This study is an attempt to analyze the impact of Edible Oil Deficit on Food Expenditure in Pakistan. Edible oil deficit is one of the major concerns for the policy makers in Pakistan. Despite of having agriculture based economy; Pakistan is unable to fulfil her domestic demand of edible oil by local production. This situation forces the government to import edible oil and oil seeds from other countries. This import not only increases our balance of payment deficit but also it negatively affects the ability to finance the external debt repayments. Increase in food expenditure causes the purchasing power of household to decline due to which his social welfare declines.

Autoregressive Distributed Lag Model has been used to analyse the long run relationship amongst the variables. Other important determinants of food expenditure along with edible oil deficit were also used in the model to check for their collective long run impact. It was found that long run relationship exists among edible oil deficit and food expenditure and hence the result derives the policy implication that there is a need to boost up the efforts in the agriculture sector to steadily increase the local production of oil seeds in the country. The relationship between the per capita GDP and food expenditure is found to be positive and significant with elasticity of 0.261 suggesting that 1 percent increase in per capita GDP will cause food expenditure to increase by 0.26 percent. The relationship between food subsidy and food expenditure is found to be insignificant suggesting that due to improper targeting and consumer’s perception about quality and accessibility of subsidized food, Government’s food support programs are not effective.

Keywords: Edible Oil, Production, Imports, Trade Deficit, Balance of Payments, International Trade, Oilseed Crops, Agriculture, Pakistan, Edible oil deficit, demand function, food, inflation, food inflation, household expenditure.

JEL: I31, Q18, Q11, E23, D20, E00
Introduction

Pakistan, a developing country, is the sixth most populous in the world (U.S. 2008), whose demand is rising due to steady economic growth. Despite the fact that Pakistan is overwhelmingly an agrarian economy, it is unable to produce edible oil sufficient for domestic requirements. Agriculture contributes 23 percent of the GDP, 42 percent of the total work force is employed to the agriculture sector and also contributes substantially to Pakistan's export earnings (Alam 2008). Agriculture Commodities and Textiles Products accounts for 62.6% of Pakistan's total exports, 33% of which are Raw or Low value added products (Memon, 2008). One of the challenges to the economy of Pakistan is the edible oil deficit. Edible oil is considered a necessity and not a luxury product and hence it demand is relatively inelastic and grows with time. There are many reasons behind the shortcoming like; lack of awareness of farmers, ignorance of policy makers regarding oilseed crops and technological deficiency in oilseed production etc. The crop that is responsible for 57 % of edible oil production is cotton seed which is primarily a fibre crop. On the other hand, smuggling is also an important factor in edible oil deficit. Demand for Edible oil in the neighboring countries (Afghanistan in particular) has been very high due to which smuggling of edible oil from Pakistan has been increased (Ahmad et al, 1986).

High dependency on few crops leads to disastrous effects on overall oil production when for some reasons the yield of those crops is declined. Indigenous production of edible oil is below the consumption levels with a very wide gap between the production and consumption. Pakistan is heavily dependent on imported edible oils to meet the local demand which is increasing by each passing year. This gap is bridged through import of edible oil worth more than Rs. 45.0 billion1

1 Author’s Estimates based on data from Agricultural Statistics of Pakistan
annually. Presently the oilseed production only met about 30% of the requirements and 70%\(^2\) remaining demand proportion is covered with imports. This increasing percentage of edible oil imports contributes heavily to the ever increasing food expenditure of household. The most common Pakistani food includes a good quantity of edible oil which is the reason behind high consumption growth rates.

At the time of independence Pakistan was self-reliant in edible oil but Pakistan began to import some small quantities of edible oil to supplement domestic production. Since 1969-70, edible oil consumption began to grow at exorbitant rates and domestic production failed to coupe up with it, as a result edible oil deficit started to grow (Chaudhry et al, 1998).

Cultivation of edible oil is not popular among the farming community due to a number of reasons. Reported area under sunflower, rapeseed and mustard, sesame, cottonseed and canola in 2004-05 was 7,70,000 acres, 6,12,000 acres, 66,000 acres, 79,79,000 acres and 288,000 acres respectively (Hasan 2006). Ratio of edible oil extracted from cotton has declined and it is estimated that in 2008, the country would get some 500,000 tons edible oil from cotton seeds which is 16.7% less than previous year. The private sector has announced to purchase sunflower seeds at Rs1200 per 40 kilogram this year against Rs900 per 40 kilogram last year. This increase in the purchase price of sunflower seeds (33%) apparently seems to give incentive to the farmers to bring more area under sunflower cultivation (Pakistan Chronicle, 2008).

Figure 1 shows that after 1959-60, local supply was unable to match the consumption needs and therefore the two lines started separating from each other after 1959-60 and the gap between the two is increasing with time.

\(^2\) Ibid
The gap between demand and supply has been filled with edible oil imports over the years. Pakistan’s edible oil import bill is increased by 1608 times between 1959-60 and 2008-09. Since 1999-00, the import bill grew by 11.1% on average annually till 2008-09 which is significantly less than 21.2% reported by Chaudhry, Mahmood and Chaudhry (1998) for the period of 1959-60 to 1997-98. Problem of increasing imports persists as share of imports in total consumption is increase from 64% to 72% in this period which may have contributed to the increase in household food expenditures.

One policy to deal with the increasing import bill of edible oil could be the tariff policy. Shivakumar et al (2007) found in their study for India that tariff had significant impact on vanaspati and edible oil household consumption however consumption of oilseeds were not changed.

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3 Author’s estimates based on Agricultural Statistics of Pakistan (various issues)
Table-1 compares the production of oil seeds and extraction of edible oil from different oilseeds in 2006-07 and 2007-08. Cottonseed accounts for 57.5% and 51.3% of total oil production in FY07 and FY08 respectively. Sunflower accounts for 27.7% and 31.7% in FY07 and FY08 and share of Canola increased from 7.4% to 9.96% in FY08.

Table-1: Area and Domestic Production of Major oil crops in Pakistan for FY 07 and FY 08

<table>
<thead>
<tr>
<th>Crops</th>
<th>2006-07</th>
<th>2007-08(P)</th>
<th>2007-08(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (000 Acres)</td>
<td>Production Seed (000 Tonnes)</td>
<td>Oil (000 Tonnes)</td>
</tr>
<tr>
<td>Cottonseed</td>
<td>7599</td>
<td>3890</td>
<td>478</td>
</tr>
<tr>
<td>Rapeseed/  Mustard</td>
<td>628</td>
<td>204</td>
<td>63</td>
</tr>
<tr>
<td>Sunflower</td>
<td>937</td>
<td>656</td>
<td>249</td>
</tr>
<tr>
<td>Canola</td>
<td>359</td>
<td>180</td>
<td>65</td>
</tr>
<tr>
<td><strong>Total Oil</strong></td>
<td><strong>855</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Economic Survey of Pakistan 2007-08

Safflower and Soya beans are also used for edible oil production but their contribution is so minute that has negligible impact on total oil production. Most of oil crops are low yielding so they were competed out by High Yielding Varieties (HYVs) of wheat, rice, maize and cotton. As a result cultivation area of oilseed crops fell consistently since 1960s (Chaudhry et al, 1998). Oils crops are suffered from different kinds of disincentives. The farmers do not get adequate support price for oilseed moreover farmer’s access to the funds is also very limited and in some cases the access is completely restricted. There is no price support system for oil crops as a result oil seed growers faced low and uncertain market prices which pull back the incentive for private investment. Major losses are incurred after the completion of harvest due to the improper market infrastructure.
Food Expenditure

Pakistan produces wheat, rice, cotton, sugarcane, maize and other cereal in sufficient quantities. Wheat is the major food grain, followed by rice, the second most important food grain in Pakistan. While cotton is an important cash crop of the country, as it is exported in sufficient quantity both in raw from and in value added form. Rice, sugarcane, tobacco, rapeseed and mustard are also large export earners. Pakistan is the ninth largest producer of wheat, 12th largest producer of rice, 5th largest producer of sugarcane and 4th largest producer of cotton among the top producers in the world as per statistics of FY05. Despite of the high volatility in the sector, Pakistan remains the top producer of the said major crops in the world economy. As far as the productivity is concern Pakistan ranks far below with reference to its total production in world economy. It ranked 9th, 14th, 10th and 14th, among the highest yield (tones/hectare) of wheat, rice, seed cotton and sugar cane respectively in FY05 (Memon et al 2008).

Food expenditure accounts for the major share of total household consumption expenditure in Pakistan. Out of total monthly household expenditure, on average 50 percent share goes to food expenditure because of the sharp food inflation for the first quarter of 2008. The recent research results show that major share of income of households in the lowest expenditure categories comes from agriculture which demands the increased allocation of resources to the agriculture sector in the long run (Dawn 2008). Social welfare is directly linked with the food intake of a person. Higher the food intake higher would be welfare as worker’s productivity will increase and society will earn more. Higher food intake also mean high food expenditure due to the ever rising food inflation (Wanga 2002). Income is the most obvious measure of well-being among families and the principal cause of differences in the level and quality of food consumption. In his behaviour towards food,

\footnote{Based on Economic Survey of Pakistan (various issues)}
the consumer is guided by a large number of different impulses. This statement that the driven force that modifies the composition of the diet and makes people buying one food rather than another is nothing but money and hunger is not completely true; other strong factors influence the choice of nutrients such as religion, habit, culture, household size etc (Tasciotti, 2006).

In countries under lowest per capita income category, edible oil has significant proportion in household food expenditure. The impact of changes in demand, supply and prices of edible oil is much greater in low-income countries (Drewnowski et al, 1997).

Several empirical studies have shown negative influence of increased Government spending in food assistance programs on hunger and malnutrition through reduced food expenditures of poor households.

Davis et al (1983) found that household income and household size exerted a significant and positive impact on household monthly food expenditures. They also found that nutrition education played a key role in decreasing food expenditures.

Fousekis et al (2001) found that, holding total consumption expenditure and number of children constant, share of food in total expenditure was greater in rural households however trend of convergence was also reported with increase in total outlay. Gibson (2002) found that household size had positive correlation with food expenditure.

Food expenditure represents a larger share of total expenditure by low-income households all over the world. With adequate targeting, for example targeting the food items most intensively consumed by the poor households, the benefit to the poor could be much greater as compared to the rich. Inadequate targeting of food subsidies benefits the higher income groups more in absolute terms than the poor because access to the subsidized food items is open to all, as a results, higher
income groups increase the consumption of subsidized food. This holds true for Morocco, as those in the top quintile consume subsidized foods twice as much as those in the lowest quintile (World Bank, 1999).

McCarthy and Taylor (1980), found that food inflation caused decline in non-food items because the demand for food is very inelastic in Pakistan. The percentage of decline in food consumption would be much less than the percentage of increase in food prices.

Since July 2007, prices of wheat flour have increased sharply all over Pakistan. In May 2008, prices of wheat flour had more than doubled in provinces with food-deficit compared to a year earlier. Prices of wheat flour were relatively stable with price changes mainly determined by variations in Government’s procurement price in previous years also the price disparity between markets are relatively small and markets were well integrated (Food and Agriculture Organization, 2008).

Food Expenditure of a mid-income urban household is 90% less than that of high income household (Gale, 2006). In total food expenditures, food away from home i.e. expenditures at stores and expenditures in restaurants were significantly higher in wealthy households as compared to the households in lower income groups. Inadequate targeting of food subsidies, by targeting the items which low-income households purchased significantly lower in quantity, would have insignificant impact on their food expenditure. The policies need for greater attention to the affordability of nutritious foods for low-income groups. Food purchasing patterns depends on household income, education of head of household, household rental and mortgage payments, and any other factor which would directly or indirectly impact the real income of an household by imposing or reducing the financial constraints. However if the household has little to spend on food, he will be based with food selection constraint and consequently will purchase nutritionally undesirable food items because he cannot afford to buy better products (Kirkpatrick, 2003).
Similarly, Horton and Campbell (1990) noted, that low-income households spend their money on food efficiently by buying more economical brands of food items. Average consumption of food declines with the decline in income (Petrovici et al 2000).

Higher food subsidies result in higher food expenditures especially in poor households in Kerala India. In Bangladesh the food subsidy did not have significant impact on food expenditures because most of the subsidy impact was on urban households as it was not feasible for government to reach poor rural households (Farrar, 2000).

Kavand et al (2007) found that food subsidy did not respond to the long-run shocks to attain equilibrium, household income and Food consumption did all the adjustments

There is an evidence from many countries that food subsidies increase the purchasing power of the target consumers. The impact is more significant on poor consumers because food constitutes large proportion of their total expenditure. This increase in real income may change over time even if the subsidy remains the same due to the factors like wage adjustment in response to the increase in real income. In Pakistan, food subsidies had much more impact on urban poor as compared to rural poor (Andersen, 1988).

The State Bank of Pakistan (SBP) has proposed revamping of food subsidy program for low-income groups and in order to make it effective, the involvement of private sector has been suggested. According to the SBP, since food prices are likely to remain high in the medium-to-long-term, the structure and implementation plan of the food subsidies for low-income groups should be revamped so that the targeted groups get maximum benefit out of it (Dawn, 2008).

In case of Egypt, the food subsidies were not designed to serve the poor alone as the subsidized products were available to any consumer. Keeping this in view, policies should be designed in a
way that could restrict the access of the well-off to the subsidies and would make it easier to the poor to access. Subsidy policies are intended to increase the living standards of the poor but if the subsidized product would not reach the target consumer, the whole subsidy program would go waste (Gutner, 1999).

Due to cash constraints and cost of availing the subsidy, the poor do not always draw the full quota entitled to them. Study showed that despite of the availability of subsidized food items to all, their purchased decreased by different percentages for all households and purchase of non-subsidized food increase due to the perceived low quality of subsidized food (Khan, 1982).

In Pakistan, people had negative image about subsidized wheat flour due to which in a mild targeting effect have resulted. The government, in return, has to publicize its efforts to maintain high quality in the subsidized foods (Rogers, 1978).

**Data and Methodology**

Data has been taken from various issues of Economic Survey of Pakistan, Pakistan Statistical Year Book, Household Integrated Economic Survey of Pakistan, Pakistan Demographic Survey, Annual Budget Statements of all provinces and federal government and Federal Bureau of Statistics of Pakistan.

In order to test the hypothesis of this study, different econometric techniques were used. Data was first checked for stationarity in order to apply conventional Ordinary Least Square Technique. Augmented Dicky-Fuller (ADF) and Dicky-Fuller Generalized Least Square Method (DF-GLS) were used to find whether the data is stationary or not.
Augmented Dicky-Fuller test uses following equation to test whether there is unit root in the time series:

\[ \Delta y_t = \beta_1 + \beta_1 t + \alpha y_{t-1} + \gamma \sum \Delta y_{t-1} + \epsilon_t \]  

(1)

Where \( \epsilon_t \) is white noise error term and \( t \) represents time trend. The null hypothesis in ADF test is that variable has unit root. According to Dejong (1992) & Harris (2003), the ADF test is not reliable for the small sample size because chances of committing TYPE 1 and TYPE 2 errors increases significantly due to its size and power properties. To cover this deficiency of ADF test, Dickey-Fuller Generalized Least Square (DF-GLS), also known as de-trending test, was developed by Elliot et al. (1996). This test could solve the problem of the data size and power properties. The DF-GLS test calculates the order of integration of \( y_t \) and enhance the power of ADF test. Following equation is used by DF-GLS test:

\[ \Delta y^d_t = \alpha^*_d y^d_{t-1} + \alpha^*_1 \Delta y^d_{t-1} + \ldots + \alpha^*_{p-1} \Delta y^d_{t-p+1} + \eta_t \]  

(2)

Where \( y^d_t \) is the de-trended series, \( \eta_t \) is white noise error term and \( t \) represents time trend. Null hypothesis of de-trending test is \( H_0 : \alpha = 0 \)

In addition to ADF and DF-GLS we use the Phillips-Perron (1988) unit root test, which is a nonparametric system of controlling for serial correlation while testing for the stationarity of variables. The PP method estimates the following equation:

\[ Y_t = \hat{\alpha}_0 + \hat{\alpha}_1 y_{t-1} + \hat{\alpha}_2 (t- \frac{n}{2}) + \hat{\epsilon}_t \]  

(3)

Where \( Y_t \) is the corresponding time series, \( n \) is the number of observations and \( \hat{\epsilon}_t \) is the error term. The null hypothesis of a unit root is \( H_0 : \hat{\alpha}_1 = 1 \).

After testing for stationarity our next step would be to investigate the long run and short run relationship in the long and short run. There are several econometric techniques to test the long run relationship among the variables. Uni-variate con-integration includes Engle-Granger (1987) and
Fully Modified Ordinary Least Squares (FMOLS) of Philips and Hansen (1990); and multivariate co-integration techniques includes Johansen (1988); Johansen & Juselius (1990); and Johansen’s (1995). Although these tests are most commonly used to test for co-integration but in recent years, the autoregressive distributed lag (ARDL) model approach, developed by Pesaran and Shin (1996 and 1988), Pesaran et. al. (1996) and Pesaran et. al. (2001), has become more popular and preferred to other conventional co-integration approaches.

The ARDL technique has become so popular particularly because it can be applied irrespective of the order of integration i.e. purely I(0), purely I(1) or mutually co-integrated (and in small samples) while other co-integration techniques require all variables be of equal degree of integration i.e. either purely I(0) or I(1) (and large samples). All the variables are assumed to be endogenous in the said approach. In this study we employed the Pesaran et. al. (2001) approach to investigate the existence of a long-run relationship in the form of unrestricted error correction model for each variable as follows:

\[
\Delta \ln FEXP_t = \alpha_1 + \beta_1 \sum_{i=1}^{N} \Delta \ln FEXP_{t-i} + \beta_2 \sum_{i=0}^{N} \Delta \ln EDEF_{t-i} + \beta_0 \sum_{i=0}^{N} \Delta \ln PCGDP_{t-i} + \beta_4 \sum_{i=0}^{N} \Delta \ln FSUB_{t-i} + \gamma_1 \Delta \ln FEXP_{t-1} + \gamma_2 \Delta \ln EDEF_{t-1} + \gamma_3 \Delta \ln PCGDP_{t-1} + \gamma_4 \Delta \ln FSUB_{t-1} + \varepsilon_t
\]

Where \(\ln FEXP\) is the per capita food expenditure in natural log, \(\ln EDEF\) is the edible oil deficit in natural log form, \(\ln FSUB\) is the food subsidy in natural log, \(\ln PCGDP\) is the per capita GDP in natural log and \(\varepsilon_t\) is the white noise error term. The parameters \(\gamma_i\) where \(i = 1, 2, 3, 4\) are the corresponding long-run multipliers, \(\beta_i\) where \(i=1, 2, 3, 4\) are the short dynamic coefficients of the underlying ARDL model. We test the null hypothesis of no cointegration i.e. \(H_0 : \gamma_i = 0\) or \(\gamma_1 = \gamma_2\)
\( \gamma_3 = \gamma_4 = 0 \) in equation 4, against the alternative using the F-test with critical values tabulated by Pesaran and Pesaran (1997) and Pesaran et al (2001).

If there is evidence of long-run relationship in the model then in order to estimate the long run coefficients, the following long-run model will be estimated:

\[
ln\text{FEXP}_t = \alpha_1 + \beta_1 \sum_{i=0}^{N} ln\text{FEXP}_{t-i} + \beta_2 \sum_{i=0}^{N} ln\text{EDEF}_{t-i} + \beta_3 \sum_{i=0}^{N} ln\text{PCGDP}_{t-i} + \beta_4 \sum_{i=0}^{N} ln\text{FSUB}_{t-i} + \mu_2 + \cdots
\]

(5)

If we find the evidences of long run relation then in the 3rd step we utilize the following equation to estimate the short run coefficients:

\[
\Delta ln\text{FEXP}_t = \alpha_1 + \beta_1 \sum_{i=1}^{N} \Delta ln\text{FEXP}_{t-i} + \beta_2 \sum_{i=0}^{N} \Delta ln\text{EDEF}_{t-i} + \beta_3 \sum_{i=0}^{N} \Delta ln\text{PCGDP}_{t-i} + \beta_4 \sum_{i=0}^{N} \Delta ln\text{FSUB}_{t-i} + \varphi_1 ECM_{t-1} + \varepsilon
\]

(6)

Where \( \varphi_1 \) is the error correction term in the model which indicates the pace of adjustment towards long run equilibrium following a short run shock. ECM \(_{t-1}\) represents the error correction term derived from long-run con-integration equation through a newly developed technique of ARDL, \( \beta_i (i=1, 2, 3, 4) \) are constant terms, and \( \varepsilon \) is the serially uncorrelated random disturbance term with mean zero. Long-Run relationship can also be verified through the model specified in equation (6), with the significance of the lagged ECM by t-test.

The ARDL approach involves two steps for estimating the long run relationship (Pesaran et. al., 2001), first step is to investigate the long run relationship among the variables specified in the equation, and the second step is to estimate short run causality. The second step is only applied when existence of long run relationship found in the first step (Narayan et. al. 2005). Two sets of asymptotic critical values are provided by Pesaran and Pesaran (1997) and Pesaran et. al. (2001).
The first set assumes that all variables are I(0) while the second based on the assumption of I(1). The null hypothesis of the no cointegration will be rejected if the calculated F-statistic is greater than the upper bound critical value, implying that there exists long run relationship among the variables. If the computed statistics is less than the lower bound critical values, we cannot reject the null hypothesis. Lastly, if the computed F-statistics falls within the two bound critical values discussed above, the result will be inconclusive.

In addition to the ARDL approach for the investigation of a long run relationship between the variables in multivariate models, the Johansen cointegration technique will also be used in this study. Johansen (1988) and Johansen and Juselius (1990) presented the method to estimate the maximum likelihood estimators in multivariate models (Yuan M. et al., 1994). They also present two likelihood ratio tests, one based on maximal eigenvalue with Ho that the number of co-integrating vectors is less than or equal to r against the H1 of r+1 co-integrating vectors and other test based on trace test with the same null hypothesis and H1 that there are at least r+1 co-integrating vectors. In order to apply Johansen cointegration technique, it is necessary that the variables should be stationary at I(1) (Ahlgren N. et al, 2002).

5 Brooks C. (2002)
Empirical Results

In order to check for non-stationarity problem in the variables, Unit root test were applied at level and 1st difference. Results of the unit root test are shown in Table-1. Using ADF test we found mixed results in level form but all variables were found to be stationary at 1st difference. DF-GLS test suggested that all variables were stationary at 1st difference except for Edible Oil Deficiency (EDEF).

<table>
<thead>
<tr>
<th>Table-2: Unit Root Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>lnFEXP</td>
</tr>
<tr>
<td>lnFSUB</td>
</tr>
<tr>
<td>lnPCGDP</td>
</tr>
<tr>
<td>lnEDEF</td>
</tr>
</tbody>
</table>

* shows significance at 1% level, ** at 5% level, *** at 10% level

Our next step would be to identify the optimum lag order for co-integration. Table-3 compares the results of four different criterions for optimum lag selection. Both SC and LR statistic suggest that we should not go for more than one lag because of small sample size.

<table>
<thead>
<tr>
<th>Table-3: Optimal Lag Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag</td>
</tr>
<tr>
<td>-----</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

* indicates lag order selected by the criterion
SC: Schwarz Criterion, HQ: Hannan-Quinn Information Criterion

We can see from Table-3 that according to all the three criteria of optimal lag selection, lag 0 is the optimal lag for error correction representation of ARDL model. However, since the model is
Autoregressive (i=1 for endogenous variable), we must use first lag of the dependent variable in the equation.

Analyzing the results of unit root tests and optimum lag selection criteria, our next step would be to apply ARDL approach to check for the long run relationship amongst the variables. Results of the test are given in Table-4.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lower Bound</td>
<td>Upper Bound</td>
</tr>
<tr>
<td>1%</td>
<td>5.37</td>
<td>6.36</td>
</tr>
<tr>
<td>5%</td>
<td>4.01</td>
<td>5.07</td>
</tr>
<tr>
<td>10%</td>
<td>3.47</td>
<td>4.45</td>
</tr>
</tbody>
</table>

* (***) Significant at 5% (10%), according to Pesaran et al., 2001
1 Table CI (V): Unrestricted Intercept & Unrestricted Trend, (Pesaran *et al*. 2001, 301)

Results presented in Table-4 shows that according to critical values developed by Pesaran et al (2001), there is a long run relationship amongst the variables as Wald test F-statistic is greater than the upper bound of 1% critical value proving that there is long run relationship amongst the variables. According to critical values of Narayan P (2005), wald test F-statistic is greater than the upper bound of 5% critical value, verifying the result from Pesaran stats i.e. long run relationship exists amongst the variables. We can also verify from error correction model of ARDL for long run relationship using the coefficient of ECM(-1). If the coefficient has negative sign and it is statistically significant then we can say that long-run relationship exists between variables.
Table-5: Estimated Long Run Coefficients using the ARDL Approach\(^6\)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Prob- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNEDEF</td>
<td>-0.148</td>
<td>0.087</td>
</tr>
<tr>
<td>LNFSUB</td>
<td>0.537</td>
<td>0.482</td>
</tr>
<tr>
<td>LNPCGDP</td>
<td>0.261</td>
<td>0.004</td>
</tr>
</tbody>
</table>

R-Squared = 0.995  
F-stat = 1316.3 [0.000]

Long-run coefficients presented in Table-5 suggest that Edible oil deficiency had significant and negative relationship with Food Expenditure because of the inefficiency in domestic edible oil production. Countries from which the edible oil and oilseeds have been imported are much more efficient than Pakistan’s domestic industry for edible oil and hence, due to low cost of production, they sell us at a price lower than local market price and hence in the terms of edible oil deficit, it is proving to be good for Pakistani consumers but relying on imports would multiply the import bill and producers will suffer. Per-Capita GDP has significant and positive long run relationship with Food Expenditure suggesting that higher income per member of a household will lead to higher food expenditure; especially in poor households due to the shift in quality of food consumed (Kirkpatrick, 2003). Interestingly, coefficient for Food Subsidy (in natural log) was found to be statistically significant. The reason for its insignificance is the fact that food subsidies are often not well targeted and hence the group of consumers meant to get benefit, does not actually get it (Rogers, 1978). Moreover, even if it is ensured that the targeted consumers get benefits from the subsidy, there is a common perception about the bad quality of subsidised food items which would restrict many of the consumers to go for subsidised food and hence the food expenditure is not affected by food subsidy programs [Khan, (1982) and Kavand, (2007)].

\(^6\) ARDL(1, 1, 0, 0) selected based on Akaike Information Criterion
Table-6: Error correction representation of ARDL model\(^7\)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>(\Delta LNFEXP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regressor</td>
<td>Coefficient</td>
</tr>
<tr>
<td>(\Delta LNEDEF)</td>
<td>0.053</td>
</tr>
<tr>
<td>(\Delta LNFSUB)</td>
<td>0.098</td>
</tr>
<tr>
<td>(\Delta LNPGDP)</td>
<td>-0.190</td>
</tr>
<tr>
<td>ECM(-1)</td>
<td>-0.405</td>
</tr>
</tbody>
</table>

R-Squared\(^8\) = 0.5  
F-stat = 4.513 [0.003]

Table-6 compares the significance of exogenous variables and it is evident that all three variables were insignificant suggesting that per capita GDP, Food Subsidy and Edible Oil deficiency does not significantly affect the food expenditure in short run. The estimated lagged error correction term ECMt-1 is negative and highly significant. These results supporting the co integration among the variables included in the model. The feedback coefficient is -0.405 suggesting that about 0.41% disequilibrium is corrected in the same year. Finally we have concluded that in the short run no variable in the model exerts significant impact on food expenditure.

\(^7\) ARDL(1, 1, 0, 0) selected based on Akaike Information Criterion

\(^8\) R-Squared measure refer to the dependent variable \(\Delta LNFEXP\) and in cases where the error correction model is highly restricted, these measures could become negative.
Co integration results

Table-7: Tests based on Maximal Eigen-value of the stochastic matrix

<table>
<thead>
<tr>
<th>$H_0$</th>
<th>$H_1$</th>
<th>Max Eigen Statistic</th>
<th>95% Critical Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r=0$</td>
<td>$r=1$</td>
<td>32.54*</td>
<td>32.11</td>
<td>0.0443</td>
</tr>
<tr>
<td>$r\leq1$</td>
<td>$r=2$</td>
<td>19.11</td>
<td>25.82</td>
<td>0.2976</td>
</tr>
<tr>
<td>$r\leq2$</td>
<td>$r=3$</td>
<td>10.85</td>
<td>19.38</td>
<td>0.5279</td>
</tr>
<tr>
<td>$r\leq3$</td>
<td>$r=4$</td>
<td>6.72</td>
<td>12.51</td>
<td>0.3743</td>
</tr>
</tbody>
</table>

Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

The results of Johansen Co-Integration test based on Max Eigenvalue reported in Table 7 suggest that there was one co-integrating equation in the model and there was an evidence of long run relationship amongst the variables providing an evidence for the results we found using ARDL approach to cointegration. Similarly Table-8 presents the results of Johansen test based on Trace Statistics and using this criterion we came to the same conclusion that there is one co-integrating equation, proving that there is long run relationship amongst the variables.

Table-8: Tests based on Maximal Trace of the stochastic matrix

<table>
<thead>
<tr>
<th>$H_0$</th>
<th>$H_1$</th>
<th>Trace Statistic</th>
<th>95% Critical Value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r=0$</td>
<td>$r\geq1$</td>
<td>69.24*</td>
<td>63.87</td>
<td>0.0165</td>
</tr>
<tr>
<td>$r\leq1$</td>
<td>$r\geq2$</td>
<td>36.69</td>
<td>42.91</td>
<td>0.1820</td>
</tr>
<tr>
<td>$r\leq2$</td>
<td>$r\geq3$</td>
<td>17.58</td>
<td>25.87</td>
<td>0.3727</td>
</tr>
<tr>
<td>$r\leq3$</td>
<td>$r\geq4$</td>
<td>6.72</td>
<td>12.51</td>
<td>0.3743</td>
</tr>
</tbody>
</table>

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Conclusion

Results show that edible oil deficit has negative and significant long run relationship with Food expenditure of and household. The relationship between the per capita GDP and food expenditure is found to be positive and significant with elasticity of 0.261 suggesting that 1 percent increase in per capita GDP will cause food expenditure to increase by 0.26 percent. The relationship between food subsidy and food expenditure is found to be insignificant suggesting that due to improper targeting and consumer’s perception about quality and accessibility of subsidized food, Government’s food support programs are not effective.

Demand for edible oil is increasing with time and local production has failed to cope with it. As a consequence, Pakistan’s edible oil import bill has grown at tremendous rate and has become unaffordable in the recent years. Negative relationship between edible oil deficit and food expenditure suggests that edible oil has been produced much more efficiently in the import host countries due to which it has been imported at low prices. This practice is positively affecting the consumers but from long run aggregate economic perspective these increasing imports are not harmless. Pakistan needs to exploit its unrealized yield potential in production of oilseed crops. In order to accomplish this effectively the cultivation of individual oil crops should be attached priority on the basis of their oil yields, climatic requirements and consistency with other national objectives. Crops that are used internationally in production of edible oil which are yet to be used in Pakistan, needs urgent attention in order to deal with the increasing deficit of edible oil.

There is a need to encourage the cultivation of non-traditional oil seeds i.e. sunflower, safflower, canola & soyabean. Olive along with other oilseeds crops has bright prospects for becoming the major edible oil source for the country if handled properly. Total cultivable waste land,
uncultivated forest and marginal barani area in the medium to high rainfall zones of the country and especially in NWFP province was about 6.870 million acres (Kakakhel 2008).

Some programs are required for the education of farmers to understand the new techniques of farming. The efforts of research, teaching and extension should be closely coordinated. Farmers should be encouraged to use their land for oilseed cultivation with other crops by ensuring the return on it. Pakistan should also improve oil extraction efficiency by reducing wastages, modernization of oil extraction industry and revival of solvent extraction industry through incentives. There is a need to allocate sufficient credit for the purpose of working capital during the harvesting season to these industries.

The area which are found socially profitable for the cultivation of oil seeds crops should be declared as an “Oil seed Zones”. For this purpose there is a need to have an environment and soil research to find out the feasibility of the olive oil cultivation. The Potowar area, has great potential to bring the import burden of the country to meets it edible oils demand. The potential is also found in the Balochistan areas which include Khuzdar, Loralai, Quetta, Pishin, Zhob and Sibi etc (Chaudhry 2008). The weather conditions (high rain falls) in the northern part of the Punjab, and the Hazara area in NWFP are quite suitable for the olive oil cultivations. The potential is seen in research study conducted by the NWFP agriculture research centre, approximately there is a about two million acres of cultivable wastelands and uncultivated forest area, which can be brought under olive oil cultivation. The policy makers should explore and design a strategic framework for the olive oil cultivations to achieve the economic growth either via government interventions or bringing private investments (Amir 2006).

Another way to increase cultivation of oil seed crops is to attract small farmers with 5 to 12.5 acres of land holding toward cultivation of oilseeds through provision of inputs like seed,
fertilizers, irrigation and credit because these farmers have low financial capacity. Awareness is needed to be developed in the small farmers in order to encourage them to shift to oilseed crops. Most of the farmers are engaged in production of cash crops and it is very difficult to convince them because they need practical evidence of its success. In order to provide them practical evidence government can produce oilseed crops near their respective areas and make them see the advantages so that they’ll get motivated to produce oilseed crops.

Improved management practices are needed to raise production. Per acre yield can be increased by introducing higher yielding hybrids, early maturing hybrids, hybrids resistant to insects, pests and diseases, availability of other inputs such as fertilizers, irrigation etc. and adoption of modern technology.

Agriculture Policy making does not properly involve small farmers and peasants which is not considered as good practice in developed countries. We should follow the footsteps of the developed and rapidly developing countries to make our system more effective and efficient. Pakistan should focus on strengthening the domestic market instead of export oriented policies which have not proved to be very successful over the years (Hasnain, 2007).
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