Factors Affecting Palm Oil Demand in India

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Article history:
Received: 19 Jan. 2017
Accepted: 18 April 2017
Available online: 1 Sept. 2017

ABSTRACT

India is the world's leading importer of edible oils and is likely to remain a prominent importer in the future. Her large population and steady economic growth are important contributing factors for her increasing consumption and imports. In the late 1980s and early 1990s, India pursued self-sufficiency in vegetable oil production. However, domestic production was then stagnant and unable to meet the growing demand. This caused the government to allow the import of edible oils under open general license (OGL), particularly of palm oil due to its price competitiveness. With the increasing demand for imported oils and fats, especially palm oil, a study on India's palm oil demand is deemed important. This study aimed to determine factors influencing the demand for palm oil in India by using the Autoregressive Distributed Lag (ARDL) models over the period 1980-2015. The result of the bound test indicates that there is a long-run relationship between the studied variables and palm oil demand. The empirical result reveals that population has a significant positive relationship with palm oil demand in India in the long-run. However, domestic income measured by gross domestic product (GDP) and the price discount of palm oil over soyabean oil was found to have a significant negative relationship with palm oil demand in India. The negative relationship between GDP and palm oil demand shows that palm oil is perceived by Indians to be an inferior goods. Meanwhile, the negative relationship between the difference between soyabean and palm oil prices and palm oil demand shows that not only are soyabean and palm oils close substitutes, but also that palm oil has the characteristic of a giffen goods.

Keywords: palm oil, demand, India, ARDL, bound test.

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INTRODUCTION

India is the largest importer of edible oils in the world. Consumption of edible oils is forecast to increase by 4% to 22.71 million tonnes in 2016/2017 (USDA, 2016b), in line with the expanding population, rising disposable income, the growing

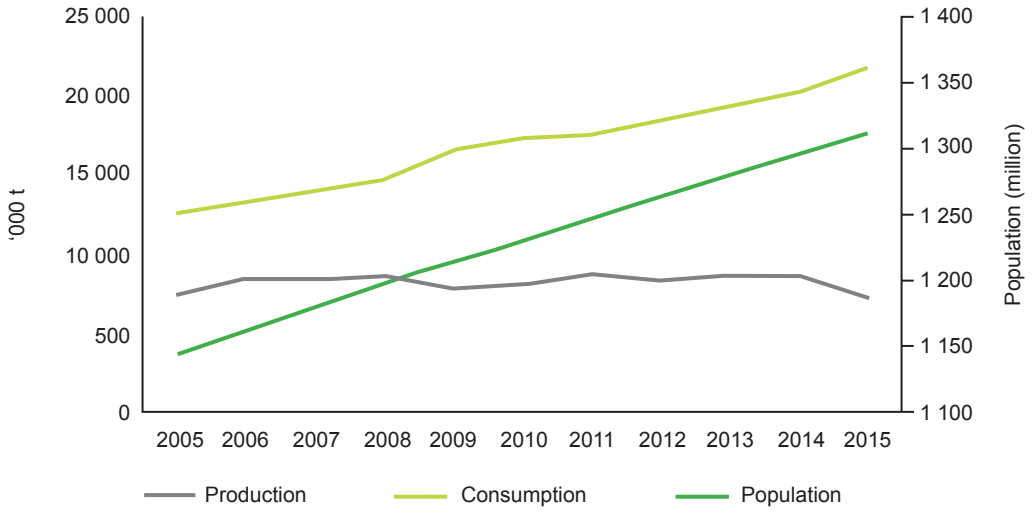
demand from hotels, restaurants, institutions, households and food-based industries, all of which will encourage higher consumption (USDA, 2016a). Per capita edible oil consumption in India is also increasing and is estimated at 17.18 kg for 2015/2016. However, this remains below the global average consumption of 24.86 kg per capita (USDA, 2016a). The Indian population of 1.3 billion is growing at an annual rate of 1.2% (World Bank, 2016). This booming population, combined with robust economic growth and the stagnation in domestic production of oilseeds, provides the basis for the country's year-on-year increase in imports of vegetable oils.

India plays an important role in the global edible oils market, accounting for 15.70% share in consumption and 4.04% share in oilseeds production in 2015. In 2005, the consumption of edible oils was 13 100 million tonnes, and this increased to 17 811 million tonnes in 2010, and to 22 285 million tonnes in 2015. India's production of edible oils also increased over the years, following a similar trend to that of consumption. Production increased from 8144 million tonnes in 2005 to 8961 million tonnes in 2010, but declined slightly to 8269 million tonnes in 2015. However, there are differences between consumption and production of various edible oils in India. The increase in production of domestic edible oils has been unable to keep pace with the increase in consumption. Thus, this gap is being met by imports. The continuous widening of the gap between demand and supply of edible oils has forced India to undertake huge imports from leading exporting countries of edible oils. In the regard, from 2013 to 2015, India was the main importer of edible oils in the world (USDA, 2016b).

The five major edible oils consumed in India are groundnut, rapeseed, sunflower, soyabean and palm oils. The consumption pattern of edible oils in India has been changing through time. In 1995, the major vegetable oil consumed in India was rapeseed oil, which accounted for 25% of the total oils and fats consumption. This was then followed by groundnut oil, butterfat, palm oil and soyabean oil. In 2011, palm oil became the major vegetable oil consumed in India at 36%, followed by soyabean oil, rapeseed oil and butterfat. India has become an important market for edible oils in line with significant increases in her population and economic growth. Consequently, understanding the Indian market demand and buying patterns of edible oils is important (*Figure 1*). However, published literature on the demand for palm oil in India is very limited, despite the fact that the information related to palm oil demand in India is very important for policy-makers and exporters in Malaysia to understand the factors that shape the importing and buying pattern of edible oils and fats in India.

LITERATURE REVIEW

According to Fatimah (2012), India's food requirements are expected to grow in tandem with the growth of the country's population and improving economy (higher income and better standard of living). Apart from that, changes in population structure will also influence the demand for foods. Increasing at a rate of 1.4% a year, the Indian population can be considered a young population,



Source: Oil World (2010; 2015; 2016), World Bank (2016).

Figure 1. Supply and demand of edible oils in India.

which in general, has a bigger appetite for food, therefore driving a bigger demand for food in the country. A similar argument was made by Patel (2016) who showed that there is a relationship between demand for food and population. The study also found that there are many factors which influence edible oil demand in India, such as the consistent gross domestic product (GDP) growth rate of about 7% in the last five years, the big emerging Indian middle class, the double-digit growth of out-of-home consumption of edible oils, and per capita consumption of edible oils of 15.32 kg (for 2014-2015).

India is a vast country and the inhabitants of several regions have developed a specific preference for certain edible oils in the respective regions; for example, people in southern and western India prefer groundnut oil, those in eastern and northern India use mustard seed/rapeseed oils, while several southern Indian states have a preference for coconut and sesame oils. There are a few studies on the factors influencing the purchasing decisions of edible oils by households. Ruchi (2016) examined the factors influencing the customer when buying branded edible oils. This study was based on primary data from a random sample of 200 respondents selected in the Hadoti region. The study found that 50% of the respondents were unaware of the benefits associated with edible oils. Purchases of the edible oil were based on the husband's opinion. This shows that the husband played a major role in deciding on the purchase of edible oils, amounting to 50% of the time. In terms of monthly consumption pattern of edible oil, the analysis showed that around 39% of the respondents consumed 1-2 litres of edible oil. In the Hadoti region, it was found that people generally preferred soyabean oil which accounted for 50% of the edible oils consumed.

Sarwade (2011) also studied the factors influencing the purchasing decision for edible oils, but in a different state in India, namely Maharashtra state. This study used primary data from the state, covering 35 different districts with 10 scores of the population. One thousand respondents were selected and the results show that for the majority of the families interviewed, the housewife was the decision-maker for the brand and type of edible oils used. Health awareness and quality of a particular brand were the next important factors in the decision making. This study also found that branded oil was preferred over the loose oils amongst the higher income class of consumers. The majority of the respondents consumed 2-4 litres of edible oils per month. In Maharashtra state, most of the respondents used sunflower oil, followed by *kardi* (safflower), groundnut, soyabean and corn oils, and *kardi* blends.

Bhuvaneswari (2015) tried to evaluate consumer awareness on various branded edible oils, to identify the factors that influenced the purchase of edible oils, and to find the usage and consumption patterns of edible oils. The researcher used the random sampling method in a survey of 250 respondents in Coimbatore City, Tamil Nadu. The study found that 100% of them were aware of the brand *Gold Winner* (sunflower oil), 98% of *Parachute* (for coconut oil), 94% *Idayam* (for gingerly oil), 83% *Ganapathy* (for groundnut oil), 79.6% Ruche (for palm oil) and 94.8% *Dalda* (for vanaspathi). Thus, the study showed that the majority of the consumers were aware of the branded edible oils they used. Most of the respondents purchased edible oils from supermarkets on a cash basis, spending Rs 1000-2000 on the oils for cooking purposes. From the study, it was found that gender was a significant influence on the frequency of purchase of the various brands of edible oils. It was also found that occupational status was a significant influence on the place of purchase of the various brands of edible oils. Education level and number of family members also had significant influence on the mode of purchase of the various brands of edible oils in Coimbatore City.

Vyas *et al*. (2013) analysed edible oils consumption in Raipur City to understand the factors influencing the purchasing decisions for edible oils, buying and consumption patterns of the product, and also to understand the preference of demographic clusters. The majority of the respondents held a Master's degree, followed by a Bachelor's. The research which used Cluster analysis found that health factors were important in the choice of brands by the selected respondents. At Raipur, around 30% of the people preferred the brand *Fortune*, followed by 24% preferring *Suffola*, while the third most preferred brand in oil was *Sundrop* (21%). Most of the households consumed more than 5 litres of oil every month.

Kumar (2014) observed that the most preferred oil brand and edible oil variant of the consumers in Hyderabad, using the survey method. Brand image, price, health consciousness and quality of a particular brand were the most important factors influencing decision-making for purchases. Thus, a marketer's value proportion and positioning should be built around health and value for money. The majority of the Hyderabad community used sunflower oil (*Gold Drop* brand).

Even though most of the studies showed sunflower oil to be the most

preferred oil, they focussed only on specific regions and communities, or the research concentrated only on respondents with a high education level, or only those from middle income and high income groups. Thus, the results did not reflect the real preference for edible oils of the Indian community as a whole, only for the particular region studied. In 2014, Singh examined the cost-effectiveness of palm oil in comparison to other oils and fats in the country with special emphasis on the lower income groups. According to this research, the lower and middle class Indian consumers were very sensitive to prices and switched readily to cheaper oils. Therefore, the study showed that the majority of the lower income group preferred palm oil because it was cheaper in comparison to any other vegetable oil. This result is in line with that of Kumar *et al*. (2011) who estimated demand elasticity for food commodities in India. From the analysis of price and income effects based on the estimated demand system, the researchers suggested that with an increase in food price inflation, the demand for staple foods (*i.e.* rice, wheat and sugar) may not be affected adversely, but high-value food commodities are likely to be affected negatively.

Hemanth and Shruthi (2013) determined consumer buying behaviour in rural India. There are certain unique characteristic features which call for separating market strategies to be distinctly developed to suit rural and urban market behaviour. This is especially because rural consumers differ in terms of their consumption pattern, purchasing decisions, purchasing behaviour, attitudes and perceptions towards various products. The dominant economic peculiarities of rural India may be recognised in terms of sources of income (agriculture), frequency of receipt of income (unstable because of a dependence on the monsoon) and the seasonal nature of income and consumption (mainly among farmers). These differences also affect the consumption pattern of rural consumers. In 2016, Patel studied the different patterns of preference for edible oils in India. This study showed that consumption trend in India was marked not just by rising overall consumption, but also by the changing patterns of consumption, reflecting traditional patterns of domestic oilseeds production. The study found that in northern India, traditionally a mustard oil market, there had been a shift to soyabean oil for household consumption while palm oil was mainly for out-of-home consumption. For the southern Indian community, palm oil was the major consumed oil compared with the other edible oils. In western India, palm oil was also the highest consumed oil.

Gandhi and Zhou (1997) studied food demand and food security challenges in relation to rapid economic growth in the emerging economies of India and China. The study showed that major changes in the levels and patterns of food consumption and buying behaviour in China and India were impacted by the huge populations of the two countries (together making up 37% of the world total) and high economic growth rates of 7% to 12% in the last two decades. The results are in line with the findings of the latest research done by USDA. According to USDA (2016b), vegetable oil consumption as food is forecast to expand by 3% in 2016/2017, reflecting population and GDP growth. Food use consumption of all vegetable oils is expected to grow, led primarily by palm oil and soyabean oil. Palm and soyabean oils are considered substitute goods because food processors often switch between the two oils as the prices fluctuate. This issue also been discussed by Fatimah (2015), who pointed out that palm oil trade in Pakistan will be affected by the China-Pakistan Economic Corridor (CPEC). CPEC is expected to intensify the flow of products from China to Pakistan, including oils and fats. Palm oil has to be in a position ready to compete with similar substitutes from China, particularly soyabean oil. Hassan and Rina (2015) also studied the demand for palm and soyabean oils. Edible vegetable oils are some of the most crucial cooking ingredients in the world. Palm and soyabean oils dominated the edible oils market, and production of these two oils make up more than 50% of total world production of edible oils. The study showed that there are some factors that determine the demand for soyabean and palm oils, such as population and exchange rate.

There are also various studies on issues related to palm oil, such as demand issues. Hameed *et al*. (2007) examined the palm oil import demand in selected Middle Eastern and North African (MENA) countries. The study used the Autoregressive Distributed Lag (ARDL) technique. The results show that palm oil price, national income and the prices of substitute oils were significant determinants of palm oil demand in the selected MENA countries. However, palm oil price discount, world petroleum price, anti-palm oil campaigns, trade embargos on Libya and Iraq and exchange rate were also verified to be important factors affecting the demand for palm oil in some MENA countries. Tety *et al*. (2009) found that factors which influenced consumption of Indonesian palm cooking oil included domestic palm cooking oil price and the population size. On the other hand, Hameed and Arshad (2012) investigated the

behaviour of palm oil demand in the top importing countries (*i.e.* India, China, Bangladesh, Pakistan and USA). The study found that prices of palm oil and its substitutes, national income, trade liberalisation policy and exchange rate were the most important factors affecting the import demand for palm oil in some of these countries. Egwuma *et al*. (2016) identified principal factors that shape the Nigerian palm oil industry using the ARDL cointegration approach over the period 1970 to 2011. The results reveal that the most significant factors influencing the Nigerian palm oil industry included palm oil price and income. The study recommended that macroeconomic stabilisation strategies and appropriate pricing policies be designed to ensure the expansion of the palm oil market share.

METHODOLOGY

Annual data on India's palm oil imports, palm oil price and soyabean oil price were collected from the United Nations Conference on Trade and Development (UNCTAD) database. At the same time, data on real GDP and population were obtained from the World Development Indicators (WDI).

ARDL Bound Test

For empirical analysis, this study firstly investigated the stationarity property of the variables by employing the most used unit root tests in empirical literature, which include the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. The reason for choosing 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 mean. 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 one [I(1)], cointegration 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 ARDL bound testing approach to cointegration developed by Pesaran *et al*. (2001) to verify the long-run relationships between the variables. This method was chosen for its advantages for small numbers of observation 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 deterministic elements, as well as the optimal 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:

$$\Delta \ln DDI_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln GDP_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta \ln POP_{t-j} + \sum_{k=1}^{r} \beta_{3k} \Delta \ln PSPO_{t-k} + \delta_1 \ln DDI_{t-1} + \delta_2 GDP_{t-1} + \delta_3 \ln POP_{t-1} + \delta_4 \ln PSPO_{t-1} \varepsilon_t \quad \text{Equation (1)}$$

where Δ is the symbol of difference, ε_t is the error/residual (white noise), and α, β and δ are parameters to be estimated. lnDDI, lnGDP and lnPSPO refer to the log of India's palm oil demand (as reflected by imports), log of real per capita GDP, and log of the difference between soyabean oil and palm oil prices, respectively.

The study then estimated the long-run relationships between the variables. The first step was to justify the intervals for the variables by using the F-statistic (variable addition test). The null hypothesis of no cointegration (H0: $\delta 1 = \delta 2 = \delta 2 = 0$) was tested against the alternative hypothesis of existing cointegration (H1: at least $\delta m \neq 0$, m = 1, 2, 3, 4). Two sets of critical bounds for the F-statistic had been generated by Pesaran *et al*. (2001) and Narayan (2005), lower critical bound (LCB) and upper critical bound (UCB), respectively. If the F-statistic is less than LCB, it indicates that no cointegration or no long-run relationship exists 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 involves the estimation of the coefficients of the variables in the equation. The lag selection criterion of the model is based on either Akaike Information Criterion (AIC) or Schwartz-Bayesian Criterion (SBC). Once cointegration is established, the conditional ARDL long-run model can be estimated as follows:

$$\Delta DDI_t = \alpha_1 + \sum_{i=1}^{p} \delta_{1i} \ln DDI_{t-i} + \sum_{j=0}^{q} \delta_{2j} \ln GDP_{t-j} + \sum_{k=0}^{r} \delta_{3k} \ln POP_{t-k} + \sum_{i=0}^{s} \delta_{4l} \ln PSPO_{t-l} + \varepsilon_{t-1} \quad \text{Equation (2)}$$

The subsequent estimation and model selection are 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:

$$\Delta \ln DDI_t = \alpha_1 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln DDI_{t-i} + \sum_{j=1}^{q} \beta_{2j} \Delta \ln GDP_{t-j} + \sum_{k=1}^{r} \beta_{3k} \Delta \ln POP_{t-k} + \sum_{l=1}^{s} \beta_{4l} \Delta PSPO_{t-l} + \Psi ECM_{t-1} + \varepsilon_{t-1} \quad \text{Equation (3)}$$

where β1, β2 and β3 are the short-run dynamic coefficients of the model's convergence to the equilibrium, 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, a higher value of error correction coefficient (in negative terms) means a quicker adjustment of the economy 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 the testing of cointegration, a test of order of integration for each variable was conducted using the ADF and PP procedures to examine data stationarity, and consequently the existence of unit roots. *Table 1* shows that based on the ADF and PP tests, the calculated t-statistics for the population (POP) and price discount of palm oil against soyabean oil (PSPO) are greater than the critical values in their level forms, suggesting that these variables are stationary at level form or at the integrated order I(0). For the DDI (India's palm oil demand) and GDP variables, the calculated t-statistics are less than the critical values in their level forms and greater than the critical values in their differenced forms, suggesting that they were stationary after the first difference or integrated order I(1).

ARDL Bound Testing

The bound test procedure indicated that the optimal lag length for this model was four. The absence of residual serial correlation also confirmed the correct order of the lag selection. The results of the bound test for cointegration are given in *Table 2*. This test is based on the Wald test or F-statistic, and is conducted against the null hypothesis that there existed a long-run relationship between the variables. The results of the bound test indicate the existence of long-run relationships between the variables. This is because the F-statistic result is higher than the upper bound critical value at the

TABLE 1. UNIT ROOT TESTS (with intercept)

Variable	Level		First difference	
	ADF	PP	ADF	PP
DDI	-1.0596	-1.1001	-6.5357***	-6.4944***
GDP	2.1427	4.2339	-4.8941***	-4.9000***
POP	-3.5188**	-0.8882	-3.9386***	-3.9526***
PSPO	-4.3328***	-4.0994***	-8.0218***	-9.3285***

Note: *Significant at 10% level, **significant at 5% level, ***significant at 1% level.
DDI - palm oil demand.
GDP - gross domestic product.
POP - population.
PSPO - price discount of palm oil against soyabean oil.
ADF - Augmented Dickey-Fuller.
PP – Phillips-Peron.

TABLE 2. AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) BOUND TEST OF COINTEGRATION

Significance level	Critical value (unrestricted intercept and no trend)	
	Lower bound	Upper bound
1%	5.333	7.063
5%	3.710	5.018
10%	3.008	4.150
Diagnostic tests		
India:		
Maximum lag length	: 4	
Wald test F-statistic	: 6.9937**	
LM test χ^2	: 0.6275	

Note: *Significant at 5% level.
LM – Langrange Multiplier.

5% level of significance (Pesaran, 2001).

Long-run Estimations

The empirical results of the Indian long-run models are presented in *Table 3*. The results indicate that income as measured by real per capita GDP produced a long-run negative influence on DDI. This implies that palm oil is perceived by Indians to be inferior against other major oils. The model shows that in the long-run, for every 1% increase in real per capita GDP, DDI will decline by 4.99%. Meanwhile, the model also shows that the percentage of the population aged from 15 to 64 years in relation to the POP has a positive influence on the demand for palm oil in India. This productive segment of the population represents the portion of the population with the highest demand for oils and fats. The model indicates that every 1% increase in the percentage of the population aged between 15 and 64 years in relation to the total population will lead to an increase by 1.49% in palm oil demand. Another important factor that explains India's palm oil demand is the price discount of PSPO. The model indicates that in the long run, for every 1% increase in palm oil price discounted against soyabean oil price, India's palm oil demand will decrease by 0.004%. This result shows not only that soyabean oil and palm oil are close substitutes, but also that palm oil has the characteristic of a giffen goods.

TABLE 3. ESTIMATED LONG-RUN COEFFICIENTS USING AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH

INDIA: ARDL (3,0,0,2) based on Akaike Information Criterion (AIC)

Variable	Dependent variable: DDI	
	Coefficient	t-value
GDP	-4.9928	-1.9046*
POP	1.4894	+2.5843**
PSPO	-0.0039	-3.4424**

Note: *Significant at 10% level, **significant at 5% level, ***significant at 1% level.
GDP - gross domestic product.
PSPO - price discount of palm oil against soyabean.
POP - population.

TABLE 4. ERROR CORRECTION REPRESENTATION FOR THE SELECTED ARDL MODEL [ARDL (1,0,2,2) based on Schwarz Bayesian Criterion (SBC)]

India
ARDL (3,0,0,2) based on AIC

Variable	Dependent variable: DDI	
	Coefficient	t-value
Constant	45.9318	1.4861
ΔGDP	-3.7499	-1.6673
ΔPOP	1.1187	2.1239**
ΔPOP(-1)	0.1320	0.8701**
ΔPOP(-2)	0.3897	2.5354
ΔPSPO	-0.0005	-0.8595
ΔPSPO(-1)	0.0021	3.8705***
ECT(-1)	-0.7516	5.2338***

Diagnostic tests

R-squared	:	0.6346
Adjusted R-squared	:	0.5074
Durbin Watson	:	2.0695
Alkaike Information Criterion	:	-22.1500
F-statistics (7, 24)	:	5.7051***

Note: *Significant at 10% level, **significant at 5% level, ***significant at 1% level.
GDP - gross domestic products.
POP - population.
PSPO - price discount of palm oil against soyabean.
ECT – error correction terms.

Short-run Error Correction Models

The short-run Error Correction Model (ECM) from the ARDL model is presented in *Table 4*. In the case of India, in the short-run, palm oil demand was found to be shaped by the percentage of the population aged between 15 and 64 years in relation to the total population and by the price discount of palm oil price against that of soyabean oil. Similar to the long-run relationship, the population aged between 15 and 64 years as a percentage of the total population was found to positively influence India's palm oil demand. It was also found that the impact of the current proportion of the population aged 15 to 64 years is higher than that of the previous year. The result also shows that when India experienced a better palm oil price discount against soyabean oil price in the previous year, the demand for palm oil for that year increased.

The error correction terms [ECT(-1)] are negative and highly significant, showing that there is

causality in at least one direction. For India, the ECT coefficient is -0.7516, which indicates a higher rate of convergence to the equilibrium. It implies that any deviation from the long-run equilibrium will be corrected by 75.16% over each year.

CONCLUSION

The study found that in the long-run, the buying pattern of palm oil in India is very much influenced by the country's GDP and the price discount of palm oil against soyabean oil. The study also found that of the proportion of Indian population aged between 15 and 64 years in relation to the total population also shapes the country's importing pattern of palm oil. It was established that Indians generally perceive palm oil as being as an inferior goods. This is understandable because, in India, palm oil is sold in the retail market through the public distribution system (POS).

ACKNOWLEDGEMENT

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

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