\[ M_I = f(Y, P^m, P^d) \]  

Where \( Y_t \) is real income and \( (P^m/P^d) \) is relative prices which explains why economic agents switch their demand between imports and domestic goods (Carone, 1996). As mentioned earlier in the literature and following formulations by Giovanetti (1989), Tang (2003), Ho (2004), Narayan and Narayan (2005) among others, we divide real domestic income (final expenditure) into consumption expenditure on private and public sectors, investment expenditure, and exports. This enables us to modify equation (2) into a log-linear disaggregate import demand model for Sierra Leone as follows:

\[ \ln{M_I} = \alpha_0 + \alpha_1 \ln{CE_t} + \alpha_2 \ln{GE_t} + \alpha_3 \ln{I_t} + \alpha_4 \ln{X_t} + \alpha_5 \ln{RPP_t} + POLICY + \epsilon \]  

Where \( \ln{M_I} \) is the natural log of real imports of goods and service; \( \ln{CE_t} \) is the natural log of private or household expenditure, \( \ln{GE_t} \) is the natural log of government
expenditures $\text{LnI}_t$ the natural log of the expenditure on investment goods (i.e. gross capital formation including change in inventory); $\text{LnX}_t$ is the natural log of expenditure on total exports of goods and services, $\text{LnRPP}_t$ is the natural log of the relative prices (the ratio of import price index to domestic price index), POLICY is a dummy variable for trade liberalisation and $\epsilon_t$ is the error term, at period $t$. From economic theory, it is expected that the signs of the coefficients $\alpha_1$, $\alpha_2$, $\alpha_3$ and $\alpha_4$ will be positive, while $\alpha_5$ is negative. Equation (3) is expected to capture the separate effects of the various final demand components on import.

### Estimation Procedure

This study utilises the autoregressive distributed lag (ARDL) bounds testing procedure developed by Pesaran, et al. (2001) to examine the cointegration relationship between import demand and its determinants. The ARDL approach has numerous advantages over other cointegration methods. The main advantage of this approach lies in the fact that it can be applied irrespective of whether the variables are $I(0)$ or $I(1)$ (Pesaran and Pesaran 1997). 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 modelling framework (Laurenceson and Chai 2003). Moreover, the ARDL approach is known to have superior small sample properties than that of Johansen and Juselius cointegration technique (see Pesaran and Shin, 1999). Given that our sample size is limited with a total of 32 observations only, this approach will be appropriate. It is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data (Laurenceson and Chai 2003).

The ARDL framework for equation (3) is given as:

$$
\Delta \text{LnM}_t = \alpha_{0t} + \sum_{i=1}^{p} \alpha_{1t} \Delta \text{LnM}_{t-i} + \sum_{i=1}^{p} \alpha_{2t} \Delta \text{LnCE}_{t-i} + \sum_{i=1}^{p} \alpha_{3t} \Delta \text{LnI}_{t-i} + \sum_{i=1}^{p} \alpha_{4t} \Delta \text{LnX}_{t-i} \\
+ \sum_{i=1}^{p} \alpha_{5t} \text{LnRPP}_{t-i} + \beta_{1t} \text{LnRPP}_{t-i} + \beta_{2t} \text{LnI}_{t-i} + \beta_{3t} \text{LnCE}_{t-i} + \beta_{4t} \text{LnI}_{t-i} + \beta_{5t} \text{LnX}_{t-i} + \epsilon_t
$$

(4)

The ARDL model testing procedure starts with conducting the bound test for the null hypothesis of no cointegration $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ against the alternative hypothesis of the existence of cointegration.

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2 From demand theory, increases in import prices reduces demand for imports as imported goods become relatively more expensive while demand for imported goods increase as domestic prices increase. Therefore, it is expected that import price relative to domestic price will be negatively related to real import.
Using an F-test. Two sets of critical values are reported in Narayan (2004); the upper critical bound that assumes that all the series are I(1) and the lower critical bound values assume that the series are all I(0). If the computed F-statistic falls outside the critical bound, a conclusive inference can be made without considering the order of integration of the underlying regressors. For instance, if the F-statistic is higher (lower) than the upper (lower) critical bound, then the null hypothesis of no cointegration is rejected (cannot be rejected). In cases where the F-statistic falls inside the upper and lower bounds, a conclusive inference cannot be made.

After establishing the long-run relationship, the ADRL method obtains the optimal lag length of each variable using the model selection criteria like Schwartz-Bayesian Criteria (SBC) and 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.

When there is a long run relationship between variables, there exists an error correction representation. Therefore, in the next step, the error correction model is estimated. The error correction model result 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. The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

**DATA**

In this study, we use yearly data over the period 1977 – 2008. Following Frimpong and Oteng-Abayie (2006) and Yue and Constant (2010), the index of trading partners’ export price indices is used to proxy import price index for Sierra Leone since data for import price index is not available. All variables are deflated by CPI and are in logs. POLICY is a dummy variable used as a proxy to control for trade liberalization (1989-2008 = 1, 0 otherwise). All the data series used were taken from the International Monetary Fund’s International Financial Statistics (IFS) CD-ROM and the Bank of Sierra Leone. Microfit 4.1 for Windows developed by Pesaran and Pesaran (1999) was used in the estimation procedure.

**EMPIRICAL RESULTS**

**Unit Root 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). The results of the Augmented Dickey-Fuller
(ADF) test are reported in table 1. The results show that real imports of goods and service (Mt), Private or household expenditure (CE), Government expenditures (GE), Expenditure on total exports of goods and services(X) and Relative prices(RPP) are stationary at first difference. However, Investment expenditure (I) is stationary at levels. This result thus reinforces the use of the bounds test to determine cointegrating relationship among the series.

Table 1: ADF Unit Root Test Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Statistic</th>
<th>Lag Length</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept without trend</td>
<td>Intercept with trend</td>
<td></td>
</tr>
<tr>
<td>LM</td>
<td>-1.5721</td>
<td>-1.3202</td>
<td>1</td>
</tr>
<tr>
<td>DLM</td>
<td>-3.4691</td>
<td>-3.6557</td>
<td>1</td>
</tr>
<tr>
<td>LX</td>
<td>-2.0492</td>
<td>-2.2137</td>
<td>1</td>
</tr>
<tr>
<td>DLX</td>
<td>-4.2304</td>
<td>-4.2894</td>
<td>1</td>
</tr>
<tr>
<td>LCE</td>
<td>-1.3847</td>
<td>-1.1217</td>
<td>1</td>
</tr>
<tr>
<td>DLCE</td>
<td>-4.5460</td>
<td>-4.6937</td>
<td>1</td>
</tr>
<tr>
<td>LGE</td>
<td>-0.91769</td>
<td>-0.61191</td>
<td>1</td>
</tr>
<tr>
<td>DLGE</td>
<td>-4.3945</td>
<td>-4.6244</td>
<td>1</td>
</tr>
<tr>
<td>LI</td>
<td>-4.3206</td>
<td>-4.7880</td>
<td>1</td>
</tr>
<tr>
<td>DLI</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LRPP</td>
<td>-1.1453</td>
<td>-2.9842</td>
<td>3</td>
</tr>
<tr>
<td>DLRPP</td>
<td>-7.6300</td>
<td>-6.4252</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Critical Values: without trend = -2.94; with trend = -3.53

Bounds Cointegration Test Results

In order to perform the bounds testing procedure, we estimated equation (4) using the ARDL approach to cointegration. Under the ARDL approach, the calculated F-statistics are compared against the critical values, which are extracted from Narayan (2004). Each variable in our model for equation (3) excluding the POLICY dummy is taken as a dependent variable in the calculation of the F-statistic. Table 2 reports the result of the bounds test. The F-Statistic when import demand is taken as dependent variable is 4.6393, which is higher than the upper bounds critical value of 4.060 at the 5 percent significant level. Therefore, the null hypothesis of no cointegration relationship can be rejected. This indicates that import demand and its determinants are cointegrated. Similarly, when the regression is normalized on private expenditure, there is also evidence of another cointegrating relationship. However, based on the import demand literature discussed, real import is taken as the dependent variable. The computed F-statistics for the other variables suggest either an inconclusive or no cointegrating relationships at the 5 percent significant level.
Table 2: ARDL Bounds Test for Cointegration Results

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>F-Statistic</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LM</td>
<td>4.6393</td>
<td>Cointegration</td>
</tr>
<tr>
<td>LX</td>
<td>3.5971</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>LCE</td>
<td>7.3744</td>
<td>Cointegration</td>
</tr>
<tr>
<td>LGE</td>
<td>0.99099</td>
<td>No cointegration</td>
</tr>
<tr>
<td>DLI</td>
<td>2.7055</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>LRPP</td>
<td>1.8511</td>
<td>No cointegration</td>
</tr>
</tbody>
</table>

Notes: Critical values from the bounds test are obtained from Narayan (2004) - Case II: restricted intercept and no trend, 10% CV [2.293, 3.448], 5% [2.741, 4.060], 1% [3.871, 5.571].

Static Long-run Coefficients

Having established that import demand is cointegrated with its determinants, we now estimate equation (3) for the long run elasticities using the appropriate lag lengths. For our annual data, Pesaran and Shin (1999) suggest a maximum of 2 lags. The estimated model presented here is based on the AIC. The results for the long run elasticities are reported in table 3. The regression fit remarkably well (adjusted R-squared of 0.88) and pass the diagnostic tests against serial correlation, non-normality, heteroscedasticity in the error term and functional-form misspecification. The tests of CUSUM and CUSUMSQ suggest no evidence of structural instability in the parameters during the sample period as the plots (which are presented in appendix II) lie within the 5 percent critical bounds. The result of the specification test supports the use of aggregate import demand function with disaggregated components as determinants.

The elasticity estimates in table 3 indicates clearly that the major determinants of the Sierra Leone’s aggregate imports, in the long run, are government expenditure, exports and consumption expenditures. In particular, government/public expenditure appears to dominate the influence of other macro components of final expenditure in the long run. The results reveal that the elasticity estimate of government expenditure is positive and significant at the 1 percent level. This indicates that in the long run a 1 percent increase in government expenditure increases aggregate import demand by 0.52 percent. A possible explanation for this is the fact that government has over the years subsidized the importation of essential goods such as petroleum products, rice and pharmaceutical products. Government expenditure constitutes a significant proportion of the import bill in Sierra Leone. The significantly positive effect of government expenditure on import is consistent with findings by Ho (2004).

Expenditure on exports is also a determinant for Sierra Leone’s aggregate imports demand in the long run. Its estimated elasticity is 0.23, suggesting that export earnings
may stimulate the importation of goods and services. This result is not surprising given the foreign exchange bottlenecks in the country and hence the tendency for economic agents to utilize export earnings to facilitate the importation of capital goods. A significant proportion of export earnings are derived from the mining sector and few agricultural exports.

The results also suggest that a 1 percent increase in consumption expenditure induces an increase in imports by 0.39 percent. This is attributed to the fact that import of consumable goods has been a key component of Sierra Leone’s imports bill due in part to the country’s limited productive capacity and the changing preferences due to globalisation. The positive sign agrees with the findings by Ho (2004) and Constant and Yue (2010).

However, changes in the price of imports relative to the price of domestically produced goods appear to have no significant effect on imports in the long run. This is however not surprising given a limited domestic productive capacity and hence the heavy reliance on imports to meet domestic demand. Similarly, investment expenditure and POLICY dummy do not exert any significant influence on the demand for imports in the long run.

Table 3: Estimated Long Run Elasticities of Import Demand based on AIC ARDL (2,0,1,0,2,2,0)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.0343</td>
<td>1.2268</td>
<td>-1.6583</td>
</tr>
<tr>
<td>LX</td>
<td>0.23231</td>
<td>0.089498</td>
<td>2.5957**</td>
</tr>
<tr>
<td>LCE</td>
<td>0.39504</td>
<td>0.22252</td>
<td>1.7753*</td>
</tr>
<tr>
<td>LGE</td>
<td>0.51920</td>
<td>0.14212</td>
<td>3.6532***</td>
</tr>
<tr>
<td>LI</td>
<td>0.095450</td>
<td>0.078747</td>
<td>1.2121</td>
</tr>
<tr>
<td>LRPP</td>
<td>0.025446</td>
<td>0.019719</td>
<td>1.2905</td>
</tr>
<tr>
<td>POLICY</td>
<td>0.12782</td>
<td>0.11418</td>
<td>1.1194</td>
</tr>
</tbody>
</table>

Note: ***, **, * imply significant at the 1, 5 and 10 percent levels respectively.

Diagnostic Tests

<table>
<thead>
<tr>
<th></th>
<th>LM Version</th>
<th>F Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>A:Serial Correlation</td>
<td>.16663 [.683]</td>
<td>.088987 [.769]</td>
</tr>
<tr>
<td>B:Functional Form</td>
<td>.095586 [.757]</td>
<td>.050932 [.824]</td>
</tr>
<tr>
<td>C:Normality</td>
<td>.075299 [.963]</td>
<td>Not applicable</td>
</tr>
<tr>
<td>D:Heteroscedasticity</td>
<td>.5329E-3 [.982]</td>
<td>.4996E-3 [.982]</td>
</tr>
</tbody>
</table>
Short-run Dynamics – ARDL (2,0,1,0,2,2,0)

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 Frimpong 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. Hence, it is imperative that we examine the short run adjustment of imports to changes in its determinants. The existence of a cointegrating relationship between imports and its determinants provides support for the estimation of a short-run dynamic model for import demand. The results of the error-correction model are reported in table 4. All the short-run elasticities have the expected signs and are inelastic. The literature postulates that the coefficient of the lagged error correction term should be negative and statistically significant to further confirm the existence of a long-run relationship.

Table 4: Error Correction Representation for the ARDL Import Demand (2,0,1,0,2,2,0)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-1.7991</td>
<td>1.2108</td>
<td>-1.4859</td>
</tr>
<tr>
<td>dLX</td>
<td>0.20545</td>
<td>0.073052</td>
<td>2.8124***</td>
</tr>
<tr>
<td>dLCE</td>
<td>0.55168</td>
<td>0.15868</td>
<td>3.4767***</td>
</tr>
<tr>
<td>dLGE</td>
<td>0.45917</td>
<td>0.11533</td>
<td>3.9812***</td>
</tr>
<tr>
<td>dLI</td>
<td>0.14145</td>
<td>0.051524</td>
<td>2.7453**</td>
</tr>
<tr>
<td>dLI1</td>
<td>0.12536</td>
<td>0.055367</td>
<td>2.2641**</td>
</tr>
<tr>
<td>dLRPP</td>
<td>-0.17394</td>
<td>0.10710</td>
<td>-1.6240</td>
</tr>
<tr>
<td>dLRPP1</td>
<td>0.32929</td>
<td>0.10967</td>
<td>3.0027***</td>
</tr>
<tr>
<td>dPOLICY</td>
<td>0.11304</td>
<td>0.10468</td>
<td>1.0799</td>
</tr>
<tr>
<td>ecm(-1)</td>
<td>-0.88438</td>
<td>0.14047</td>
<td>-6.2960***</td>
</tr>
</tbody>
</table>

Note: ***, **, * imply significant at the 1, 5 and 10 percent levels respectively.

R-Squared 0.93369
R-Bar-Squared 0.88580
S.E. of Regression 0.10007
F-stat. F(10, 21) 25.3465[.000]
Mean of Dependent Variable 0.012917
S.D. of Dependent Variable 0.29614
Residual Sum of Squares 0.18027
Equation Log-likelihood 37.4585
Akaike Info. Criterion 23.4585
Schwarz Bayesian Criterion 13.1984
DW-statistic 2.0572
The coefficient of ECMt-1 is found to be large in magnitude, negative and statistically significant at the 1 percent level. This confirms the existence of a long run relationship between the variables. The coefficient of the lagged ECM term is -0.88438, which suggests a fast adjustment process. This implies that 88 percent of the disequilibrium of the previous year’s shock adjusts back to the long run equilibrium in the current year.

The short run results reinforce the long run results with respect to consumption, government and export expenditures. The magnitude of impact of these expenditure components on the import demand is however different. In the short run, the results reveal that consumption expenditure has the highest influence on aggregate import demand in Sierra Leone, followed by government and exports expenditures respectively. The result implies that a 1 percent increase in final consumption expenditures will lead to a 0.55 percent increase in aggregate import bills. This result agrees with findings by Frimpong and Oteng-Abayie (2006). Also, a 1 percent increase in government and exports expenditures will lead to a 0.45 percent and 0.20 percent increases in aggregate import demand respectively. The positive relationship between government and exports expenditures and imports is consistent with findings by Ho (2004).

Unlike the long run, investment expenditure and its one period lag are statistically significant at the 5 percent level. Relative price has the expected negative sign but statistically insignificant. Its one period lag is however significant at the 1 percent level but with the wrong sign. The POLICY dummy is also not significant in the short run.

CONCLUSION AND POLICY RECOMMENDATIONS

The study has examined the aggregate import demand function for Sierra Leone. The Autoregressive Distributed Lag (ARDL) modeling technique is adopted to examine the relationship between the aggregate import demand and disaggregated components of final demand and relative price for the period 1977 to 2008. The bounds test results suggest that there is a cointegrating relationship between import demand and its determinants. This is further confirmed by the negative and statistically significant coefficient of the lagged error correction term in the short run dynamic model. The coefficient also suggests a fast adjustment process.

The short run dynamics suggest that consumption expenditure has the highest influence on aggregate import demand in Sierra Leone, followed by government, exports and investment expenditures respectively. Even though relative price has the expected negative sign, it is statistically insignificant. However, a one period lag of this variable is significant but positive. The POLICY dummy for trade liberalisation does not seem to exert any influence on imports.
Government expenditure, exports and consumption expenditures are the major determinant of Sierra Leone’s aggregate imports demand in the long run. On the other hand, relative price and Investment expenditure appear to have no important effect on imports in the long run.

This dominant effect of the expenditure components on import demand suggest the following: firstly, that the Sierra Leone government expenditure in the form of huge subsidies provided for the importation of key commodities constitutes a significant proportion of the country’s import bill; secondly, that given the limited availability of foreign exchange in the country, earnings from exports especially in the mining and agricultural sectors have been used for the importation of capital goods and finally, that the country’s limited productive capacity has led to the importation of consumable goods that otherwise could be produced locally.

For policy implication therefore, the results of this study suggest that fiscal policies designed to influence the pattern of expenditure on the final demand components, particularly consumption (private) and government are essential to reduce the import of goods and hence ameliorate external imbalance. The large influence of the demand components on import demand also reveals the ineffectiveness of exchange rate policy in influencing import demand. The implication is that expenditure-reducing policies are more effective than exchange rate policy in correcting Sierra Leone’s trade deficits. Government should thus create the enabling environment to boost domestic productive capacity in order to reduce imports especially on consumer goods such as rice, which can be produced locally. Ultimately, this policy will result in the elimination of government subsidies on these consumables and hence reduce the import bill. Also, by increasing domestic capacity, the export base will be broadened, which is likely to increase export receipts and hence reduce the trade deficits.
REFERENCES


Appendix I: Key trade ratios of Sierra Leone

Key Trade Ratios 1970-2008

(%)

Year


IOR IPRate EOR