Using the Price and Income Elasticities for Demand Planning of Imports in Iraq

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Abstract: ***The value of trade elasticities has remained the subject of diverse opinion in most debates of international economic policy. This is due to results from most empirical studies in this area which are still mixed. Therefore, this paper uses import substitution model framework to estimate the price and income elasticities of import demand in Iraq for the period 1970 – 2013. Autoregressive Distributed Lag (ARDL) Bound Testing has been used to study the long run relationship between variables of interest. The results of the unit root test based on Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) provide justification for theuse of ARDL Bound Testing as the variables were either I(0) or I(1) and none is I(2). The cointegration results show that there is a long run relationship between import demand and the chosen explanatory variables, thus all the variables move together in the long run. The estimated long run coefficients show that the price and income elasticities of import demand in Iraq were about 0.02 and 0.31 respectively during the period covered. This implies that the long run import demand in Iraq has been price and income inelastic since the sizes of the coefficients of real Gross Domestic Product (GDP) and relative prices were less than unity and among the explanatory variables studied, real GDP was the main determinant of import demand in Iraq. Furthermore, the long run coefficient of domestic prices which is also regarded as the crossprice elasticity of import demand with respect to home made goods was about 0.055 and statistically insignificant, thus there is evidence of imperfect substitution between foreign made goods and domestically produced goods. The results from the short run dynamics of the model suggest that about 59% of the disequilibrium between the long term and short-term import demand is corrected each year.***

Keywords: Price elasticity of import, Income elasticity of import, Import demand

1. Introduction

It is well known that foreign trade provides impetus for industrial development by making inputs available for domestic production particularly in developing economies like Iraq where production activities depends heavily on imported inputs. While foreign trade enlarges market frontiers for domestic output and brings about foreign exchange to the country through exports, it also expands the production possibility frontiers and increases the utility of consumers by broadening the consumption basket of the people in the participating countries through imports, thus improving their welfare.[1] Foreign trade also provides an opportunity for government to source revenue through taxes on exports and imports. However, the extent to which a country benefits from foreign trade is a function of a number of factors, most prominent of which is the trade policy regime prevalent in the economy, which could be protective or liberalized. It is important to point out here that Iraq has experimented with a mix of the two-trade policy regimes.[2]Over the past decade most developing countries including Iraq have been faced with severe problems of external imbalance stemming from a persistently growing current account deficit. It is widely believed the deficit is linked with the huge deficits in merchandize trade.[3]

The value of trade elasticities has remained the subject of diverse opinionin most international economic policy debates. This is because results from most empirical studies are still mixed. Despite the fact that a number of studies have attempted the estimates of income and price elasticities of imports and other related issues across countries worldwide, there appears to be a lack of empirical studies in this area based on Iraqi data.[4]

This study therefore intends to make a modest contribution to the literatures by using the most recent method of ARDL Bound Testingin obtaining the estimates of the income and price elasticities of agricultural imports using data from Iraq. Variables other than income and price will be adequately incorporated and analyzed.[5]Most interesting of these variables is the Dinar/Dollar exchange rate given its much discussed influence on trade.

2. Methodology

Theoretical Framework

The study will depend onthe import substitution model which is from Goldstein and Khan in 1985, and the basic model consists of 8 equations for quantities and prices of tradable goods between the state and global market.[6]

IM= f (Y, PI ,PD) (Equation 1)

Where:
IM =imports.
Y= GDP
PI & DI= relative prices of imports to local domestic products (local prices).
Equation 1 represents the more familiar framework which is used in empirical studies about the import behaviour.
According to Equation 1 we put forward the following model:

$IMP = \beta o + \beta 1 GDP + \beta 2\ RLP + \beta 3\ OPN + \beta 4\ EXR + \beta 5\ CPI + u$ (Equation 2)

Where:
IMP= imports
RLP= relative prices
OPN= degree of economic openness (exports imports)/ gross domestic product
EXR= exchange rate

CPI= consumer price index (domestic prices)
u= random error term
Bo= intercept limit
$\beta_1 - \beta_5$= estimatedcoefficients

By adopting specification of double logarithmic, the model will become:

$$Ln\ IMP = \beta_o + \beta_1 Ln\ GDP + \beta_2 Ln\ RLP + \beta_3 Ln\ OPN + \beta_4 Ln\ EXR + \beta_5 Ln\ CPI + u \quad \text{(Equation 3)}$$

Where:
Ln= natural logarithm

This implies all the estimated coefficients ($\beta_1 - \beta_5$) will represent elasticities.
A priori specification of them should be[7]:
$0 >< 0$, $\beta_1 \beta_2, 0 > \beta_3$, $\beta_5 > 0$, $\beta_4 < 0$.

Estimation Technique

The data used are annualized secondary time series obtained from the ICB statistical bulletin over the period 1970 – 2013.

Cointegration test is carried out using the ARDL Bound Testing approach. This procedure is adopted because it has better small sample properties than alternative methods (i.e. Engel-Granger, Johansen and Julius, and Philip and Hansen). Another advantage of ARDL Bound Testing is that unrestricted ECM seems to take satisfactory lags that captures the data generating process in a general-to-specific framework of specification.[8]The method avoids the classification of variables as I(1) and I(0) by developing bands of critical values which identifies the variables as being stationary or non-stationary processes. Unlike other cointegration techniques (e.g. Johansen's procedure which require certain pre-testing forum it roots and that the underlying variables to be integrated of the same order), the ARDL model provides an alternative test for examining a long-run relationship regardless of whether the underlying variables are purely I(0) or I(1), even fractionally integrated. Therefore, the previous unit root testing of the variables is unnecessary.[9] Moreover, traditional cointegration method may also suffer from the problems of endogeneity while the ARDL method can distinguish between dependent and explanatory variables. Thus, estimates obtained from the ARDL method of cointegration analysis are unbiased and efficient, since they avoid the problems that may arise in the presence of serial correlation and endogeneity. Also the ARDL procedure allows for uneven lag orders, while the Johansen's VECM does not. However, appropriate modification of the orders of ARDL model is sufficient to simultaneously correct for residual serial correlation and problem of endogenous variables. In summary, it can be seen that ARDL Bound Testing can be used with a mixture of I(0) and I(1) data; it involves just a single-equation set-up, making it simple to implement and interpret and different variables can be assigned different lag-length as they enter the model.[10]

The ARDL Bound Testing procedure consists of estimating an unrestricted error correction model with the following generic form:

$$\Delta LIMPt = \alpha + \Sigma\beta i \Delta LIMPt\text{-}i + \Sigma\delta j \Delta LRGDPt\text{-}j + \Sigma\lambda k \Delta LRLPt\text{-}k + \Sigma\phi l \Delta LOPNt\text{-}l + \Sigma\gamma m \Delta LEXRt\text{-}m + \Sigma\theta n \Delta LCPIt\text{-}n + \eta 1 LIMPt\text{-}1 + \eta 2 LRGDPt\text{-}1 + \eta 3 LRLPt\text{-}1 + \eta 4 LOPNt\text{-}1 + \eta 5 LEXRt\text{-}1 + \eta 6 LCPIt\text{-}1 + \mu t \quad \text{(Equation 4)}$$

Our F-statistic which normalizes on *LIMP* is denoted with *FLIMP (LIMP /LRGDP,LRLP,LOPN,LEXR, LCPI).* The F-test has a nonstandard distribution which depends upon whether variables included in the ARDL model are I(0) or I(1), the number of regressors and whether the ARDL model contains an intercept and/or a trend.[11] Twosets of critical values are used, one set is calculated assuming that all variables are included in the ARDL model are I(0) and the other is estimated considering that the variables are I(1). We reject the null hypothesis of no cointegration when the F-statistic exceeds the uppercritical bounds value. We do not reject the null hypothesis if the Fstatistic is lower than the lower bounds.[12]Finally, the decision about cointegration is in conclusive, if the calculated Fstatistic falls between the lower and upper bound critical values.[13]

If a stable long run relationship is confirmed from the ARDL bound test, then we shall estimate the short run dynamic coefficients through the following error correction model:

$$\Delta LIMPt = \alpha + \Sigma\beta i \Delta LIMPt\text{-}i + \Sigma\delta j \Delta LRGDPt\text{-}j + \Sigma\lambda k \Delta LRLPt\text{-}k + \Sigma\phi l \Delta LOPNt\text{-}l + \Sigma\gamma m \Delta LEXRt\text{-}m + \Sigma\theta n \Delta LCPIt\text{-}n + \Psi ECM(-1) + \mu t \quad \text{(Equation 5)}$$

Where *ECMt-1* is the error correction term resulting from the verified long-

3. Empirical Results and Discussion of Findings

Unit Root Testing

As stated earlier, cointegration analysis based on ARDL Bound Testing implies that unit root testing is not necessary. However, it is important that we carry out this test to ensure that none of the chosen variables are order two, I(2). This is because the ARDL Bound Testing approach becomes meaningless in the face of I(2) variables. To determine the order of integration of the chosen variables, the Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests have been carried out on levels and differences of the included variables. The tests were performed assuming intercept and no trend in both ADF and PP unit root specifications. The results for both ADF and PP unit root tests are reported in Table 1.

Table 1: Results of unit root test of ADF & PP

variable	ADF statistic	Order of integration	PP statistic	Order of integration
LIMP	-5.0150**	I(1)	-8.9921**	I(1)
LRGDP	-2.0010**	I(1)	-6.8161**	I(1)
LRLP	-7.2733**	I(1)	-6.9166**	I(1)
LOPN	-4.4434**	I(1)	-3.0000**	I(1)
LEXR	-7.4055**	I(1)	-7.1005**	I(1)
LCPI	-2.9999*	I(0)	-3.3312**	I(0)

NB: **(*) implies significant at 1%(5%) level of significance.
Source: Authors' Computation by using e-views 9.

The results in Table 1 show that within the framework of both ADF and PP unit root testing, all variables (LIMP, LRGDP, LRLP, LOPN, and LEXR) are I(1) except LCPI which is I(0). This implies that the use of ARDL Bound Testing for cointegration is justified as the variables are either I(0) or I(1) and none are I(2).

Cointegration Test

This procedure consists of estimating anun constrained ECM given by Equation 4. The first step to ARDL Bound Testing was to determine the optimal lag length for the first differences of the chosen variables.[14] The lag selection test was carried out for the first differences of the series, and the results show that the optimal lag lengthis 5 according to AIC and 1 as per SIC. Although it is known that SIC is preferred to AIC when dealing with a small sample, the diversity between AIC and SIC is settled with the Final Prediction Error (FPE) which is at lag 4.[15] The ARDL Bound Testing results and the critical values are reported in Table 2.

Table 2: ARDL Bound Testing Results (with Intercept and Trend)

F-Statistic	5% Critical Value		1% Critical Value	
21.3114**	Lower bound I(0)	Upper bound I(1)	Upper bound I(1)	Lower bound I(0)
	2.77	2.27	6.67	1.29

NB: ** implies significant at both 1% and 5% levels of significance.
Source: Authors' Computation by using e-views 9.

The results shown in Table 2 show the ARDL Bound Testing for cointegration. The ARDL Bound Testing results indicate evidence of cointegration among the variables of interest. This is confirmed by the value of the F-statistic for the joint significance of the lagged level variables in equation 4which is greater than the upper bound critical values at both 1% and 5% levels of significance. Therefore, following the ARDL Bound Testing approach to cointegration, we conclude that along run relationship exist between LIMP and the chosen explanatory variables. Furthermore, Table 3 presents the Johansen cointegration tests as a compliment to the ARDL Bound Testing.[16] This test was performed allowing a lag length of 4 based on the FPE. The null hypothesis underlying this test is that $r = 0$, against the general alternatives that $r > 0, 1, 2, 3,4$, and 5. The null hypothesis of no cointegration among the variables of interest is rejected at5% level of significance since the values of both trace statistic and max-Eigen statistic do not lead to the rejection of the null hypothesis of $r \leq 4$. Thus, there is evidence of a long run relationship among the chosen variables, and this result supports the ARDL Bound Testing.[17]

Table 3: Johansen Cointegration Results

Critical value%5	Max Egin value	Critical value%5	Trace test	H1	Ho
34.70177	84.22141*	83.61231	311.5050*	r>0	r=0
23.66613	63.23144*	60.63101	111.2011*	r>1	r≤1
25.31888	43.44509*	43.35412	111.8111*	r>2	r≤2
25.50236	25.16601*	22.11111	42.22202*	r>3	r≤3
17.27777	13.26677	13.19210	8.11311	r>4	r≤4
1.771446	1.650205	1.311002	0.15392	r>5	r≤5

Estimated Long run Coefficients

Table 4 shows the estimates of Equation 3 including the estimated first-order auto regressive coefficient of the error term using OLS. Although all the variables conform toa priori expectation, only the variables LGDP and LOPN are statistically significant at 1%, others such as LRLP, LEXR, and LCPI are statistically insignificant at a 10% level of significance. The estimated long run coefficients show that a 1% increase in LGDP will bring about a rise in imports by about 0.45% in the long run while a 1% increase in relative prices (LRLP) will lead to about 0.01% decline in imports in the long run. These results imply that the Iraqi import demand is price and income-inelastic since the long run price and income elasticities of imports are 0.02 and0.49 respectively which are less than unity.[18] Also, a unit increase in the degree of openness(LOPN) will lead to about 0.19 unit rise in imports and a unit increase in Dinar/Dollar exchange rate (LEXR) will bring about 0.00012 decreases in imports.[19]Furthermore, a 1% increase in the price of domestically produced goods (LCPI) will lead to 0.0041% increase in imports. This implies that the domestically produced goods are not perfect substitutes for foreign goods since the coefficient of LCPI which is also the cross elasticity of import demand on products with respect to domestic goods is far less than unit 1.In passing, it should be noted that among the variables studied, income which is proxies by gross domestic product (LGDP) is the main determinant of import demand of products in Iraq during the periods covered by the study. The coefficient of determination (R-Squared) is about 0.91 which implies that about 96%of total variations in import demand were accounted for by variations in the explanatory variables of the model. The F-statistic value of 139.3120 with its p-value of 0 shows that the overall model is statistically significant at 1% since the p-value is less than 1%. This implies that although not all the explanatory variables are individually statistically significant, they jointly explain variations in the dependent variable (LIMP). Furthermore, the value of D-Wand that of Breusch-Godfrey Serial Correlation LM Test show that our model is not plagued by autocorrelation of any order.[20]

Table 4: Estimated Long run Coefficients Results

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	12.65107**	3.01555	4.887011	0.0000
LGDP	0.454759**	0.102023	2.118879	0.0010
LRLP	-0.010400	0.93721	-0.190070	0.7556
LOPN	0.195500**	0.115523	2.621320	0.0067
LEXR	-0.000120	0.028177	-0.004179	0.9634
LCPI	0.004130	0.007787	0.660340	0.3997
AR(I)	0.855289	0.03999	9.72541	0.0000

R^2=0.917,
R^2 $Adjested = 0.899, F = 139.3120, prob. (F - statistic$=0.000000, D−W=1.503321.
Breusch-Godfrey Serial Correlation Test: F- statistic= 1.031161, prob. F(2,25)=0.2717.

NB: **(*) implies significant at 1%(5%) level.
Source: Authors' Computation by using e-views 9.

Estimated Short run Dynamics

We present in Table 5 the short run dynamics of the agricultural import demand function given by Equation 5 as a parsimonious ECM version of ARDL model. The parsimonious model was arrived at from an over-parameterized model through general to specific method. Specifically from the ECM expressed in Equation 5, the coefficients βi, δj, λk, ϕl γm, and θn capture any immediate short term or contemporaneous effect that the explanatory variables have on LIMP.[19] The coefficient *Ωi* in Equation 3 reflects the long run equilibrium effect of LGDP, LRLP, LOPN,LEXR, and LCPI on LIMP while the absolute value of ψ explains how quickly the equilibrium is restored in the event of shock. Table 5 provides us the proportion of disequilibrium error that is accumulated in the previous period, which is corrected in the current period. The p-value of the error correction term coefficient in Table 5 shows that it is statistically significant at a 1% level with the expected negative sign, thus suggesting that imports (LIMP) adjust to the explanatory variables.[21] The coefficient of ECM(-1) is -0.527010in the short run model, implying that the deviation from the long term equilibrium is corrected by about 52%each year. The lag length in the short run model is selected on the basis of AIC and SIC. Furthermore, a stability test was conducted using cumulative sum and the cumulative sum of squares. The results show that the parsimonious model is dynamically stable since the fitted CUSUM and CUSUMQ happen. Also, the Breusch-Godfrey Serial Correlation LM Test shows the absence of autocorrelation in the model.[22]

Table 5: Parsimonious Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.521377	0.023011	6.270401	0.0000
D(LIMP(-1))	1.002222	0.101324	5.867667	0.0000
D(LIMP(-2))	1.113571	0.135353	8.412071	0.0000
D(LRLP(-1))	-0.000120	0.098157	-0.504041	0.2417
D(LRLP(-2))	-0.618120	0.035060	-4.217561	0.0009
D(LRGDP(-1))	1.122065	0.112030	7.950105	0.0000
D(LRGDP(-2))	1.321120	0.113542	6.434189	0.0000
D(LRGDP(-3))	1.050111	0.115060	6.312016	0.0000
D(LOPN (-1))	1.111666	0.100600	7.598750	0.0000
D(LOPN (-2))	1.808750	0.119807	5.004061	0.0000
D(LEXR (-1))	-0.007560	0.009581	-2.698644	0.0022
D(LEXR (-2))	-0.113020	0.007324	-2.562363	0.0037
D(LCP (-1))	0.023772	0.009495	2.989999	0.0029
D(LCP (-2))	0.012057	0.006682	2.910501	0.0044
ECM(-1)	-0.572213	0.158772	4.231861	0.0000

R^2 = 0.912913Mean dependent var.=0.068100
Adjusted R^2 =0.831847 S.D. dependent var.=0.397694
S.E. =0.104371 Akaike info. criterion=-1.101061
Sum squared resid.=0.227241 Schwarz criterion=-0.324607
Log likelihood=51.312636Hannan-Quinn criter.=-1.016412
F-statistic= 8.173029 Durbin-Watson test=2.043466
Prob(F-statistic)=0.000099

Breusch – Godfry Serial Correlation L M Test:
F- statistic 4.711310 Prob, F(2,10) 0.0920
Obs*R^2 16.75880 Prob, Chi-square (2) 0.0941

Source: Authors' Computation by using e-views 9.

4. Conclusion

This paper estimated the price and income elasticities of import in Iraq for the period 1970 – 2013, using the ARDL Bound Testing proposed which was complimented with Johansen cointegration to study the long run relationship between variables of interest.

The results of the unit root test based on ADF and PP indicate that the variables under study follow I(1) process except the domestic prices (LCPI) which is I(0). This shows that the variables under study were either I(1) or I(0), implying that the use of ARDL Bound Testing is justified for cointegration analysis.

The cointegration results show that there is a long run relationship between import demand(LIMP) and the chosen explanatory variables, which imply that all the variables move together in the long run.

The long run coefficient of domestic prices, which is regarded as the cross-priceelasticity of import demand with respect to domestic goods, was about 0.0062, thus there is evidence of imperfect substitution between foreign goods and domestic goods, and that is explained by consumption of domestic products and preference over foreign product, despite it's low price especially in vegetable crops, citrus, dates and red meat, we then estimated the short run dynamics of the model and the results suggest that about 67% of disequilibrium between the long term and short term of agricultural import demand is corrected each year.

5. We conclude that the use of currency devaluation (via using floating exchange rate) as an import substitution tool (to reduce imports and increase exports) is not validated and also, the use of higher taxes and interest rates as a tool of expenditure switching policies (as a structural adoption policy) should be expected to have limited impact on Iraq's agricultural trade balance.

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