Demand for Palm Oil in Turkey

Kalsom Zakaria*; N Balu*; Norhanani Mohd Baharim* and Norrafidah Mohd Rapiee*

ABSTRACT

This study attempts to examine the short- and long-run relationships between Turkey's palm oil imports, palm oil prices, sunflower oil prices and domestic income, using the Autoregressive Distributed Lag (ARDL) method with data collected for the period 1980 to 2015. The bound test indicates that there is a long-run relationship between the studied variables. The empirical results show that domestic income, measured by the Gross Domestic Product (GDP), and sunflower oil prices have positive significant relationships with palm oil demand in Turkey in the long run. At the same time, palm oil prices show a significant negative relationship with palm oil demand in Turkey.

Keywords: palm oil, Turkey, ARDL, GDP, unit root test, error correction models.

INTRODUCTION

The agriculture sector plays a vital role in the development of the Turkish economy. It is the seventh largest sector contributing over 8% of the Gross Domestic Product (GDP) and absorbs 21% of the country's total labour force (Investment Support and Promotion Agency of Turkey, 2017). This sector is the main source of raw and food materials to other sectors. Agricultural products are one of the main contributors to Turkey's exports and the sector attracts the largest market share of industrial products such as pesticides, fertiliser, agricultural machinery and implements.

Turkey is also one of the countries in the world having the most agricultural land. About 35.5% of the country comprises arable land, while 15% consists of forests. Cultivated land covered around 24 million hectares in 2015. Around 18.4% of the cultivated land is irrigated. Vegetable products account for 76% of total agricultural production, followed by animal husbandry accounting for 15%, while forestry and fishing contribute a much smaller amount (8%). Oilseeds are one of the vegetable products. According to USDA (2017), Turkey's oilseed production is estimated at 2.45 million tonnes in 2016/2017. Total production is projected to increase by about 11% to 2.71 million tonnes in 2017/2018. Sunflower is the most important oilseed in Turkey, and dominates 70% (600-700 tonnes) of the country's liquid vegetable oil consumption. However, sunflower production of about

* Malaysian Palm Oil Board,
6 Persiaran Institusi,
Bandar Baru Bangi,
43000 Kajang Selangor,
Malaysia.
E-mail: kalsom@mpob.gov.my

800 000 tonnes is insufficient to meet the local consumption (Kaya *et al.*, 2008).

In 2000, total consumption of edible oils was 1.77 million tonnes, while production of these oils was 1.04 million tonnes, accounting for 58.9% of the total availability of oils. The balance of 46.3% of total availability was filled by imports. Similarly, in 2005, 1.24 million tonnes (or 60.89%) of edible oil were imported, while local production was 1.08 million tonnes, *i.e.* 53.3% of total availability of these oils. Total consumption of oils was 2.03 million tonnes (*Figure 1*).

The five major vegetable oils consumed in Turkey are sunflower, palm, soyabean, rapeseed and cotton oils. Palm oil is the second most consumed vegetable oil from 2000 to 2016, and the quantity had been increasing from year to year. In 2000, the consumption of palm oil was 209.1 million tonnes. By 2010, the consumption of palm oil had increased by 91.15% to 399.7 million tonnes, while in 2016, the consumption of palm oil was 601.8 million tonnes (*Figure 2*).

Many factors influence the demand for palm oil in Turkey. Several studies done on the demand for oils and fats in Turkey show that they are used in the food industry as well as for fuel. Kleindorfer and Öktem (2007) conducted a study on the economic and business challenges in biodiesel production in Turkey. The source of oil for biodiesel production has primarily been from imported palm oil and soyabean oil until late 2015. In 2006, there was a transitional period when 5-6% of existing biodiesel sales (500 000 t) used palm oil imported mainly from Africa.

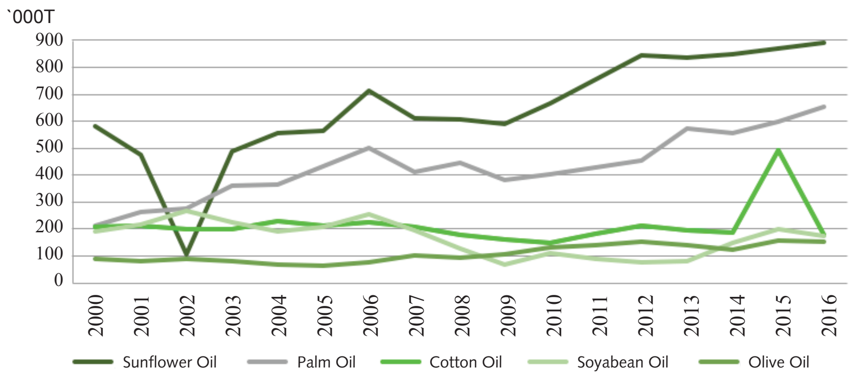

Figure 1. Total oils and fats disappearance, production and imports of Turkey, 2000 – 2016.

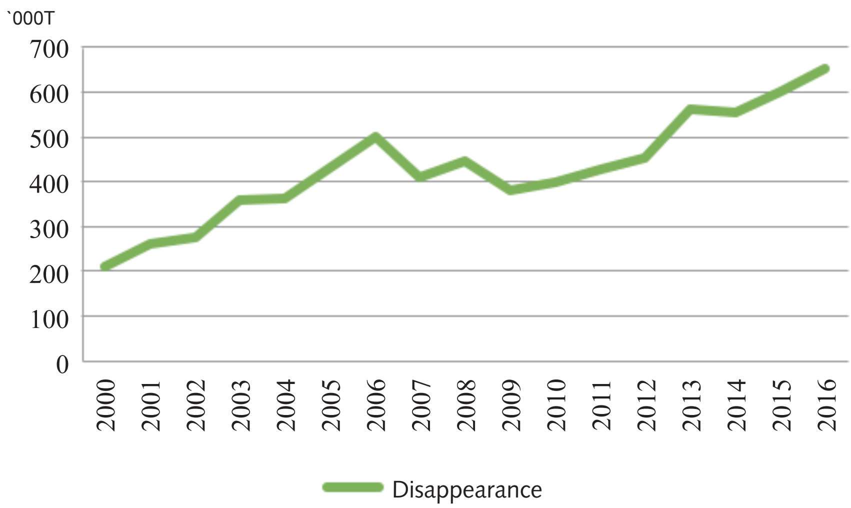

Figure 2. Palm Oil disappearance in Turkey, 2000-2016.

The above study was continued by Erdoğan and Keskin (2015). They focussed on evaluating biodiesel production problems in Turkey using SWOT analysis. Biofuel-producing countries usually grow their own agricultural products and utilise them in the production process rather than import the raw materials. These countries specialise particularly in those agricultural products which adapt well to their climatic conditions. For example, the EU countries use rapeseed oil in biodiesel production and developed a standard according to this raw material. USA, on the other hand, prefers using corn as the raw material in bioethanol production, whereas Brazil prefers sugarcane for the same purpose. South-East Asian countries, such as Indonesia and Malaysia, use palm oil in biodiesel production.

Eryilmaz *et al.* (2016) studied the potential of using oilseeds in diesel production in Turkey. Biodiesel can be used on its own or by mixing it with petroleum-based diesel at various rates. Most of the world uses a system known as the 'B' factor to state the amount of biodiesel in any fuel mix. For example, fuel containing 20% biodiesel is labelled B20, while pure biodiesel is referred to as B100. Globally, there are more than 350 oil-bearing crops which have been identified as potential sources for biodiesel production. The cost of biodiesel varies, depending on the base stock, geographic area and variability in crop productivity from season to season. The dominant feedstocks are soyabean oil in USA, rapeseed oil in Europe and palm oil in South-East Asia. In Turkey, there is an increased potential for using oils and fats to produce biodiesel. El-Araby *et al.* (2017) developed mixing rules to calculate the essential properties of palm oil, palm oil biodiesel and their blends with diesel fuel as a function of diesel content based on experimental values of the blended fuel properties. The results show that fuel properties of blends up to 30% were very close to those of diesel, provided that the other characteristics were within the set limits. Mohd Hafizil *et al.* (2017) discussed the potential of palm oil as a new feedstock oil for a global alternative fuel. This study showed the benefits of using biodiesel, such as mitigating environmental pollution and reducing full dependency on fossil fuel. Such benefits will indirectly increase the demand for oils and fats in Turkey.

Price is another factor that influences the demand for palm oil. Mohammad Suhaili (2015) discussed price competitiveness, showing that a price discount of more than USD 100 t^{-1} exists for palm oil products when compared to the prices of sunflower oil products. In agreement with a report by the Turkish Vegetable Oil Association (2013), the study suggested that this has resulted in palm oil dominating 81% of the margarine market for local consumption in Turkey. Besides that, a study by Akbay and Boz (2007) on household food consumption in Turkey showed that price influenced the demand for oils and fats in the country.

Attitude is also a factor that influences the demand for palm oil in Turkey. Topcu *et al.* (2009) studied Turkish consumer attitudes towards food products in Erzurum. The study divided consumers into three groups, namely C1 (young, high income), C2 (mature, low income) and C3 (mature, mid income). The results show that price was the dominant factor influencing the food buying decisions of consumers in all groups. Consumer satisfaction with the food products, brand loyalty and price were the most effective factors in clusters C1, C2 and C3, respectively. In addition, income played an important role by contributing to the demand for food in Turkey, with oils and fats being one of the components of food. Azam and Acaroglu (2015) studying food consumption pattern in Eskisehir, Turkey, observed the behaviour of the residents, in terms of the relationship between income and food consumption. The study showed that the average income spent on food was 42.39% of total income. It was concluded that income and the size of the household were positively correlated with the consumption of various food items.

According to Mohammad Suhaili (2014), Turkey has good potential for expanding her palm oil market. The study showed that Turkey had a large population and high growth in palm oil imports and consumption. The demand for palm oil in the food, oleochemical and other non-food industries increased every year. The study also showed that there was high potential for the use of palm oil in the blended cooking oil sector. This is in agreement with the findings of Haznita (2011), which showed opportunities for palm oil in the growing food industries, especially in the biscuit and bakery sector, and fried snacks. Furthermore, the ongoing removal of trans-fats from many consumer products, particularly margarine, coupled with the changing consumer behaviour towards a healthier choice, augers well for palm oil.

METHODOLOGY

Annual data on Turkey's palm oil imports, palm oil and sunflower oil prices were collected from the United Nations Conference on Trade and Development (UNCTAD) database. Data on real GDP were obtained from the World Development Indicator (WDI).

ARDL Bound Test

For empirical analysis, this study first investigated the stationarity property of the variables by employing the unit root tests commonly cited in empirical literature, including the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. The reason for the unit root tests is that generally economic and financial time series, such as prices and real GDP, exhibit trending behaviour or non-stationarity in the means. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among non-stationary time series variables. If these variables are integrated to the order of one I (1), co-integration techniques can be used to model these long-run relationships. Hence, pre-testing for unit roots is often a first step in cointegration modelling.

The study then employed the Autoregressive Distributed Lag (ARDL) bound testing approach to cointegration developed by Pesaran *et al.* (2001) to verify any long-run relationship between the variables. This method was chosen for its advantages when dealing with a small observation number, as well as the fact that it can be applied irrespective of the order of integration, *i.e.*, I (0) or I (1). In addition, the ARDL method avoids the larger number of specifications to be made in the standard cointegration test. These include decisions regarding the number of endogenous and exogenous variables (if any) to be included in the treatment of the deterministic elements, as well as the optimum number of lags to be specified. By employing the ARDL method, it is possible to have different variables that have different optimal lags, which is impossible with the standard cointegration test. Moreover, the model can be used with limited sample data.

The estimated ARDL model is as follows:

$$\Delta \ln POimport_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln GDP_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta \ln PSFO_{t-j} + \sum_{k=1}^{r} \beta_{3k} \Delta \ln PPO_{t-k} + \delta_1 \ln POimport_{t-1} + \delta_2 GDP_{t-1} + \delta_3 \ln PSFO_{t-1} + \delta_4 \ln PPO_{t-1} + \varepsilon_t \quad (1)$$

where:

α, β and δ	:	Parameter to be estimated
GDP_{t-1}	:	Gross Domestic Product
PPO_{t-1}	:	Palm oil price
$SFOP_{t-1}$	:	Sunflower oil price
$POImport_{it}$	:	Palm oil imports by Turkey
ε_t	:	Error term

The study then estimated the long-run relationships between the variables. The first step was to justify the interval for the variables by using the F-statistic (variable addition test). The null hypothesis of no cointegration (H0: δ1 = δ2 = δ3 = 0) was tested against the alternative hypothesis of existing cointegration (H1: at least δm ≠ 0, m = 1,2,3). Two sets of critical bounds for the F-statistic had been generated by Pesaran *et al.* (2001) and Narayan (2005): the lower critical bound (LCB) and the upper critical bound (UCB). If the F-statistic is less than LCB, it indicates that there is no cointegration or long-run relationship between the studied variables. However, if the F-statistic is greater than UCB, it means that there is cointegration or long-run relationships between the variables. On the other hand, if the F-statistic is between LCB and UCB, the cointegration test is considered to be inconclusive.

The second step of the ARDL estimation procedure involved estimation of the coefficients of the variables in the equation. The lag selection criterion of the model was based on either the Akaike Information Criterion (AIC) or Schwartz-Bayesian Criterion (SBC). Once cointegration was established, the conditional ARDL long-run model can be estimated as follows:

$$\ln POimport_t = \alpha_1 + \sum_{i=1}^{p} \delta_{1i} \ln GDP_{t-i} + \sum_{j=0}^{q} \delta_{2j} \ln PSFO_{t-j} + \sum_{k=0}^{r} \delta_{3k} \ln PPO_{t-k} + \varepsilon_{t-1} \quad (2)$$

The subsequent estimation and model selection were made based on three criteria, namely the adjusted R-squared, AIC and SBC, to select the maximum length of the interval.

Finally, the study looked at the short-run dynamic parameters by estimating an error correction model associated with the previously determined long-run estimates. The ARDL error correction model is expressed by the following equation:

$$\Delta \ln POimport_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln GDP_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta \ln PSFO_{t-j} + \sum_{k=1}^{r} \beta_{3k} \Delta \ln PPO_{t-k} + \psi ECM_{t-1} + \varepsilon_{t-1} \quad (3)$$

where β_1, β_2 and β_3 are the short-run dynamic coefficients of the model's convergence to the equilibrium, ψ is the speed of the adjustment parameter, and ECM is the error correction term that is derived from the estimated equilibrium relationship of Equation (1). Equation (3) indicates that when there is a shock in the economy, the higher the value of the error correction coefficient (in negative terms), the quicker the economy adjusts to achieve long-run equilibrium, and *vice versa*. To ascertain the goodness of fit of the ARDL model, diagnostic and stability tests were conducted. The diagnostic test examined the serial correlation, functional form, normality and heteroscedasticity associated with the model, by employing the Lagrange Multiplier (LM) test. The structural stability test was conducted to determine the stability of the model by employing the cumulative sum of recursive residuals (CUSUM) test and the cumulative sum of squares of recursive residuals (CUSUMSQ) test.

EMPIRICAL RESULTS

Unit Root Tests

Prior to testing for co-integration, a test on the order of integration for each variable using the Augmented Dickey-Fuller (ADF) and Phillip Perron (PP) procedures to examine data stationarity, and consequently the existence of unit root, was conducted. *Table 1* shows that based on the ADF and PP tests, the calculated t-statistic for PO import was greater than the critical values in their level forms, suggesting that these variables were stationary at the level form or integrated to the order I(0). For the GDP, PSFO and PPO variables, the calculated t-statistic was less than the critical values in the level form and greater than the critical values in the differenced forms, thus suggesting that they were stationary after the first difference or integrated to the order I(1).

TABLE 1. UNIT ROOT TESTS (WITH INTERCEPT)								
Variable	Level				First difference			
	ADF				ADF			
POImport	-5.4606	***	-5.2198	***	-9.4317	***	-18.9209	***
GDP	0.7396		-0.9916		-6.5101	***	-7.1536	***
PSFO	-1.8677		-1.9344		-7.0676	***	-6.9664	***
PPO	-2.0811		-2.2194		-7.0007	***	-5.6206	***

Note: * significant at 10% level, ** significant at 5% level, *** significant at 1% level.

TABLE 2. ARDL BOUND TEST OF COINTEGRATION				
F-Statistic	95% lower bound value	95% upper bound value	90%lower bound value	90% upper bound value
15.67	3.5934	4.8908	2.9357	4.0778

Autoregressive Distributed Lag (ARDL) Bound Testing

The results of the bound test in *Table 2* indicate the existence of a long-run relationship between the variables. The reason is that the F-statistic result was higher than the upper bound value at the level of significance of 95% and other upper value at the 90% level of significance. The serial autocorrelation was checked by the Breusch-Godfrey LM test. The value which is greater than 0.05% of the value of the LM test at the 95% confidence interval represents the absence of serial autocorrelation. The results are given in *Table 3*.

Long-run Estimations

The empirical results of the Turkish long-run models are presented in *Table 4*. The results indicate that income as measured by the real per capita GDP had a long-run positive influence on Turkish palm oil imports (POImport). It suggests that palm oil was perceived by the Turkish people as a normal product. The model showed that, in the long run, for every 1% increase in real per capita GDP, Turkish palm oil imports will increase by 2.84%. Another important factor that explained the volume of Turkish palm oil imports was the price of sunflower oil (PSFO). The model indicated that, in the long run, for every 1% increase in the price of sunflower oil, Turkish palm oil imports will increase by 1.84%. Palm oil price also influenced the imports of palm oil, with the results showing that in the long run palm oil price (PPO) had a negative influence on Turkish palm oil imports. Every 1% increase in the price of palm oil will result in Turkish palm oil imports declining by 1.96%.

Short-run Error Correction Models

The short-run error correction model (ECM) from the ARDL model is presented in *Table 5*. Most of the variables were found to be significant in the short run. It was found that in the short run, lagged GDP and lagged sunflower oil price had positive relationships with palm oil imports. However, lagged palm oil price was found to have a negative impact on palm oil imports in the short

TABLE 3. TEST FOR SERIAL CORRELATION		
Test	Statistic	Probability
Breusch-Godfrey LM test	0.0580	0.811

TABLE 4. ESTIMATED LONG-RUN COEFFICIENTS USING ARDL APPROACH		
TURKEY: ARDL (1,0,0,0) based on Schwarz Bayesian Criterion (SBC)		
Variable	Dependent variable: POImport	
	Coefficient	t-value
Constant	-12.8695	-4.7775***
GDP	2.8453	6.7389***
PSFO	1.8359	2.8994**
PPO	-1.9565	-3.8875**

Note: * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

TABLE 5. ERROR CORRECTION REPRESENTATION FOR THE SELECTED ARDL MODEL		
TURKEY: ARDL (1,0,0,0) based on Schwarz Bayesian Criterion (SBC)		
Variable	Dependent variable: POImport	
	Coefficient	t-value
ΔGDP	2.1382	4.3986***
ΔPRSFO	1.3796	3.1309**
ΔPPO	-1.4702	-4.0440***
ECT(-1)	-0.7515	-8.8140***
Diagnostic test		
R-squared	0.7792	
Adj. R-squared	0.7497	
Durbin Watson	2.0547	
Alkaike info criterion	-7.1331	
F-statistic (7, 24)	26.4621***	

Note: * Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level.

run. The error correction terms (ECT(-1)) were negative and highly significant. This shows that there was causality in at least one direction. For Turkey, the ECT coefficient is -8.8140, which indicates a higher rate of convergence to the equilibrium.

CONCLUSION

The study found that there are relationships between the variables, both long-run and short-run, in the demand for palm oil in Turkey. Based on the results, the most significant influence is attributed to GDP (positive relationship); as GDP increases, the demand for palm oil will increase. The price of palm oil has a significant and inverse relationship with the palm oil demand in Turkey. A similar observation was made by Mohammmad Suhaili (2015), who noted that price competitiveness is the main reason for the increasing demand for palm oil in Turkey. The findings from this study are also in tandem with the results from other studies in this field, *e.g.* Hameed *et al*. (2007) in the context of the Middle East and North Africa, which also found that palm oil price, income and price of a substitute oil are significant determinants of palm oil demand. Tety *et al.* (2009) found that factors which influence the consumption of Indonesian palm cooking oil include palm cooking oil price and the population.

ACKNOWLEDGEMENT

The authors wish to express their sincere thanks to the Director-General of MPOB for permission to publish this article.

REFERENCES

AKBAY, C and BOZ, I (2007). Household food consumption in Turkey. *European Review of Agricultural Economics, 34(2)*: 209-231.

AZAM, A and ACAROLU, H (2015). Food consumption pattern in Eskisehir. *International J. Financial Research, 7(1)*: 101-108.

EL-ARABY, R; ASHRAF AMIN, A; EL MORSI, K; EL-IBIARI, N N and EL-DEWANI, G I (2017). Study on the characteristics of palm oil-biodiesel-diesel fuel blend. *Egyption J. Petroleum*, p. 1-8.

ERDOĞAN, Y and KESKIN, M (2015). Evaluation of biodiesel production problems in Turkey. *Proc. of the World Congress on New Technologies (NewTech 2015)* Barcelona, Spain, July 15-17, 2015. p. 162.

ERYILMAZ, T; KADIR, M; YESILYURT, CESUR, C and GOKDOGAN, O (2016). Biodiesel production potential from oil seeds in Turkey. *Renewable and Sustainable Energy Reviews*, *58*: 842-851.

HAMEED, A A A; ARSHAD, F M; SHAMSUDIN, M N and YUSOF, Z (2007). The palm oil import demand in Middle East and North African (MENA) countries. *J. International Food & Agribusiness Marketing, 9(2-3)*: 143-169.

HAZNITA, H (2011). Growing demand for palm oil in Turkey – A positive development for MPO. *Malaysia Palm Oil Fortune, 9*: 1, 7, 11.

INVESTMENT SUPPORT AND PROMOTION AGENCY OF TURKEY (2017). Retrieved from http://www.invest.gov.tr/en-US/sectors/Pages/Agriculture.aspx, accessed on 20 November 2017.

KAYA, Y; KAYA, V; SAHIN, I; KAYA, M U; EVCI, G and CITAK, N (2008). The future potential of oleic type sunflower in Turkey. *Proc. 17th Int. Sunflower Conference*, Cordoba, Spain.

KLEINDORFER, P R and ÖKTEM, Ü G (2007). Economic and Business Challenges for Biodiesel Production in Turkey. Retrieved from http://opim.wharton.upenn.edu/risk/ library/2007_PRK-UGO_BiodieselTurkey.pdf, accessed on 20 November 2017.

MOHAMMAD SUHAILI (2015). Price competitiveness supports the increasing demand of palm oil in Turkey. Palm oil demand up in Turkey. *Global Oils and Fats Business Magazine*, *12(3*): 18-20. Palm Oil Market Development Report, at http://www.pomdr.org.my/ report_view.php?id=66, accessed on 20 November 2017.

MOHD HAFIZIL, M; RIZALMAN, M; NAJAFI, G; OBED MAJEED, A; AHMAD FITRI, Y and MOHD HAFIZ, A (2017). Potential of palm oil as new feedstock oil for global alternative fuel: A review. *Renewable and Sustainability Energy Reviews, 79(1)*: 1034-1049.

MOHAMMAD SUHAILI (2014). Great potential to expand palm oil market in 2015. Regional workshop on: *Palm Oil Trade Fair and Seminar (POTS)*, Kuala Lumpur 2014. MPOC.

TETY, E; HUTABARAT, S and NOFIANNA, A S (2009). The influencing factors on consumption of palm cooking oil in Indonesia. *Economic J. Emerging Markets, 1(2)*: 137-246.

TOPCU, Y; ISIK, H B and UZUNDUMLU, A S (2009). Turkish consumer attitudes toward food products: The case of Erzurum. *Italian J. Food Sci., 1(21)*: 37-50.

USDA (2017). Turkey Oilseeds and Products Annual Report. GAIN Report Number: TR7006.