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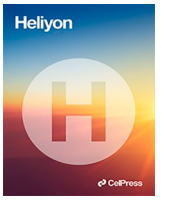

Research article

Demand elasticity of import nuts in Korea

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ABSTRACT

This paper empirically analyzes import demand for nuts in Korea using Almost Ideal Demand System (AIDS). Six budget shares and prices demand equations for nuts group: almond, pistachio, walnut, cashew, hazelnut and macadamia are analyzed during the period 2009 to 2019. Empirical results show that all uncompensated own-price elasticities are negative, walnut and pistachio are own-price elastic while almond, cashew, hazelnut and macadamia are own-price inelastic. Uncompensated cross-price elasticities indicate that nuts have both complementary and substitutable relationships. Expenditure elasticities reveal that all import nuts are expenditure inelastic and they can be considered as necessary goods in Korea. Our research can help related to policy decision for the demand of Korea import nuts.

1. Introduction

Nuts are rich source of unsaturated fatty acids, protein, vitamins, minerals and antioxidants, and play an important role in human health and the prevention of many diseases [1]. Global tree nuts consumption increased by 60% in 2016 compared to 2006, and the growth rate is even more significiant in economies of middle and high income [20]. In the Korean population, per capita daily consumption of seeds and nuts increased from 2.6 g in 2001 to 7.6 g in 2015 [21]. Various types of nuts are being imported in Korea as the efficacy and value of nuts increase [2], which obviously reflects the increasing demand from Korea consumers.

According to our knowledge, few empirical research has been performed on the demand for nuts. Most studies with regard to demand focuses on meat [3–5]. Some studies analyzes the demand for apple juice [6], processed foods [7], wood pellets [8], honey [9], cotton [10], vegetable oil [11], etc. Rencently Lopez and Grigoryan (2018) [12] and Cheng et al. (2017) [16] analyzes U.S demand for nuts. As a healthy food, the imports of nuts have increased significantly as demand increases. In Korea, nuts market highly is dependent on import. Considering the high import of nuts in Korea, it is important to study demand elasticity of nuts import for policy analysis and decision making.

The purpose of this study is to provide empirical evidence on import nuts demand system in Korea. The specific objectives are to estimate own-price, cross-price and expenditure elasticities to show the impact of relative changes in prices and expenditures on changes in the demand and determine the relationship between nuts from major import countries. The analysis is based on the Almost Ideal Demand System (AIDS) using data from 2009 to 2019. The import nuts include amond, pistachio and walnut imported, cashew, hazelnut and acadamia.

This research is the first to analyze the demand for import nuts in Korea. Our study is expected to show the situation among import nuts and examine whether Korea consumers can accept alternative for these nuts. This study is expected to fill the gap in the nuts demand system literature. The results can help policymakers as well as businesses in adopting appropriate policies.

The rest of this paper is organized as the following. Section 2 provides an overview of Korea import nuts market. Section 3

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introduces AIDS model. Section 4 provides data. The empirical results are presented in Section 5. Final section concludes the findings and discuss the policy implication.

2. Korea import nuts market

Table 1 shows the imports of almond, walnut and pistachio in Korea and major importing countries in 2009 and 2019. Almond import increased from 11,363 tons in 2009 to 26,034 tons in 2019, an increase of 2.3 times, with the largest import coming from US (99.4% of all almond imports in 2009 and 2019). Walnut imports grown from 9,497 tons in 2009 to 12,845 tons in 2019, with the US being the largest importer, accounting for 96.3% of all imports in 2019. Pistachio import in 2019 were three times higher than in 2009, with the US being its largest importer, accounting for 98.9% of all imports in 2019. Overall, The US held more than 90% of almond, walnut and pistachio import market share to Korea as primary supplier of tree nuts. This may be due to the fact that after Korea-US FTA took effect in March 2012, tariffs on the almond and pistachio were eliminated from a base tariff of 8% and 30%, and tariffs on walnut were eliminated after 6 stages, 30%, 25%, 20%, 15%, 10%, 5%.

Table 2 shows the imports of cashew, hazelnut and macadamia in Korea and major importing countries in 2009 and 2019. In the past 10 years, Cashew import have increased rapidly by 68.8%. India was the largest importer in 2009, accounted for 84.3% of all cashew imports. However, Vietnam has grown form a 5.3% market share in 2009 to 62.5% in 2019, becoming the largest importer. Turkey is the major importer of hazelnuts in Korea, accounting for 96.0% of the market share. Macadamia import increased four times from 2009 to 2019, with Australia being its main importer.

3. Method

The Almost Ideal Demand System (AIDS) model was developed by Deaton and Meulbauer (1980) [13] to estimate demand elasticity for Korea import nuts. This model has been extensively applied in various empirical studies on demand analysis. The AIDS model (1) is specified as follow:

$$w_i = a_i + \sum_{j=1}^{n} \gamma_{ij} ln\, p_j + \beta_i \ln(X / P) \tag{1}$$

where w_i is the budget share of nut i; p_j is the price of nut j; X is the total expenditure of import nuts; a_i, γ_{ij} and β_i are parameters to be estimated in the share equations. $ln\, P$ is the translog price index defined as (2):

$$lnP = \alpha_0 + \sum_{i=1}^{n} \alpha_i ln\, p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} ln\, p_i\, ln\, p_j \tag{2}$$

This translog price index is non-linear, which normally complicates the estimation process. In order to overcome this problem, Deaton and Muellbauer (1980) [13] suggested a linear approximation AIDS (LA/AIDS) model using Stone price index (3):

$$lnP = \sum_{i} w_i ln\, p_i \tag{3}$$

The LA-AIDS model is more commonly estimated in practice than the nonlinear AIDS model. To be consistent with the demand theory, the following restrictions must be satisfied:

Adding-up:

$$\sum_{i=1}^{n} \alpha_i = 1; \sum_{i=1}^{n} \gamma_{ij} = 0; \sum_{i=1}^{n} \beta_i = 0$$

Table 1
Korea imports of almond, walnut and pistachio and major importing countries.

Country	2009		2019	
	TON	USD 1000	TON	USD 1000
World (almond)	11,363	51,132	26,034	178,117
US	11,300	50,810	25,888	176,796
Others	63	322	146	1,321
World (walnut)	9,497	44,484	12,845	83,137
US	9,409	44,343	12,372	79,984
Vietnam	88	141	0	0
Chile	0	0	466	3,090
World (pistachio)	292	2,237	879	9,267
US	231	1,736	869	8,903
Iran	0	0	10	353
Others	60	502	0	0

Source: Korea customs database.

Table 2
Korea imports of cashew, hazelnut and macadamia and major importing countries.

Country	2009		2019	
	TON	USD 1000	TON	USD 1000
World (cashew)	919	5,235	2940	23,939
India	775	4,446	611	5,170
Vietnam	49	294	1837	14,798
Others	96	494	492	3,968
World (hazelnut)	273	1,881	508	4,398
Turkey	262	1,828	504	4,377
Others	11	52	4	22
World (macadamia)	154	1,215	683	12,463
Australia	153	1,208	669	12,242
Others	1	7	15	220

Source: Korea customs database.

Homogeneity:

$$\sum_{i=1}^{n} \gamma_{ij} = 0$$

Symmetry:

$$\gamma_{ij} = \gamma_{ji}$$

Demand elasticities are estimated from the estimated parameters of AIDS model.
Expenditure elasticity: $\eta_i = 1 + \frac{\beta_i}{w_i}$ Own-price elasticity: $\varepsilon_{ii} = -1 + \frac{\gamma_{ii}}{w_i} - \beta_i$ Coss-price elasticity: $\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i}$

4. Data

The raw data are 2009 to 2019 monthly data from Korea customs database. Table 3 summarizes the categories and six-digit Harmonized system (HS) code of import nuts in this study. Import nuts group include: 1) almond, 2) walnut, 3) pistachio, 4) cashew, 5) hazelnut, 6) macadamia. The raw dataset includes data on the quantities q_i and values x_i of import nuts. The import price data $p_i = x_i/q_i$ are calculated. The unit import quantity is 'ton' and the unit import value is 'USD 1000'. The unit import price is 'USD 1000/ton'.

Descriptive statistics for budget share, unit price and total expenditure are presented in Table 4. Almond accounts for the highest mean budget share (51.1%) in total expenditure on import nuts, and then walnut accounts for 35.5%, the rest is cashew 7.3%, pistachio 2.3%, macadamia 2.3%, hazelnut 1.5%.

Market share of six import nuts are presented in Figs. 1 and 2. It is observed that during the sample period, import market share of almond and walnut is more than other nuts in import nuts system. It means that Korean consumers prefer almond and walnut. Specially, import share of almond steadily increased from 48% in 2009 to 57% in 2019. By comparison, walnut import share decreased from 42% in 2009 to 27% in 2019. It implies that import market share of walnut may be affected by factors price, advertising and other. Market share of pistachio, cashew, hazelnut and macadamia is small. This means that a few consumers prefer these nuts. According to the demand theorem, the high unit price leads to less demand. There may be also other factors, such as taste.

Table 3
Classification of Korea import nuts.

Nuts	Category	HS code
Almond	In shell	080211
	Shelled	080212
Walnut	In shell	080231
	Shelled	080232
Pistachio	Fresh or Dried	080250
	In shell	080251
	Shelled	080252
Cashew	In shell	080131
	Shelled	080132
Hazelnut	In shell	080221
	Shelled	080222
Macadamia	Fresh or Dried	080260
	In shell	080261
	Shelled	080262

Source: Korea customs database (https://unipass.customs.go.kr/ets/index.do).

Table 4
Descriptive statistics of variables.

Variables	Obs	Mean	Std. Dev.	Min	Max
Budget share of almond (w1)	132	0.511	0.073	0.316	0.674
Budget share of walnut (w2)	132	0.355	0.097	0.114	0.620
Budget share of pistachio (w3)	132	0.023	0.012	0	0.069
Budget share of cashew (w4)	132	0.073	0.033	0.014	0.182
Budget share of hazelnut (w5)	132	0.015	0.010	0	0.048
Budget share of macadamia (w6)	132	0.023	0.021	0	0.115
Price of almond (p1)	132	6.86	1.66	4.22	10.61
Price of walnut (p2)	132	8.56	2.21	4.09	12.29
Price of pistachio (p3)	132	10.61	5.02	4.56	60.00
Price of cashew (p4)	132	8.25	1.45	5.10	11.23
Price of hazelnut (p5)	132	8.22	3.26	0	18.03
Price of macadamia (p6)	132	15.38	3.56	0	19.39
Total expenditure on import nuts (X)	132	2,4034	9,871	7,081	49,699

Note: Prices are USD 1000/ton. Total expenditure is USD 1000.

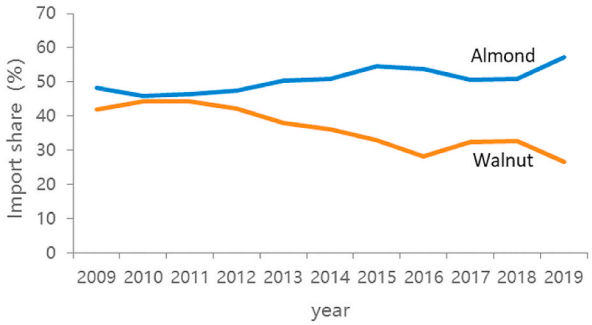

Fig. 1. Import shares of almond and walnut in Korea, 2009–2019.

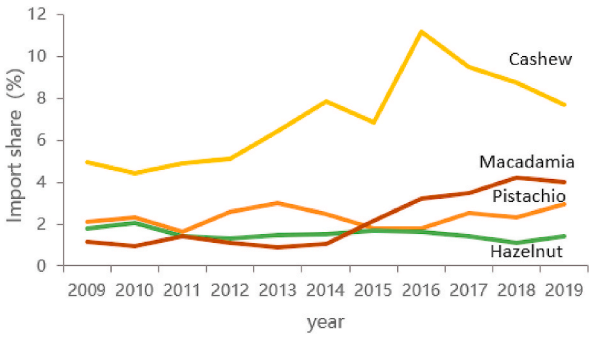

Fig. 2. Import shares of pistachio, cashew, hazelnut and macadamia in Korea, 2009–2019.

Table 5
Homogeneity and symmetry test of demand system.

Homogeneity	F test	P-value
W1 equation	6.04	0.000
W2 equation	11.57	0.000
W3 equation	1.10	0.366
W4 equation	7.54	0.000
W5 equation	4.42	0.000
W6 equation	10.19	0.000
Symmetry test	Chi-square	
	49.94	0.000

5. Results and discussion

5.1. Testing demand constraints

The estimation of demand system function needs to meet some restrictions, including adding up, homogeneity and symmetry. The homogeneity test represented by six null hypotheses, $[H_0 : \gamma_{i1} + \gamma_{i2} + \gamma_{i3} + \gamma_{i4} + \gamma_{i5} + \gamma_{i6} = 0, i = 1,2,3,4,5,6]$, and all p-values {Pr > F = 0.000, 0.366, 0.000, 0.000, 0.000, 0.000}, are smaller than the 5% significance level. All null hypotheses are rejected. The symmetry test represented by null hypotheses, $[H_0 : \gamma_{ij} + \gamma_{ji}, i,j = 1,2,3,4,5,6, i \neq j]$, p-value is smaller than the 5% significance level. The null hypotheses are rejected (Table 5). The result of demand system estimation used iterated linear least-squares (ILLS). ILLS estimator is performed by seeming unrelated regression (SUR) within each iteration, whether constraining for homogeneity or not [14].

5.2. Parameter estimates

The estimated parameters of demand system composed of six share equations are shown in Table 6. The statistical software Stata 14 and *aidsills* command [14] are used for estimation by iterated linear least-squares estimator [15]. Most parameters are significant at 5% level. The R square result is 0.32, 0.53, 0.09, 0.44, 0.19, 0.46, respectively. Because individual parameters do not have the direct economic interpretation, the result will focus on the estimated elasticity.

5.3. Expenditure and price elasticity

Table 7 shows uncompensated price and expenditure elasticities. Expenditure elasticity is the percentage change in the quantity as a result of the percentage change in expenditure. All the estimated expenditure elasticities are positive and significant at 1% level, range from 0.87 to 0.94. All nuts are considered as necessity goods, because their expenditure elasticities are less than 1, in which means 1% change in expenditure for import nuts would yield less than 1% in demand. Our expenditure elasticity estimates for almond, cashew and pistachios are consistent with Cheng et al. (2017) [16] and Lopez and Grigoryan (2018) [12]. Overall, the demand of imports nuts will increase when income of Korea consumers increases, all other factors held constant.

Price elasticity is the percentage change in the quantity as a result of the percentage change in price. All of the uncompensated own-price elasticities are negative and statistically significant at 1% level, which means that an increase in the price will result in a decrease in quantity demand, and the corresponding demand curves are downward sloping, satisfying the law of demand [17]. Walnut and pistachio have own-price elastic demand of −1.233 and −1.036, respectively, which can be explained as a 1% increase in prices will lead to a drop in demand by more than 1%, indicating that Korean consumers are more responsive to changes in these nuts price. These results for almond and pistachio are consistent with Lopez and Grigoryan (2018) [12]. Almond, cashew, hazelnut and macadamia have own-price inelastic demand of −0.776, −0.854, −0.830 and −0.842, respectively, which means that 1% increase in the price of these nuts will reduce the quantity demanded by less than 1%, implying that Korean consumers are not sensitive to price changes of these nuts.

Cross-price elasticity is the percentage change in the quantity of another nut as a result of one nut in price. Positive sign means substitutable relationship, while negative sign means complementary relationship. Table 8 shows the demand relationships of uncompensated elasticities among these nuts. There are both substitutable and complementary relationships between nuts during data analysis. For example, almond and walnut, almond and pistachio, walnut and cashew, walnut and macadamia, pistachio and cashew, pistachio and macadamia, it seems that drivers other than price affect market share.

Table 9 shows compensated elasticities of import nuts. Unlike uncompensated elasticities of demand, consumers can compensate their consumptions through income when facing price changes [16]. The own-price compensated elasticities are negative and significant at 1% level except almond.

5.4. Welfare evaluation

After estimating the compensation elasticity, this study attempts to measure the welfare effect of price changes by calculating compensating variation (CV) in Table 10. We calculated the monetary compensation for Korean consumers when price increased by 20%. In order to keep the initial utility level, per household payments should be 5,131, 14,444, 11,531, 5,523, 7,304, 12,168, respectively (unit is USD, based on 22,444,006 households in Korea in 2019).

6. Conclusion

This study used monthly data from 2009 through 2019 to estimate Korea import demand for nuts, including almond, pistachio, walnut, cashew, hazelnut and macadamia. The empirical results show that all uncompensated own-price elasticities are negative at 1% statistical level, walnut and pistachio are own-price elastic while almond, cashew, hazelnut and macadamia are own-price inelastic for the period analyzed. Uncompensated cross-price elasticity indicates that nuts have both complementary and substitutable relationships. Expenditure elasticity estimates that all import nuts are positive at 1% statistical level, and close to 0 and expenditure inelastic.

Nuts demand is influenced by both price and nonprice factors. Results of our study suggest that price had positive, significant impacts on demand for walnuts and pistachio. However, compared with price, demand for almond, cashew, hazelnut and macadamia

Table 6
AIDS parameter estimates.

Price	Budget share					
	Almond (w1)	Walnut (w2)	Pistachio (w3)	Cashew (w4)	Hazelnut (w5)	Macadamia (w6)
Almond (lnp1)	0.22 (0.04)***	−0.35 (0.04)***	−0.01 (0.01)	0.11 (0.02)***	−0.00 (0.01)	0.03 (0.01)***
Walnut (lnp2)	−0.09 (0.03)***	0.19 (0.03)***	0.00 (0.01)	−0.05 (0.01)***	−0.00 (0.00)	−0.05 (0.01)***
Pistachio (lnp3)	−0.02 (0.02)	0.04 (0.02)	0.00 (0.00)	−0.01 (0.01)	0.00 (0.00)	−0.01 (0.01)*
Cashew (lnp4)	−0.02 (0.05)	−0.05 (0.06)	−0.01 (0.01)	0.06 (0.02)***	−0.02 (0.01)**	0.04 (0.01)***
Hazelnut (lnp5)	−0.03 (0.03)	0.06 (0.03)*	−0.01 (0.01)	−0.03 (0.01)**	0.01 (0.00)***	0.00 (0.01)
Macadamia (lnp6)	0.11 (0.04)***	−0.19 (0.05)***	−0.00 (0.01)	0.04 (0.02)*	0.00 (0.01)	0.04 (0.01)***
Total expenditure (lnx)	−0.09 (0.02)***	0.15 (0.02)***	0.01 (0.00)***	−0.04 (0.01)***	−0.00 (0.00)	−0.02 (0.01)***
_cons	0.84 (0.15)***	−0.14 (0.17)	−0.04 (0.03)	0.20 (0.06)***	0.05 (0.02)***	0.09 (0.04)**
R-square	0.32	0.53	0.09	0.44	0.19	0.46

Note: *p < 0.1, **p < 0.05, ***p < 0.01. Standard errors are in parentheses.

Table 7
Uncompensated (Marshallian) price and expenditure elasticities.

	Almond	Walnut	Pistachio	Cashew	Hazelnut	Macadamia	Expenditure
Almond	**−0.776***** (0.026)	−0.099*** (0.021)	−0.020 (0.016)	0.003 (0.038)	−0.019 (0.021)	0.092*** (0.031)	0.937*** (0.006)
Walnut	0.445*** (0.056)	**−1.233***** (0.029)	−0.041 (0.022)	0.090 (0.051)	−0.042 (0.029)	0.189*** (0.049)	0.868*** (0.006)
Pistachio	0.194*** (0.073)	−0.092 (0.053)	**−1.036***** (0.042)	0.128 (0.104)	0.079 (0.063)	0.028 (0.083)	0.878*** (0.009)
Cashew	0.297*** (0.040)	−0.144*** (0.026)	−0.028 (0.018)	**−0.854***** (0.043)	−0.053** (0.025)	0.081** (0.035)	0.914*** (0.003)
Hazelnut	−0.001 (0.109)	−0.045 (0.057)	0.064** (0.059)	−0.216 (0.164)	**−0.830***** (0.097)	0.072 (0.091)	0.926*** (0.012)
Macadamia	0.219*** (0.041)	−0.218*** (0.041)	−0.045** (0.022)	0.177*** (0.057)	0.013 (0.028)	**−0.842***** (0.045)	0.908** (0.002)*

Note: **p < 0.05, ***p < 0.01, standard errors are in parentheses.

Table 8
Demand relationship of uncompensated price elasticities.

	Almond	Walnut	Pistachio	Cashew	Hazelnut	Macadamia
Almond		C	C	S	C	S
Walnut	S		C	S	C	S
Pistachio	S	C		S	S	S
Cashew	S	C	C		C	S
Hazelnut	C	C	S	C		S
Macadamia	S	C	C	S	S	

Note: S indicates substitute, C indicates complement.

Table 9
Compensated (Hicksian) price elasticities.

	Almond	Walnut	Pistachio	Cashew	Hazelnut	Macadamia
Almond	**0.518***** (0.196)	−1.158*** (0.228)	−0.120*** (0.046)	0.492*** (0.098)	0.040 (0.035)	0.347*** (0.066)
Walnut	1.645*** (0.171)	**−2.215***** (0.207)	−0.134*** (0.049)	0.543*** (0.100)	0.012 (0.041)	0.425*** (0.071)
Pistachio	1.407*** (0.218)	−1.085*** (0.235)	**−1.130***** (0.054)	0.587*** (0.133)	0.134** (0.068)	0.266*** (0.101)
Cashew	1.560*** (0.213)	−1.178*** (0.229)	−0.125*** (0.046)	**−0.376***** (0.082)	0.004 (0.038)	0.329*** (0.066)
Hazelnut	1.278*** (0.225)	−1.092*** (0.214)	−0.035 (0.073)	0.268 (0.186)	**−0.772***** (0.079)	0.323*** (0.107)
Macadamia	1.473*** (0.216)	−1.245*** (0.232)	−0.142*** (0.048)	0.651*** (0.100)	0.070 (0.039)	**−0.596***** (0.055)

Note: **p < 0.05, ***p < 0.01, standard errors are in parentheses.

is affected by other potential factors. First, from the perspective of marking, advertising may play an important role in demand [18]. Second, from health study, nuts may be beneficial to health, and this may be related to nuts demand [19]. For expenditure inelastic, from the perspective of consumer preferences, Korea consumers may choose other health alternatives food of nuts. These potential factors affecting demand can be examined in future research. Because price variable is endogenous, which can itself cause endogeneity bias in demand elasticity estimation.

Considering the changes in expenditure and demand in consumers, it is an important issue to examine demand elasticity of import

Table 10
Compensated variation of import nuts price changes (increase by 20%).

Nuts	Mean CV per household
Almond	5,131
Walnut	14,444
Pistachio	11,531
Cashew	5,523
Hazelnut	7,304
Macadamia	12,168

nuts. The estimated elasticities of demand can be used to evaluate the impact of various economic factors that influence the Korea import price. Our study can be useful in making policy-related decisions and Korea nuts import plan.

Author contribution statement

Xiaoling Zhu: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no competing interests.

References

[1] K.L. Kumawat, W.H. Raja, L. Chand, K.M. Rai, Nutritional Value and Health Benefits of Nuts, Indian Farmer 4 (8) (2017) 627–637.
[2] K.J. Community, L. Sci, A Survey on Peoples' Preference for Nuts and the Factors for Purchasing Nuts for Adults over 20 8565, 2019, pp. 421–431.
[3] P.R. Taljaard, Z.G. Alemu, H.D. Van Schalkwyk, The demand for meat in South Africa: an almost ideal estimation, Agrekon 43 (4) (2004) 430–443, https://doi.org/10.1080/03031853.2004.9523659.
[4] R. Anindita, A.A. Sadiyah, N. Khoiriyah, D.R. Nendyssa, The demand for beef in Indonesian urban, IOP Conf. Ser. Earth Environ. Sci. 411 (1) (2020), https://doi.org/10.1088/1755-1315/411/1/012057.
[5] A.S. Jabarin, Estimation of meat demand system in Jordan: an almost ideal demand system, Int. J. Consum. Stud. 29 (3) (2005) 232–238, https://doi.org/10.1111/j.1470-6431.2005.00408.x.
[6] D.K. Mekonnen, Demand Estimation for US Apple Juice Imports : A Restricted Source Differentiated AIDS Model, 2011.
[7] W. Suanin, Demand elasticity of processed food exports from developing countries: a panel analysis of US imports, J. Agric. Econ. (2020), https://doi.org/10.1111/1477-9552.12409.
[8] L. Sun, K. Niquidet, Elasticity of import demand for wood pellets by the European Union, For. Policy Econ 81 (2017) 83–87, https://doi.org/10.1016/j.forpol.2017.02.001.
[9] M. Alnafissa, M. Alderiny, Analysis of Saudi demand for imported honey using an almost ideal demand system (AIDS), J. Saudi Soc. Agric. Sci. 19 (4) (2020) 293–298, https://doi.org/10.1016/j.jssas.2019.05.001.
[10] H.S.C. Chang, N. Chi, Elasticity of demand for Australian cotton in Japan, Aust. J. Agric. Resour. Econ. 46 (1) (2002) 99–113, https://doi.org/10.1111/1467-8489.00169.
[11] S. Khalilian, S. Satari Yuzbashkandi, Analysis of vegetable oil demand and its price reform in Iran: using rural and urban household level data, Int. J. Agric. Environ. Food Sci. 5 (1) (2021) 122–132, https://doi.org/10.31015/jaefs.2021.1.15.
[12] S. Lopes, Jose; Grigoryan, "an empirical analysis of the U. S. import demand for nuts, J. Int. Glob. Econ. Stud. 11 (2018) 35–46.
[13] A. Deaton, J. Muellbauer, An almost ideal demand system, The American Economic Review 70 (3) (2018) 312–326.
[14] S. Lecocq, J.M. Robin, Estimating almost-ideal demand systems with endogenous regressors, STATA J. 15 (2) (2015) 554–573, https://doi.org/10.1177/1536867x1501500214.
[15] R. Blundell, J.M. Robin, Estimation in large and disaggregated demand systems: an estimator for conditionally linear systems, J. Appl. Econom. 14 (3) (1999) 209–232, https://doi.org/10.1002/(SICI)1099-1255(199905/06)14:3<209::AID-JAE532>3.0.CO;2-X.
[16] G. Cheng, S. Dharmasena, O. Capps, The Taste for Variety : Demand Analysis for Nut Products in the United States, 2017, pp. 1–28.
[17] J.M. Nzuma, R. Sarker, An error corrected almost ideal demand system for major cereals in Kenya, Agricultural Economics 41 (1) (2010) 43–50, https://doi.org/10.1111/j.1574-0862.2009.00424.x.
[18] G.W. Brester, T.C. Schroeder, The Impacts of Brand and Generic Advertising on Meat Demand 77, 1995, pp. 969–979.
[19] J. Lee, A. Shin, J.H. Oh, J. Kim, The relationship between nut intake and risk of colorectal cancer: a case control study, Nutr. J. 17 (1) (2018) 1–10, https://doi.org/10.1186/s12937-018-0345-y.
[20] International Nut and Dried Fruit Council, Nuts and dried fruits, statistical yearbook 2017/2018, International Nut and Dried Fruit Council, Reus, Spain, 2016.
[21] Ministry of Health and Welfare, Korea Health Statistics 2015: Korea National Health and Nutrition Examination Survey, Korea Centers for Disease Control and Prevention, 2015.