The paper estimates the long-run elasticities of import demand in Jordan over the period 1980-2004. The Engle-Granger test of co-integration, fails to find favor of a long-run relationship among variables associated with an import demand. Furthermore, the recently prescribed Stock-Watson Dynamic OLS (1993) procedure, is employed to derive long-run relative price and income elasticities. Results reveal that both relative price and income elasticity was -0.55 and 0.84 respectively which affect import demand significantly. Interestingly, the findings have implications explaining Jordanian import demand, in the long-run.

JEL Classification: F14, C51
Keywords: Import, Elasticity, Long run, dynamic OLS, Jordan

1. Introduction

Import demand behaviour has been an area of typical concern in the international macroeconomic literature for several years. (Kohli, 1991, Wilkinson (1992) and Margues (1994). Jordan, is a small developing country, has been characterized by a high import/GDP ratio; accompanied with a weak productive sector and relatively stagnant export sector. In addition to this, during the last few years, the development process in Jordan has been constrained by increasing foreign debt and declining foreign exchange resources (due to the decline in the inflow of Arab aid and workers remittances). The paper is organized as 5 sections: Section 2 contains the theoretically postulated import demand function. Section 3 discusses the statistical methodology employed. Section 4 discusses the results. Section 5 looks at the short-run Error Correction Model (ECM). Section 6 summarizes the findings.

2. Literature Review

An econometric model of the Kenyan economy was constructed by Elliot, et al. (1986). This model describes a small and open economy that is affected by the world credit and commodity market conditions and sensitiveness to world commodity price movements. Imports are disaggregated as petroleum and non-petroleum imports. OLS is applied for the period 1968-80. Since Kenyan exports of refined petroleum products depend on petroleum imports to a great extent, petroleum imports are estimated as a function of exports of refined petroleum products and real GDP. Results indicates that these variables have a positive impact on petroleum imports. The break-down of East African Community is represented by an intercept dummy, which has a negative impact on petroleum imports. In addition, to the study non-petroleum imports are estimated as a function of real GDP, ratio of net foreign assets to real exchange rate and ratio of GDP price deflator to other commodity imports prices. Results indicate that all variables have

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significant positive effects on non-petroleum imports.

The study by Deyak, et al. (1989), considered the stability of the U.S. aggregate and disaggregated import demand functions. These functions are estimated by OLS from 1958:Q4 to 1983:Q4. Import demand is disaggregated by economic class: crude foods, crude materials, manufactured foods, semi-manufactured foods, and finished manufactures. All real import definitions are estimated on the ratio of the import unit index to the US wholesale price index multiplied by the one period lagged value of that ratio; the real GNP multiplied by the one period lagged value of real GNP; one period lagged value of the dependent variable and seasonal dummies. Except for the crude materials, estimated price elasticities have the correct negative sign and they are statistically significant. For the income elasticities, the significant positive sign is estimated again except for the crude materials. The coefficient of the lagged dependent variable is also significantly positive.

Erlat and Erlat (1991) studied performance of Turkish export and import, they used annual data for the period 1967-87. Export supply, export demand and import demand functions are estimated by OLS first, then three equations are estimated as a set of seemingly unrelated regressions. Total volume of imports is regressed on domestic real income, price of imports (including tariffs) divided by domestic prices, real international reserves and one period lagged value of the dependent variable. Two dummies are introduced for the years 1978 and 1979 to explain the structural shift. Foreign exchange (FEX) reserves are found to be the most important variable in explaining import demand. Relative prices, however, have no significant explanatory power on import demand.

Bahmani-Oskooee et al. (1998) examine the import demand functions of 30 countries through the aggregate model by using the Johansen-Juselius (JJ) cointegration tests (Johansen 1988; and Johansen et al. 1990). Annual data is used and the sample period of each individual country is mostly 1960-1992. Fourteen countries are found to contain one cointegrating vector and 12 of them are found to contain two cointegrating vectors. In most cases, the price elasticities and income elasticities are high. However, this paper does not perform the error-correction model (ECM) estimation.

Dutta et al. (2001) use the aggregate import demand function to investigate the import behaviour in India during 1971-1995. Johansen (1988 and 1991) and JJ (Johansen et al. 1990, 1992 and 1994) cointegration tests are employed to obtain the relevant cointegrating vectors. In addition, the respective ECM is estimated by the general-to-specific procedure (Hendry 1995). One cointegrating vector is detected and then incorporated in the ECM. The aggregate import volume is rather price-inelastic with coefficient estimate being -0.47. The value of income elasticity of demand for imports of two-year lag is greater than unity at 1.48, implying that the import demand changes more than proportionately to the changes in real GDP. Moreover, the estimated coefficient of the one-year lagged error-correction term (ECT) is -0.12, which is of correct sign for adjustment in the short run while disequilibrium occurs in the long run. All these key estimated coefficients are statistically significant at 5% level.

Kotan et al. (1999) apply two econometric methodologies to perform the estimations of Turkey’s import demand function during the period 1987Q1-1999Q1. The first estimation uses the Engle-Granger two-step cointegration procedure, which shows that in the long run, income level, nominal currency depreciation rate, inflation rate and FEX reserves significantly affect imports. In the short run, however, inflation and FEX reserves lose their significant impacts on imports. The second methodology estimates
the import demand by using the Bernake-Sims structural Vector Autoregression (VAR) method. It indicates that anticipated and unanticipated changes in the real currency depreciation rate, and unanticipated changes in the income growth, have significant effects on import demand growth.

Mohammad et al. (2000) examine the long-run relationship between Malaysian real imports and the underlying components of final demand expenditure - namely real final consumption expenditure, investment expenditure and exports - and relative prices during 1970-1998 via Johansen multivariate cointegration analysis (Johansen 1988; and Johansen et al. 1990). An ECM is estimated to evaluate the short-run responses of imports to its determinants. Only one cointegrating vector is found and it implies that the partial elasticities of import demand with respect to consumption expenditure, investment expenditure and exports are 0.72, 0.78 and 0.385 respectively. The import price is fairly inelastic (at -0.69). In estimating the ECM, the speed of adjustment implied by the one-period lagged ECT is -0.637, which is quite fast. The specification of the ECM dropped out the effect of final consumption expenditure as its effect is statistically insignificant to imports.

Mohammad et al. (2001) examine the long-run relationship between imports and expenditure components of five ASEAN countries (Malaysia, Indonesia, the Philippines, Singapore and Thailand) through Johansen multivariate cointegration analysis (Johansen 1988; Johansen et al. 1991). Annual data for the period 1968-1998 are used for the countries (except Singapore, with a shorter period 1974-1998). The disaggregate model, in which the final demand expenditure is split up into three major components, is used. The results reveal that import demand is cointegrated with its determinants for all five countries.

Senhadji (1998) derives a structural import demand equation, which is composed of relative price of imports and an activity variable (defined as GDP minus exports), and applies it to 77 countries. The sample period of most countries is 1960-1993. Moreover, the model predicts a unique cointegrating vector for the relevant variables and is estimated both by ordinary least squares (OLS) and by the Phillips-Hansen fully modified (FM) estimator. Only 66 countries with the right signs for the price and income elasticities are reported, and the average price elasticity is close to zero in the short run but slightly higher than one in the long run. The short-run income elasticities are on average less than 0.5, while the long-run income elasticities are close to 1.5.

Metwally (2004) examines the determinants of aggregate imports demand functions in the GCC countries (Bahrain, Kuwait, Oman, Saudi Arabia and the United Arab Emirates). Annual data for the period of all countries is 1967-2001. The aim of this paper is to examine the impact of the fluctuations in oil exports in particular, to analyze the long run relationship between the imports of each GCC countries and the macroeconomic components of final expenditure (export, government consumption, investment and private consumption) using Johansen multivariate cointegration analysis.

The main findings of this paper may be summarized in the following:

1. Changes in GDP exert a strong influence on the demand for imports in GCC countries. However, changes in relative prices do not seem to exert any significant effect on the demand for imports in most of these countries.

2. The import function of the GCC countries is influenced by a partial adjustment mechanism.

3. There is evidence of structural shifts in the GCC import functions. The intercept
of the function was much higher during the boom years.

4. The demand for imports was highly elastic with respect to GDP in all GCC countries studied (with the exception of Oman) during the last three decades.

5. The Johansen’s maximum likelihood method of cointegration suggests that the null hypothesis of zero cointegrating vector between aggregate imports and the other components of aggregate demand (exports, public consumption, investment and private consumption) is strongly rejected in all GCC countries studied at the 5 per cent level of significance. According to the maximal eigenvalue test there appears to exist, at most, one cointegrating vector in Kuwait and UAE and two vectors in Oman and Saudi Arabia.

6. The equilibrium relationships indicate that investment is the major determinant of aggregate imports, in the long-run, in both Kuwait and the UAE while exports is the major determinant of those imports in Oman and private consumption is the major determinant of Saudi imports.

7. There are major differences in the partial elasticities of import expenditures in the GCC countries. The likelihood ratio test statistics of the restricted equations suggest that these differences are not due to chance.

In the light and past research, this study draws upon current advances in econometric time-series modeling and use these techniques as a tool to assess the long-run elasticities of import demand function in Jordan over the period 1980-1998. In particular, we adopt a more robust test for co-integration provided by Johansen (1988 and 1991, rather than the residual-based approach of Engle-Granger (1987) and directly test for multiple co-integrating relationships among a set of Variables. Assuming a simple linear relationship, in order to estimate elasticities of a simple long-run import demand equation, we then employ a procedure just recently prescribed by Stock-Watson (1993) known as Dynamic OLS (DOLS). Specially, the DOLS procedure allows for co-integrated variables, which are integrated of, mixed I (0) order, as well as tackling the problem of simultaneity amongst the regressors. Furthermore, Stock and Watson show that DOLS is more favorable, particularly in small size samples, compared to a number of alternative estimators of long-run parameters, including those proposed by Engle-Granger (1987), Johansen (1988) and Phillips and Hansen (1990).

3. Data and Methodology

Data and Theoretical Model. Data used in this study related to the period 1980 to 2004 and were obtained from various sources. Annual data on total quantities of import in Jordan are from IFS, Yearbook and External Trade Statistics. GNP, the Consumer Price Index (CPI), the import price index (MPI), the whole sale Consumer Price index are all from statistical series issued by the Central Bank of Jordan (CBJ) and Statistical Yearbook. The model used in this paper is dictated by the typical formulation postulated by economic theory for the elasticity approach in aggregate import demand functions, which, expressed in its double-log form is given by:

$$\log_{\text{IMPORT}} = a + \beta_1 \log_{\text{RGNP}} + \beta_2 \log_{\text{RELATIVEPR}} + u_t$$  \hspace{1cm} (1)

Where IMPORT is real imports; RGNP is real GNP representing economic activity variable (GNP); RELATIVEPR is the relative price of imports defined as the ratio of import price index to the domestic wholesale price index; $u_t$ is an error term, assumed to
be white-noise, normally and identically distributed. This formulation is typical of several studies of import demand in the literature (Thursby and Thursby, 1984, Arize and Afifi, 1987). Estimation of equation 1 with appropriate data will provide approximate long-run price ($\bar{\beta}_1$) and income ($\bar{\beta}_2$) elasticities. Augmenting lagged terms will add dynamic structure to the model.

**Methodology.** Accordingly to Annex A2, the PP statistics have been shown to perform poorly over small sample. It is demonstrated in Johansen (1991) that the procedure involves the identification of rank of the mxm matrix $\Pi$ in the specification given in equation 2.

$$\Delta X_t = \delta + \sum_{i=1}^{k-i} \Gamma_i \Delta X_{t-i} \Pi \Delta X_{t-k} + u_t$$  

(2)

The DOLS procedure is preferred here due to its favorable performance, in small samples. Stock-Watson (1993) Dynamic OLS (DOLS) is specified as:

$$B=(c, \alpha, \beta)', X=[1, GNP, RELATIVEPR]$$

$$IMPORT_t = B'X_t + \sum_{j=-n}^{n} \gamma_j \Delta GNP_{t-j} + \sum_{j=-m}^{m} \delta_j \Delta RELATIVEPR_{t-j} + \varepsilon_t$$  

(3)

Where $n$ and $m$ are the lengths of leads and lags of the regressors. I is indicator variable. Suppose that IMPORT has been found to be I(1) and at least some of the RHS variables I(1) or I(0), then DOLS estimates are obtained by regression analysis of the above equation.

4. **Estimation and Discussion of Test Results: OLS, DOLS and ECM**

A necessary but not sufficient condition for cointegration is that each of the variables should be integrated of the same order (more than zero) or that both series should contain a deterministic trend (Granger, 1986). It is necessary to test whether the relevant variables in equation (1) are stationary and to determine the order of integration of the variables. To test for unit roots in the levels and first differences of the variables, a standard Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) test is performed. The results reported in table A1 in the Annex show that the null hypothesis of a unit root can be rejected for all of the variables when the variables are measured in level except for the first differences in both DF and ADF test. This implies that unit root confirm stationarity for the first difference of the variables LIMPORT, LRGNP and LRELATIVEPR.

**OLS.** Engle-Granger (1987) showed that when two non-stationary variables of the same order I (1) co integrate to a stationary series I (0), then, a standard OLS procedure could be used. In addition, co integration between two non-stationary variables allows the inclusion of stationary variables such as shift dummies. When the relevant variables co integrate to form a stationary series, the first step of the Engle-Granger (1987) procedure involves estimating the long run elasticities of IMPORT DEMAND (equation 1) by OLS. The results are reported in table 2. The long run income elasticity is 1.45 has the predicted and it is clear that the estimates is significant and pass the diagnostic test except for relative price when long run elasticity is 0.57.

Table 2. OLS Estimation of import demand: 1980-2004

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Variables | Coefficient (S.E)
---|---
Constant | 2.56 (0.33)*
LRGNP | 1.45 (0.23)*
LRELATIVEPR | 0.57 (0.33)

R² 0.65  S.E. of Regression 0.2  DW-Statistic 0.84

| Diagnostic Test | Significance level |
---|---|
Serial Correlation | ?² (2)=4.39  0.026 |
Normality | JB =0.85  0.65 |
Heteroscedasticity | ?² (5) =1.21  0.33 |
Ramsay’S Test | F(5) =7.30  0.013 |

Note: * Indicates significant at 1% confidence level.

The rapid structural changes in the Jordanian economy makes it necessary to check for stability of the import demand equation, if the equation is unstable this makes it very difficult to interpret regression results. Since the parametric econometric model is completely described by its parameters, model stability is equivalent to parameter stability (Chan and Lee, 1997). The cumulative Sum of Squares of Recursive Residual CUSUMSQ test is conducted to investigate the stability of the equation parameters. In general if the CUSUMSQ is outside the critical values at 5% significant level, the null hypothesis will be rejected, which means that the equation is unstable. The test results are presented in Figure A1 in the Annex and it is clear that the import demand equation in Jordan is stable during the period 1980 to 2004. Further evidence on co integration is found from applying the Johansen procedure to estimate the total import demand in Jordan, as seen in Annex A2.

Table 4. Stock-Watson Dynamic OLS. Long Run parameters estimates of Import Demand

| Variables | Coefficient (s.e) |
---|---|
Constant | 4.99 (1.14) |
LRGNP | 0.84 (0.30)* |
LRELATIVEPR | -0.55 (-1.32) |
CHLRGNP | 0.73 (1.87) |
DCHLRELATIVE | -0.47 (-1.83) |
FUNCTIONS | -0.84 (0.25)** |
DCHLRELATIVE | 0.35  1.03 |

Sum of Square Residuals 0.18  R²-Adjusted 0.45

Notes: * and** Indicate significance at 5% and 1 percent level respectively.

Long-Run Elasticities: Stock- Watson DOLS. Stock-Watson DOLS parameters estimates of the long run parameters with all variables appearing in levels, are shown in table 4, equation 3 were estimated including up to j= +/- 3 leads and lags, the insignificant lags and leads were dropped. The long run income elasticity is 0.84 statistically significant, and price elasticity is -0.55 has the predicted sign and are statistically not
significant, implying that the demand for import is largely explained by real GDP of import, which relates to the general level of economics.

Stability tests conducted by plotting CUSMSQ where they both suggest that estimated equation are stable over the study period (see Figures in the Annex A3).

**Error Correction Model (ECM).** The ECM uses lagged residuals from the long-run OLS model as one of its regressors. Since the variable LIMPORT and LRGNP are co-integrated, the second step of the Engle and Granger (1987) procedure shows how the short run dynamic version of the long-run relationships estimated from equation 1 in table 2, can be specified as following Error Correction Model (ECM) of the following form:

\[
\text{LIMPORT} = a + \beta EC_{t-1} + \Sigma \beta_1 \text{CHIMPORT}_{t-1} + \Sigma \beta_2 \text{CHLRGNP}_{t-1} + \Sigma \beta_3 \text{CHRELATIVEPR}_{t-1} + \varepsilon_t
\]

Where \( \varepsilon_t \) is the short-run random disturbance term and \( EC_{t-1} \) is one period lagged value of the long-run random disturbance term which represents the error correction term is the residual of equation 1. If the coefficient \( \beta \) of the error correction term \( (EC_{t-1}) \) is statistically significant and correctly signed, then it is an indication that the endogenous variable adjusts towards its long-run equilibrium value in reaction to changes in the exogenous variables.

A crucial question concerning the ECM is what the optimal lag-length should be. A popular technique is Hendry’s methodology, which proceeds by eliminating lags with insignificant parameter, estimates (Gilbert(1986), Hoque and Al-Mutari(1996)). Accordingly, an ECM with three lags was initially estimated. Parameter estimates with insignificant lags were eliminated and the model was re-estimated. One lags estimates show that the ECM did not pass the diagnostic tests. This is an indication that the endogenous variable adjust towards its long-run equilibrium value Diagnostic test statistics show no evidence of misspecification of functional form, no serial correlation, no any problem of heteroscedasticity.

\[
\begin{align*}
\text{chlimport}= & 0.051- 0.20 \text{EC}_{t-1} - 0.086 \text{lachlimport} + 0.039 \text{chlrngnp} + 0.48 \text{chrelativepr} \\
R^2= & 0.095 \quad \text{F-Statistics}=0.47 \quad (p\text{-value}=0.75) \quad \text{DW}=2.00
\end{align*}
\]

5. Summary and Implications.

The purpose of this study is to estimate a single-equation import demand model for Jordan during the period 1980-2004. Recent development in time series modeling such as OLS, Stock-Watson Dynamic (DOLS), Johansen (VAR) and Error Correction Model (ECM) were used to estimate the elasticities. The paper shows that the income elasticity of demand for import is close to unity (i.e.0.84), which indicates that the economic growth in Jordan is accompanied by proportional increase in import demand. The responsiveness of import demand in long-run to relative prices change is -0.55, although it remains more or less constant to changes in aggregate income elasticity. This imply that import-demand function for Jordan suggest that the value of relative price of imports decreases more than proportionality to the increase in real GDP. The estimated coefficient of the error correction term (-0.20) indicates a slow speed of adjustment its previous period's disequilibrium by 20 percent a year. This analysis presents evidence that such non-market influences which contributed towards destabilizing Jordanian import demand
did not exert a strong enough influence to dampen the role of fundamental economic influences over the long-run.

References
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On line Appendix at the journal web site

Journal published by the EAAEDS: http://www.usc.es/economet/eaa.htm
Appendix (A)

A1. Data and definition of variables

Table A1. Data

<table>
<thead>
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<th>Year</th>
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Variable Definitions and Data used of Import demand function for Jordan.
In the empirical analysis of an import demand function for Jordan, we used annual data for the period 1980-2004. All the variables are expressed in real terms. Natural logarithms are taken on all variables.

RELATIVEPR = Relative price of imports (1992=100). This is obtained by the unit value index of imports (1992=100), adjusted for import tariff rate, deflated by wholesale price index.

RIMPRICE = Nominal value of aggregate merchandise import C.i.f. is deflated by the unit value index of imports (1992=100), adjusted for import tariff rate, deflated by wholesale price index.


A2. Methodology, ADF and Johansen
Methodology:
In order to verify to what degree these series share univariate integration properties, we perform both unit root tests and stationary tests. While this is necessary condition prior to testing for cointegration. The Dicky-fuller (DF) type test and the non-Parametric Phillips-Perron (PP) type test developed by Phillips (1987), Phillips and Perron (1988) are convenient testing procedures, both based on the null hypothesis that a unit root exists in the autoregressive representation of the time series. DF test attempt to account for temporally dependent and heterogeneously distributed error by including lagged sequences of first differences of the variable in regressors. Recently this test has been shown to suffer from lack of power, as they often tend to accept the null of a unit root too frequently against a stationary alternative (Cambell and Perron (1991) and DeJong et al (1992) Moreover, the PP statistics have been shown to perform poorly over small sample. It is demonstrated in Johansen (1991) that the procedure involves the identification of rank of the mxm matrix $\Pi$ in the specification given in equation 2.

$$\Delta x_t = \delta + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} \Pi \Delta x_{t-k} + u_i$$

(2)

Where $\Delta x_t$, a column vector of the m variables, $\Gamma$ and $\Pi$ represents coefficient matrices, $\Delta$ is a difference operator, k denotes the lag length, and $\delta$ is a constant. If $\Pi$ has zero rank, no stationary linear combination can be identified. In other words, the variable $x_t$ are non-cointegrated. If the rank r and $\Pi$ is greater than zero, however, there will exist r possible stationary linear combinations and $\Pi$ may be decomposed into two matrices $\alpha$ and $\beta$, each m x r such that $\Pi = \alpha \beta'$. In this representation $\beta$ contains the coefficient of r distinct co-integrating vectors that render $\beta' x_t$ stationary, even though $x_t$ is itself non-stationary $\alpha$ contains the speed of the adjustment coefficients.

The more recent and more robust method, particularly in small samples, proposed by Stock and Watson (1993), which corrects for possible simultaneity bias amongst the regressors, involves estimation of long run equilibria via dynamic OLS (DOLS). Stock and Watson (1993) suggest a parametric approach for estimating long run equilibria in systems, which may involve variables, integrated by different order but still co-integrated. The potential of simultaneity bias and small sample bias amongst the regressors is dealt with by the inclusion of lagged and lead values of the change in the regressors. The procedure advocated is similar to recent estimators proposed by Phillip and Loretan (1991), Phillip and Hansen (1990), Saikkonen (1991) and Park (1992), but much more practically convenient to implement and estimate. These are single equation methods for FIML estimates.

The DOLS procedure is preferred here due to its favorable performance, in small samples. Stock-Watson (1993) Dynamic OLS (DOLS) is specified as:
B=(c,α,β), X=[1, GNP, RELATIVEPR]

\[ IMPORT_t = B'X_t + \sum_{j=-n}^{j=n} \eta_j \Delta GNP_{t-j} + \sum_{j=-m}^{j=m} \delta_j \Delta RELATIVEPR_{t-j} + \varepsilon_t \]  \hspace{1cm} (3)

Where \( n \) and \( m \) are the lengths of leads and lags of the regressors. \( I \) is indicator variable.

Suppose that IMPORT has been found to be I(1) and at least some of the RHS variables I(1) or I(0), then DOLS estimates re obtained by regression analysis of the above equation.

ADF:
Table A2: Dickey Fuller (DF) and Augmenting Dickey Fuller (ADF) Test Statistics for a Unit Roots: 1980-2004

<table>
<thead>
<tr>
<th>Variables</th>
<th>DF Coefficient (t-value)</th>
<th>ADF Coefficient (t-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIMPORT</td>
<td>-0.011 (-0.076)</td>
<td>-0.028 (-0.20)</td>
</tr>
<tr>
<td>LRGNP</td>
<td>0.010 (0.118)</td>
<td>-0.045 (-0.052)</td>
</tr>
<tr>
<td>LRELATIVEPR</td>
<td>-0.025 (-1.78)</td>
<td>-0.075 (-0.82)</td>
</tr>
</tbody>
</table>

| First Difference |                   |                           |
| LIMPORT         | -0.86 (-4.12)**   | -0.97 (-4.50)**           |
| LRGNP           | -0.54 (-3.03)**   | -0.71 (-3.54)**           |
| LRELATIVEPR     | -0.83 (-4.06)**   | -1.04 (-5.12)**           |

Notes: * & ** denotes that the null Hypothesis \((H_0)\) of a unit root is rejected at 5 and 1 percent level of confidence respectively.

Critical Value

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>ADF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>-2.66</td>
<td>-1.96</td>
</tr>
</tbody>
</table>

Johansen’s test: Further evidence on co integration is found from applying the Johansen procedure to estimate the total import demand in Jordan. For this, it is necessary to estimate the number of lags required in the VAR system, by arbitrarily starting from a VAR system of order 3. Akaike Information Criterion (AIC) and the Schwaz Bayesian Criterion (SBC) indicate that the VAR system of order 2 is appropriate lag-length for the import demand function. Co integration LR test based on maximum eigenvalue matrix, there exist no long run relationships between the variables presented in equation 1 including the co integration vector (Table A3). The maximum eigenvalue test statistics
shows that the null hypothesis of co integration can be rejected at 5% level of confidence. In other words there is no co-integration.

Table A3: Johansen Test for Co integrating vector LRGNP and LRELATIVEPR

<table>
<thead>
<tr>
<th>Variables</th>
<th>Null Hypothesis</th>
<th>Max eigenvalue</th>
<th>5% CV</th>
<th>1% CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIMPORT</td>
<td>r=0</td>
<td>21.66</td>
<td>29.68</td>
<td>35.65</td>
</tr>
<tr>
<td>LRGNP</td>
<td>r ≤ 1</td>
<td>7.84</td>
<td>15.14</td>
<td>20.04</td>
</tr>
<tr>
<td>LRELATIVEPR</td>
<td>r ≤ 2</td>
<td>0.23</td>
<td>3.76</td>
<td>6.65</td>
</tr>
</tbody>
</table>

Notes: r indicates the number of cointegrating relationships.

A3. Cusum

![Figure 1: CUSUMQ Test for limport regression](image1)

![Figure 2: CUSUMQ Test for the limport regression](image2)