J Agric. Res., 2017, Vol. 55(1):137-149
ISSN: Online: 2076-7897, Print:0368-1157
http://www.jar.com.pk

DETERMINANTS INFLUENCING EDIBLE OIL IMPORT IN PAKISTAN

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ABSTRACT

Major determinants of edible oil import in Pakistan were analysed at University of Agriculture, Faisalabad, Pakistan during the year 2013 employing Johansen Cointegration model (JCM) and Error Correction Model (ECM) approaches. The determinants were examined over time period of 1982-2012 which included Gross Domestic Product (GDP), import expenditure on edible oil, domestic production of edible oil, domestic consumption of edible oil, population growth, inflation rate and exchange rate. The import of edible oil was affected positively and significantly by GDP (1.19), import expenditure on edible oil (-0.065) and domestic production of edible oil (-0.54) in the long run. The exchange rate (-0.49) had negative impact in long run on the import of edible oil. The import of edible oil was also influenced significantly by the domestic production of edible oil (-0.38), domestic consumption of edible oil (1.337), growth rate of population (0.016) and rate of inflation (0.007) in the short run. The study concludes that policy measures should be taken to increase domestic production so that import bill may be reduced, by increasing the production of edible oil through adoption of new processing technology, introducing the new varieties of oilseeds crops, stabilization of exchange rate, import substitution, export promotion, population and inflation control.

KEYWORDS: Edible oil; import demand; import expenditure; determinants; cointegration, Pakistan.

INTRODUCTION

The oilseed crops are grouped into two classes; conventional and non-conventional. Cotton, rapeseed, mustard, sesame and ground net are conventional oilseed crops and are being grown in the country from long time. Sunflower, safflower, canola and soybean are being grown as non-

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conventional crops. There are also some crops which are used for industrial purposes like castor and linseed. The major commercial oil-seed crops are cotton and rapeseed. Among oilseed crops, raya occupies a prominent place and is mostly grown in various districts of Southern Punjab. It is the cheap and good quality source of edible oil in the country. Pakistan can fulfill the demand for edible oil domestically by expanding area under oil seed crops and considering main determinants that can accelerate its productivity (10).

Major edible oils including palm, rapeseed, soybean, coconut, cottonseed and sunflower oil are being traded at global level. The trading patterns in the global vegetable oil industries are prominent by palm oil and soybean due to their major contribution in the world consumption patterns of oil and fats. Until 2004, soybean was at the top of world's consumption of oil and fats. In 2005, palm oil became most widely wed source of fats and oils. Increasing the global consumption of palm oil, mostly attached to its price competition with many other vegetable oil, which is being fulfilled by increasing import. The contribution of palm oil was 60 percent, share of soybean oil was 15 percent, sunflower oil 7 percent, the rapeseed oil 5 percent and others 17 major oilseeds contribute nearly 13 percent in the world fats and oils imports (4).

Pakistan is the third largest importer of edible oil in the world. The total availability of edible oil in the country came through three main sources i.e. domestic production of edible oil, imports of refined edible oil and local oil production from imported oilseeds (2.38 million tons). As the country is deficient of edible oil production, large amount of foreign exchange is utilized on the imports of edible oil which results in the drainage of foreign exchanges reserves (2).

Pakistan imports soybean oil and palm oil from other countries. These are mostly imported from Argentina, USA, Netherlands, Singapore, Malaysia, Norway, and South Korea with cash payments and grants (9). The prices of these edible oils in the market have shot up because of low supply and high demand. In addition overall prices of edible oil are likely to increase day by day. The government has reduced the taxes on these oils to lower prices in open market because in domestic market, oil prices have increased mainly due to increasing soybean and palm oil prices in the world market. Overall consumption of edible oil now stands at three million tons, out of which 0.5 million tons oil is locally produced while remaining 2.5 million tons is being imported. In Pakistan, farmers mainly grow traditional crops like rapeseed and mustard .These crops have lower yields per acre as compared to non-traditional crops as canola, soybean and sunflower. Average per acre yield of

sunflower, soybean and canola is 724 kg, 483 kg and 500 kg, respectively while per acre yield of rapeseed and cotton seed is 300 kg and 498 kg, respectively (6). Present study aims to identify the factors affecting the edible oil import and suggest policy measures.

MATERIALS AND METHODS

Data and variable specifications

This study was conducted at (University of Agriculture, Faisalabad, Pakistan) during the year 2013. Time series data used for this study related to GDP (million rupees), import of edible oil (tones), domestic production and consumption of edible oil (tons) in Pakistan, import expenditures on edible oil (million rupees), inflation rate (in percent), population growth rate and exchange rate for the time period of 1982-2012 The data were collected from Economic Survey of Pakistan, Food and Agricultural Organization (FAO) database and Handbook of statistics on Pakistan economy. A set of these variables, have been used in literature while studying determinants of edible oil import. The study at hand used macro variables particularly related to edible oil import in Pakistan that can be expected to affect directly or indirectly the import of edible oil.

Model specifications

To study the impact of various determinants on import of edible oil, the model is specified as:

$$LMEO = f(LGDP, LDCEO, LDPEO, LPG, LINF, LMEXP, LEX)\ldots\ldots \quad (1)$$

Where

LMEO = log of import of edible oil in tones.
LGDP = log of gross domestic product in million rupees.
LDCEO = log of domestic consumption of edible oil in tones.
LDPEO = log of domestic production of edible oil in tones.
LINF = log of inflation rate in percentage.
LMEXP = log of import expenditure on edible oil in million rupees.
LEX = log of exchange rate.
LPG= log of population growth.

Estimation procedure

Unit Root Test: In this study the presence of unit roots in data series was tested by Augmented Dickey Fuller (ADF) test (3,4), both with and without a

deterministic trend. The presence of serial correlation is tested by Breusch-Godfrey statistic and lags number also selected in ADF-equation to make sure that serial correlation is not present (12). The ADF equation is essential to estimate the following by Ordinary Least Square (OLS).

$$\Delta Y_t = \alpha_2 + \beta_2 t + (\Phi_2 - 1) Y_{t-1} + \sum_{i=1}^{k} \prod_i \Delta Y_{t-i} + \mu_t \ldots\ldots\ldots\ldots (2)$$

Y_t = Series to be investigated
T = Shows time trend and
μ_t = White noise residuals.

Testing for cointegration: Johansen's (8) approach can be used when two series have same order of integration to test long run relationship between them. The approach is based on maximum likelihood estimation of the Vector Error Correction Model (VECM):

$$\Delta Z = \delta + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \ldots\ldots\ldots + \Gamma_{p-1} \Delta Z_{t-p+1} + \pi Z_{t-1} + \Psi x_t + \mu_t \ldots\ldots (3)$$

Z_t = endogenous variables vector $I(1)$, $\Delta z_t = z_t - z_{t-1}$
X_t = exogenous variables vector $I(0)$, and
π and Γ_i shows $(n \times n)$ parameters matrices with $\Gamma_i = -(I - A_1 - A_2 - \ldots - A_i)$, $(i=1,\ldots,k-1)$, and $\pi = I - \pi_1 - \pi_2 - \ldots - \pi_k$ respectively.

Equation (3) provides information about the short-run and long-run adjustments to the changes in z_t by estimating the values of Γ_i and π, respectively. Information about the long-run equilibrium relationship between the variables in z_t is provided by the term πz_{t-k}. Rank of the π-matrix gives us the information about the number of cointegrating relationships among the variables in z_t. The given model is subject to a unit root if π is reduced rank and π can be decomposed into two $(n \times r)$ matrices α and β, such that $\pi = \alpha\beta'$ where $\beta' z_t$ is stationary, if $0<r<n$, where r is the rank of π. α represent Error Correction term and it measures the speed of adjustment in Δz_t and β contains r distinct co-integrating vectors that are the co-integrating relationships between the non-stationary variables. This reduced rank regression procedure used by Johansen (8) to estimate the α and β-matrices and similarly to test the null hypothesis of at most 'r' co-integrating vectors against the alternative that it is greater than r the trace test statistic used in the present study.

Error correction mechanism: Co-integration and ECM can be used as a unified theoretical and empirical framework for the analysis of short-run and long-run behavior. The ECM model is based on the idea that adjustments are made to get closer to the long-run equilibrium relationship.

Let assume that X_t and Y_t variables are co-integrated and the relationship between these two can be expressed as ECM. Assuming that the X_t is the cause of Y_t and both variables are considered in logarithmic form. The ECM can be written as:

$$DLX_t = \alpha_o + \alpha_1 DLY_t + \alpha_2 ECT_{t-1} + \mu_t \ldots\ldots (4)$$

Here D denotes the first difference operator and μ_t is the random error term. The ECT_{t-1} shows the error correction term for one period from the co-integration regression. The equation (4) states that DX_t depends on DY_t and also on the Error Correction Term (ECT).

RESULTS AND DISCUSSION

Unit root results

ADF-test was performed for testing the unit roots. ADF test statistics results are presented in Table 1 and 2.

Table 1. ADF- unit root results of the selected variables at 1st difference.

Variables	Non-Trended	Trended	Conclusion
LMEO	-4.08	-4.16	*I*(1)
LGDP	-4.27	-4.11	*I*(1)
LMEXP	-4.91	-4.87	*I*(1)
LDPEO	-3.98	-4.34	*I*(1)
LEXR	-3.69	-3.27	*I*(1)
Critical Value (CV)	-2.96	-3.57	

Note: Critical Value (CV) at 5% level of significance

The data (Table 1) showed that values of variables like import of edible oil (LMEO), gross domestic product (LGDP), import expenditure on edible oil (LMEXP), domestic production of edible oil (LDPEO) and exchange rate(LEX)], in the level form were less than absolute critical values ($P<0.05$), for both trended as well as for the non-trended models. Thus the null hypothesis of unit root was accepted and concluded that the above mentioned data series were non-stationary in the level form. The data (Table 2) showed that values of variables i.e population growth (LPG), inflation rate (LINF) and domestic consumption of edible oil (LDCEO)], in the level form, were greater than absolute critical values. Therefore, unit root null hypothesis was rejected which employed that these variables were stationary at the level

form. Thus these variables (LPG, LINF, LDCEO) were zero integrating order and denoted by *I*(0). The variables which were non stationary at the level form, analyzed again in the first difference form to check stationarity. All series become stationary at their first difference form and are denoted as *I*(1).

Table 2. Augmented Dickey Fuller unit root results of selected variables at level form.

Variables	Non-Trended	Trended	Conclusion
LMEO	-2.55	-2.90	---
LGDP	-2.20	-1.14	---
LMEXP	-2.27	-0.92	---
LDPEO	-0.56	-1.40	---
LEXR	-1.54	-0.92	---
LDCEO	-4.44	-3.65	*I*(0)
LPG	-5.69	-6.55	*I*(0)
LINF	-4.37	-4.46	*I*(0)
Critical Value (CV)	-2.96	-3.57	

Note: Critical Value (CV) at 5% level of significance.

Cointegration results

Selection of order of Vector Auto Regressive (VAR) is the first step in Johansen's approach. For this purpose adjusted LR-Test was carried out on the VAR with maximum four lags values. The adjusted LR-test selects the order one of the VAR because at order one the parenthesis value (p-value) of adjusted LR is greater than 0.05 (Table 3). The value of SBC is maximum at the order one i.e. 87.03. Thus Schwarz Bayesian Criterion (SBC) also confirms the order one of VAR. Akaike Information Criterion (AIC) selects order four because the value of AIC is maximum at order four i.e. 122.91. Thus both adjusted LR-Test and SBC are selecting order one and only AIC selecting order four. It is clear that the order of VAR is only one.

Table 3. Results of LR-Test on VAR with maximum four lags values.

Variables List to be Included in Unrestricted VAR: LMEO LGDP LMEXP LDPEO LEXR			
Deterministic and/or Exogenous Variables List: LPG LINF LDCEO			
VAR order	Akaike Information Criterion	Schwarz Bayesian Criterion	Adjusted LR-test
4	122.91	56.30	-----
3	110.09	60.13	21.60(.658)
2	102.84	69.54	40.03(.842)
1	103.69	87.03	53.84(.969)
0	-143.12	-143.12	209.16(.000)

Note: *p*-values are in the parenthesis.

After unit root testing procedure, test for co-integration is the next step. The results of unit root show that LPG, LINF and, LDCEO variables are stationary at level form and are represented by *I(0)* i.e., stationary series.

The co-integration between the respective variables can be tested by using Johansen's procedure. The rank of co-integration i.e. number of co-integrating vectors was selected by using the Eigen and trace values test statistics. The Johansen co-integrating results of the existence and number of co-integrating vectors among the series in model show (Table 4and 5) that first statistic value was greater than 95 percent critical value. Thus on the basis of results, the study rejected the null hypothesis of no cointegration and accepted the alternative hypothesis of the existence of cointegration. According to Harris (7), the number of co-integrating vector is one when null hypothesis is rejected for the first time. It can safely be said that there was one co-integrating vector among the series concerned.

Table 4. Co-integration results (maximum eigen value statistics).

Variables List to be Included in Unrestricted VAR: LMEO LGDP LMEXP LDPEO LEX INTERCEPT			
Deterministic and/or Exogenous Variables List: LPG LINF LDCEO			
H_0: (No Cointegration)	$H_{1:}$ (Cointegration)	Test Statistic	Critical Value at 95 %
r=0	r=1	41.2751	40.5300
r<=1	r=2	27.5388	34.4000
r<=2	r=3	21.6159	28.2700
r<=3	r=4	18.1654	22.0400
r<=4	r=5	7.6612	15.8700

Note: r shows the number of cointegrating vectors

Table 5. Co-integration results (Trace statistics).

Variables List to be Included in Unrestricted VAR: LMEO LGDP LMEXP LDPEO LEX INTERCEPT			
Deterministic and/or Exogenous Variables List: LPG LINF LDCEO			
H_0: (No Cointegration)	$H_{1:}$ (Cointegration)	Test Statistic	Critical Value at 95 %
r = 0	r = 1	41.2751	40.5300
r <= 1	r = 2	27.5388	34.4000
r <= 2	r = 3	21.6159	28.2700
r <= 3	r = 4	18.1654	22.0400
r <= 4	r = 5	7.6612	15.8700

Note: r shows the number of cointegrating vectors

In this model, unknown parameters of the cointegrating vector to be estimated can be interpreted as the estimates of long run cointegrating relationship between variables (5). The estimated parameter values of equation (5), when normalized on the series of MEO were the long-run elasticities.

$$LMEO = 1.19LGDP - 0.065LMEXP - 0.54LDPEO - 0.49LEX \ldots\ldots\ldots(5)$$

Error correction model estimates results

The error correction model results (Table 6) and showed that signs of estimated coefficients of all the determinants are according to a priori expectations. it indicated that GDP has a positive impact on the import of edible oil and highly significant at 1 percent level of significance. A one percent increase in gross domestic product increased the 1.19 percent in the import of edible oil in the long run. This result is consistent with demand theory. According to demand theory, income level and quantity of demanded are positively related. The same case is in this study as GDP and quantity of edible oil imported are positively related. This equation also represented the relationship between import of edible oil and import expenditure on edible oil. The result also consistent with the prior expectations, according to the demand theory, cost of goods is negatively related with the quantity of goods.

The coefficient of import expenditure on the edible oil is highly statistically significant. The result showed that the import of edible oil decreased by 0.065 percent due to one percent increases in the edible oil import expenditure.

The results also showed that negative relationship between the import of edible oil and the local production of edible oil exist. The result represent that one percent increase in the local production of edible oil decreased the 0.54 percent in the import of edible oil. The coefficient of local production of edible oil is statistically significant at 5 percent level. Table 5 also reveals the negative relationship between exchange rate and imports of edible oil. Exchange rate coefficient is highly statistically significant. The above result represent the one percent increase in exchange rate decreased 0.49 percent in the import of edible oil. This result is in accordance with the results of Nguyen and Jolly (11), who computed -1.55 exchange rate in the long run for seafood import demand in Caribbean region.

Table 6. Error Correction Model Estimates.

Regressors	Short run elasticities	Long RUN ELASTICITIES
Constant		4.65 (1.67)*
DLGDP	0.075 (1.12)^{ns}	1.19 (2.51)***
DLMEXP	0.005 (1.48)^{ns}	-0.065 (2.20)***
DLDPEO	-0.38 (-1.855)*	-0.54 (2.06)**
DLEX	0.008 (1.26)^{ns}	-0.49 (2.22)***
LDCEO	1.337 (1.95)**	
LPG	0.016 (1.93)**	
LINF	0.007(1.95)**	
ECM1 (-1)	-0.393 (-3.31)***	
R^2	0.7088	LM test 3.9463
D.W	2.03	Reset test 9.5520
Jaeque-Bera Normality test	4.0805	

(a) t-ratios are given in parenthesis, (b) *,** " and ***indicates level of significances at 10, 5 and 1 percent, respectively , (c) NS denotes the non-significances of the coefficients.

The results of edible oil import and its domestic consumption are presented in table 6 which showed that domestic consumption of edible oil coefficient (1.337) is statistically significant at 5 percent in short run and these results indicate that edible oil import increased by 1.337 percent due to one percent increase in the consumption of edible oil. The domestic consumption and import of edible oil both are positively related with each other in the short run. Table 3 gives the result of the impact of domestically produced edible oil. The present study also shows that domestically produced edible oil is statistically significant at 10 and 5 percent level of significant in short run (-0.38) and long run (-0.54) respectively. Domestically produced edible oil has negative impact on the import of edible oil in both short run and long run. These results shows that import of edible oil decreased in both short run and long run due to increased in the domestic production of edible oil.

The data (Table 6) shows that population growth coefficient (0.016) is significant at 5 percent level. The coefficient of population growth indicates that one percent increase in population increased the import of edible oil by 0.016 percent. The coefficient of population growth is positive indicating the positive impact of population growth on the import of edible oil. The impact of population growth is only in short run.

The exchange rate coefficient in short and long run are 0.008 and -0.49, respectively. Positive impact of exchange rate in short run indicates that edible oil import increased by 0.008 due to one percent increased in the

exchange rate. Negative impact in long run shows that one percent increase in the exchange rate decreased -0.49 percent in the import of edible oil. Its coefficient is non-significant and highly statistical significant (α = 1%) in short run and long run respectively. These results also indicate that exchange rate has smaller impact in short run than long run.

These results are in accordance with the study of Nguyen and Jolly (11), who estimated short run and long run exchange rate coefficient having values -0.71 and -1.55, respectively in study of seafood import demand model in Caribbean region. The result of inflation rate indicates the positive impact of inflation rate on the import of edible oil. The coefficient (0.007) of inflation rate is statistically significant at a 5 percent level that reveals that one percent increase in the inflation rate increased the import of edible oil by 0.007 percent in the short run.

ECM coefficient was also negative as expected. The result of ECM indicates the speed of correction with which the model could be corrected towards the long run equilibrium. The coefficient of ECM is -0.39 indicates the 39 percent deviation of the import of edible oil from long run equilibrium is corrected in the study period. The coefficient of ECM is statistically significant at 1 percent level.

The value of R^2 is 0.71 that indicates that 71 percent variation in the import of edible oil is explained by the selected variables of the model and 30 percent variation is explained by some unknown variables. For all the diagnostic tests, the model presents the expected satisfactory results. The value of LM-test upto one order shows no serial correlation problems in the residuals. The *p*-values for RESET test for functional form misspecification and Jarque Bera (JB) test for normality are greater than 0.05. These results indicate that functional form of the model is correct and normal distribution of residuals. The value of DW statistic is 2.03 as expected.

RECOMMENDATIONS

Following policy measures have been proposed for future import policy and domestic production development of edible oil in Pakistan on the bases of the findings of present study.

- The gross domestic product has significant impact on the import of edible oil. The import of edible oil increased in both short run and long run. As GDP increased the per capita income due to which edible oil demand also increased. This increased in demand for edible oil is met by domestically produced edible oil or import of edible oil. The study suggests is that this increased in demand for edible oil could be only fulfilled by increasing the domestic production of edible oil and import of edible oil can be reduced to save foreign reserves.
- Import expenditure of edible oil is increasing over time. This expenditure can be reduced only by increasing the domestic production of oilseed crops like sunflower, canola, soybean, mustard/rapeseed, groundnut, sesame, etc.
- Domestic consumption of edible oil is also major determinant of edible oil import. This huge increase in consumption of edible oil should be fulfilled by increasing domestic production of oilseed crops and not by importing edible oil.
- Domestic production of edible oil is substitute of imported edible oil in Pakistan. Domestic production affects the import of edible oil in both short run and long run. The domestic production decreases with import of edible oil in short run because the production cycle of oilseed crops can be completed in short run. However, the production of oilseed crops is increasing with import of edible oil but this increase in the production of oilseed crops is not sufficient for fulfilling the domestic consumption of edible oil. Thus there should be more increase in the production of oilseed crops. This large increase in the production of edible oil can be possible by increasing the area of cultivation under oilseed crops. The domestic production of oilseed crops can be increased by cultivating the oilseed crops on marginal land. The productivity of oilseed crops can be increased by replacing the old varieties with new genetically improved varieties.
- The population growth is also a determinant of import of edible oil in Pakistan. Population growth affects the import of edible oil in the short run. The population growth rate should be managed in such a way that per capita GDP should not decline over the time.
- The exchange rate affects the import of edible oil in Pakistan in short run and long run. The impact of exchange rate in the short run is non-significant and in the long run it is statistically significant. The impact of

exchange rate on the edible oil import is negative. The deprecation of rupees causes the increase in import expenditure with same quantity of import of edible oil. There should be a policy for stabilize the exchange rate to reduce the fluctuations in import bill.

- The inflation rate is also significantly affects the import of edible oil. There should be a policy for controlling the inflation rate. When the inflation rate increases in the country the prices of goods and services also increase, then demand for import of substitute goods increase. Thus these should be solid policy measures for controlling the prices of domestically produced edible oil so that the import of edible oil can be reduced.

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Received: September 30, 2014 Accepted: June 22, 2016

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Muhammad Ashfaq	**:**	**Made the first draft of the paper and helped in data collection**
Abdul Ghafoor	**:**	**Helped in data collection**
Muhammad Waseem	**:**	**Selected model**
Sarfraz Hassan	**:**	**Reviewed the paper and helped in data collection**