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An Econometric Estimation of The World Price Leadership Impact on The Production and Export of Peanut of A.R.E

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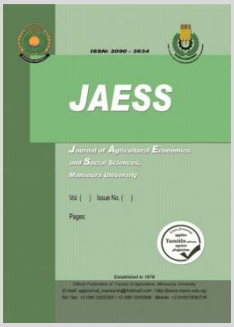


ABSTRACT

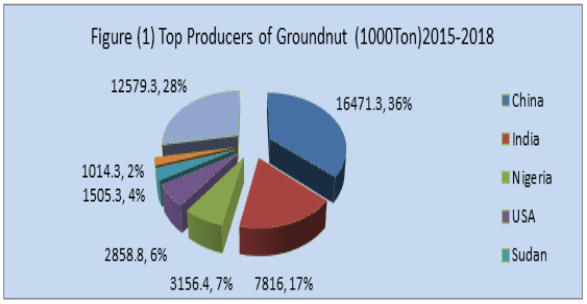
The study aims to evaluate the market integration in the main importing markets for the Egyptian shelled groundnut among other rivals. The study applied Vector Error-correction model (VECM) to test the co-integration existence between prices. Geographical Concentration investigation showed that Greece, Italy, Turkey, Tunisia, Jordon, Syria, and Netherlands are the main importers of Egyptian groundnut exports. The Augmented Dickey-Fuller test (1987-2017) revealed that all prices are stationary at the 1st differences, i.e. prices are integrated of order one P~I(1).Johansen co-integration test indicated that there is only one co-integration equation that confirm the long run relationship among rivals 'prices of shelled groundnut in each market.Error Correction Terms (ECTs) proved the unidirectional impact of other exporters 'prices on the Egyptian export price, and 6%, 22.8%, 70.6%, 75.3%, and 58.1% of the Egyptian price disequilibrium were be adjusted each year in Greece, Italy, Turkey, Jordon, and Netherlands markets respectively. Weak exogeneity test revealed that Argentine is considered a price leader in Greece, Italy, and Netherlands, and China is considered a leader price in Turkey and Jordon, while Tunisia is considered a regular price competitive. It is expected that the Egyptian export price will upward deviate 23%, 1%, and 31% from Argentinian price in Greece, Italy, and Netherlands markets respectively, and 13.7%, 27.6% from Chinese price in Jordon and Turkey respectively. It is recommended that Egyptian exporters should adopt low price policy not less than the leaders' prices as it covers the producer cost to allure importers to redirect to the Egyptian market.

Keywords: Price leadership, Co-integration test, VECM, Weak exogeneity test.

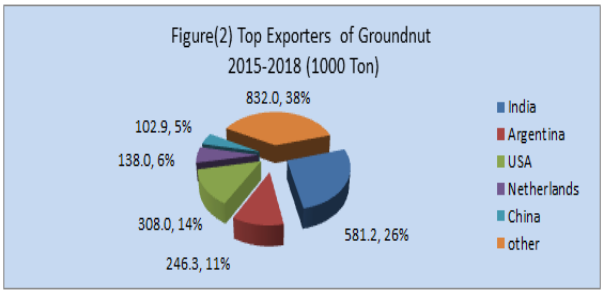
INTRODUCTION

The world cultivated area of groundnut crop has been increasing in the last ten years due to increasing demand of its processing products, such as margarine, desserts, soap, and livestock feed. It has distinctive characteristics cause it to be a widely cultivated legume crop in arid lands which improve sandy soils fertility. In Egypt, it is cultivated in the desert districts and newly reclaimed soils in the summer season to improve the soil properties as the total production of desert districts is 131.54 thousand ton representing 61% of Egyptian production, which is amounted 215.5 thousand ton. The cultivated area of desert districts is 38.13 thousand hectare, representing 62.6% of Egyptian cultivated area, which is amounted 60.964 thousand hectare in 2015- 2018. (Agricultural Statistics, (MALR)

The world production of groundnut crop is concentrated in six countries namely; China, India, Nigeria, the United States of America(USA), Sudan, and Argentine as the total production of those countries reached about 32.822 million tons, representing about 72.3% of the world production, which amounted to about 45.4 million tons in 2015- 2018(Figure 1).The world's exports are also concentrated in fewer countries namely; India, , USA, Argentine ,Netherlands and China as the total exports of those countries reached about 1376.4 thousand tons, representing about 62.3% of the world exports, which amounted to about 2208.4 thousand tons in 2015-2018(Figure 2).India exports about 581.2 thousand tons, representing about 26% of the total exports , which amounted to about 2208.4 thousand tons in 2015-2018,followed by USA, which exports about 308 thousand tons representing about 14% of the world's exports, followed by Argentine 11%, Netherlands 6%, China5%, and the rest of the world's exports are less than 1%(Figure 2).



Source: FAOSTAT.



Source: FAOSTAT.

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Egypt produces about 215.5 thousand ton of groundnut crop representing about 0.5% of world production, and exports only about 8.3 thousand ton representing about 0.4% of world exports in 2015-2018.It is clear that approximately 60-70% of production and export are concentrated in few countries, and of course the price transmissions of these countries will have an inevitable impact on the domestic production and exports of the rest of the world producing the crop, including Egypt.

The aim of the paper is to evaluate the market integration in the main importing markets for the Egyptian peanut among other rivals countries through:

1- Investigate the statuesque production and exports of groundnut crop in Egypt and the world.

2- Investigate as to whether or not there is a dominant price that leads price information flow over the main competitors for Egypt in importing markets.

3- If such dominant price exists, how does the price affect the domestic production of groundnuts and Egyptian exports?

The paper is organized as follows: Section two describes the data source and analysis approaches followed in the study. Section three presents the results of the study. Section four concludes and outlines possible policy implications to improve the performance of Egyptian groundnut market.

MATERIALS AND METHODS

This study relied on export prices of major producing and exporting countries of groundnut crop for the period 1987 to 2018 that are derived by Central Agency of Public Mobilization and Statistics (CAPMAS), Food and Agricultural Organization (FAO) (FAOSTAT), Agricultural Statistics, Egyptian Ministry of Agriculture and Land Reclamation (MALR), and Comtrade database.

The study applied Vector Error-correction model (VECM) to test the co-integration existence between prices which reflect the partial adjustment of one exporter' price to another. The (VECM) model is a restricted feature of Vector Autoregressive Model (VAR) which is suggested by Sims (1981) subject the variables are stationary in their differences or ~ I (1), and have co-integrating relationships between them. Usually, (VECM) is applied to measure how price deviations restore to equilibrium when a long run and short run relationships are proved between co-integrated series. It imposes robust non-linear restrictions on the dynamic econometric equations to describe the multivariate interactions characteristic of variables (Alogoskoufis and Smith, 1991) (Bassa and Goshu, 2019).

VECM specification

(Johansen, 1988) proposed a general framework of estimating VECM based on VAR equations with which the numbers of co-integration relationships could be determined if the system has more than two variables. For k variables, the system has up to k-1 co-integration relationships. K-dimensional VAR model with ρ lags is as follow:

$$\mathbf{P_t = \Pi_1\, P_{t-1} + \Pi_2\, P_{t-2} + \Pi_\rho P_{t-\rho} + \varepsilon_t} \qquad \mathbf{(1)}$$

Where **(P_t) is a vector of k time series(prices of Egypt and other rivals) at time t, and ε_t is a vector of white noise with covariance Σ_ε.If the variables from the VAR model are co-integrated,**

The VAR model can be represented in the form of VECM as follow:

$$\mathbf{\nabla P_t = \Pi P_{t-1} + \Gamma_1\, \nabla P_{t-1} + \cdots + \Gamma_{\rho-1}\, \nabla P_{t-\rho-1} + \varepsilon_t,} \qquad \mathbf{(2)}$$

$$\mathbf{\Pi = \Pi_1 + \cdots + \Pi_\rho - I_k,} \qquad \mathbf{(3)}$$

$$\mathbf{\Gamma_K = -\sum_{j=k+1}^{\rho} \Pi_j\,,\ k = 1, \ldots\ldots, \rho - 1} \qquad \mathbf{(4)}$$

The k-dimensional VECM for VAR (ρ) process can be written as:

$$\mathbf{\nabla P_t = \Pi_{[K*K]} P_{t-1} + \Gamma_1\, \nabla P_{t-1} + \cdots + \Gamma_{\rho-1}\, \nabla P_{t-\rho-1} + \varepsilon_t,} \qquad \mathbf{(5)}$$

Where: **$\Pi_{[K.K]} P_{t-1}$ is an error correction term (ECT).If (r) is the rank of the co-integration, $\Pi_{[K.K]} = \alpha_{[k.r]} \beta'_{[r.k]}$, as α contains the speed of adjustments in each parameter toward long run equilibrium, and β contains the coefficients of the long run relationship. 0 <Rank (Π) = r <k.If the null hypothesis (H_0: r =0) is not rejected, then the price variables are not co-integrated or no long-run relations among variables, while If (H_0 r =0 is rejected), then the null hypothesis (H_0: r =1) is further tested. The price series are co-integrated if r =1 is not rejected.**

Weak Exogeneity Test

The long-run causality between price variables is investigated by applying Wald test for the coefficients of α, which are referred to as weak exogeneity tests. This causality is typically interpreted as price leadership (Motamed, Foster, and Tyner, 2008).

RESULTS AND DISCUSSION

The current situation of groundnut crop production and export

Table (1) shows the simple regression of groundnut production and exports trends of Egypt and world markets (1987-2018) using Ordinary least square (OLS) method. The average global production of groundnuts was about 34797.9 thousand tons, and it increased statistically by 814.47 thousand tons at growth rate 2.3%. The harvested area was about 23451.9 thousand hectares, and it increased statistically by 258.9 thousand hectares at growth rate 1.1%. The average global export of groundnuts was about 1230.9 tons, and it increased statistically by 29.5 thousand tons at growth rate 4.4 %.

In Egypt, the average production of groundnut was about 154.7 thousand tons in 1987-2018, and it increased statistically by 6.645 thousand tons at growth rate 4.3%. The harvested area was about 49.304 thousand hectares, and it increased statistically by 1.749 thousand hectares at growth rate 3.5%. The average export of groundnut was about 6.514 thousand tons, and it increased statistically by 0.4 thousand tons at a growth rate of 6.1 %. Results refer to the rapidly growth of production comparing with harvested area due to the improvement of productivity globally and nationally.

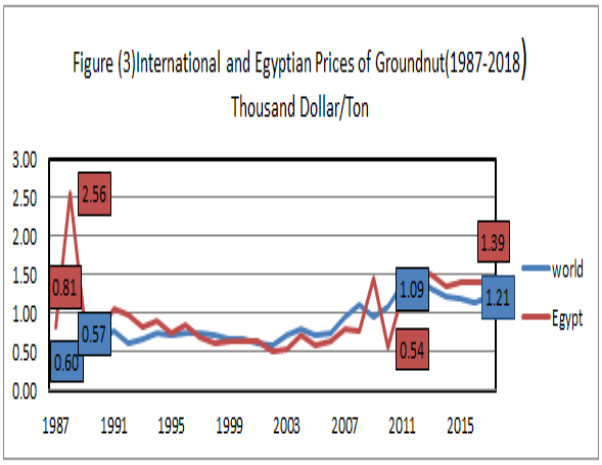
In desert districts of Egypt, the average production of groundnut was about 93.432 thousand tons in 1987-2018, and it increased statistically by 3.108 thousand tons at growth rate 3.3%. The harvested area reached was about 29.093 thousand hectares, and it increased statistically by 0.729 thousand hectares at growth rate 2.5%. It is noted that although the growth rate of national production is higher than that of desert districts, the growth rate of harvested area in desert districts is higher than national harvested area of groundnuts referring to low productivity of desert districts.

Table 1. Simple regression of international and Egyptian Groundnut' Production and Exports Trends

Dependent Variable	b^	Average	Growth Rate	R^2
World exports (1000 ton)	29.5 (8.688)***	1230.9	2.4	0.72
Egyptian exports (1000 ton)	0.4 (4.762)***	6.514	6.1	0.44
World production (1000 ton)	814.47 (23.912)***	34797.9	2.3	0.95
Egyptian production(1000ton)	6.645 (10.481)***	154.7	4.3	0.79
World harvested area(1000ha)	258.9 (15.649)***	23451.9	1.1	0.89
Egyptian harvested area (1000ha)	1.749 (8.481)***	49.304	3.5	0.71
Desert districts production (1000 ton)	3.108 (5.496)***	93.432	3.3	0.53
Desert districts harvested area (1000 ha)	0.729 (4.273)***	29.093	2.5	0.41

Source: FAOSTAT,CAPMAS, and Agricultural Statistics, (MALR)

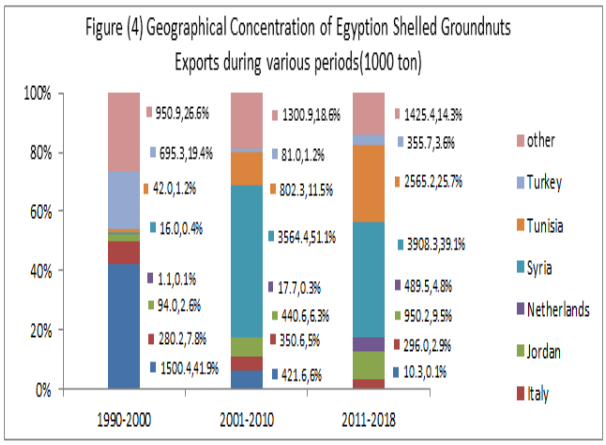
Figure 3 shows a coherence trend between the Egyptian and the world prices during 1987-2018, as Egypt follows the average world price which was ranged from \$0.60 thousand per ton in 1987 to \$1.21 thousand per ton in 2018. Moreover, a considerable price deviation in 1988, that the Egyptian price increased to \$2.56 thousand per ton, 4.5 times more the world price which was \$ 0.57thousand per ton. A contrary situation occurred in 2010, as the Egyptian price fall to\$ 0.54 thousand per ton, 2 times less the world price which was \$ 1.09 thousand per ton.



Source: FAOSTAT, Comtrade.

Geographical Concentration of Egyptian Groundnut

Figure (4) depicts the Geographical Concentration of the Egyptian exports of shelled groundnut, as it is was3579.9 ton in 1990-2000, 5678.2ton in 2001-2010, and 10000.6 ton in 2011-2018.In 1987-2000. Greece was the larger importer with 1500.4 tons, or 41.9% of Egyptian exports. Turkey was the second largest importer with 695.3 tons, or 19.4%. Italy was ranked the third importer with 280.2 tons, or 7.8% of Egyptian exports. Jordon and Tunisia's imports represented 2.6%, 1.2% respectively. Netherlands and Syria's imports were less than 1%. In 2001-2010, Exports of shelled groundnut diverted to Syria and Tunisia with 51.1% and 11.5% respectively, Greece and Italy and Turkey's imports were shrunk to 6.6%, 6.5%, and 1.2% respectively. In 2010-2018, Syria and Tunisia were sustained in the first and the second rank with 39.1%, 25.7%.Jordon was ranked in the third rank with 9.5%. The imports of Netherlands and turkey increased once more with 4.8%, 3.6% respectively. Lastly, Italy and Greece's imports were shrunk to 2.9% and 0.1 % respectively.



Source: FAOSTAT, Comtrade.

Market share of top exporting rivals

Table (2) describes the market share of top rivals for Egypt in exporting shelled groundnut in three periods: I (1987-2000),II (2001-2010), and III (2011-2018).In Greece market, the imports were about 9691.8 ton, 12640.7 ton, and 12043 ton in periods I,II, III respectively. Mainly four countries compete Egypt; Argentine, China, India, and Netherlands in exporting groundnuts. In period (I); Argentine was in the 1st rank with 29% market share followed by China (22%), Netherlands 17.6%, Egypt 14.3%, and India 8% market share. In period (II) China was in the 1st rank with 69.5% market share followed by Argentine 22.2%, Netherlands 3%, and Egypt 2.8% market share. In period (III); Argentine was in the 1st rank with 47.6% market share, followed by China 44.9%, Netherlands 3.7%, India 1.3% and Egypt 0.1% market share.

In Italy market, the imports were about 10241.8 ton, 13863.7 ton, and 19040.4 ton in periods I, II, III respectively. Argentine, China, Netherland and USA are the main four countries compete with Egypt. In period (I); Argentine was in the 1st rank with 48% market share followed by Netherlands 18%, USA17%, China 2.6% and Egypt 2.2% market share. In period (II) Argentine was in the 1st rank with 58% market share followed by China 11.2%, Netherlands 8.9%, USA8.1% and Egypt 0.4% market share. In period (III); Argentine was in the 1st rank with 70% market share, followed byUSA8.8%, China 6.6%, Netherlands 3.6% and Egypt 0.1% market share.

In Turkey market, the imports were about 3912 ton, 6004.1 ton, and 7458.6 ton in periods I, II, III respectively. Argentine and China are the main two countries compete with Egypt. In period (I); Egypt was in the 1st rank with 42.1% market share followed by China 16.9%, and Argentine 2.7% market share. In period (II) Egypt was in the 1st rank with 89% market share followed by Argentine 5.7% and China 2% market share. In period (III); Argentine was in the 1st rank with 57.2% market share, followed by Egypt 33.4%, and China 4.3% market share.

In Tunisia market, the imports were about 7349 ton, 9305.7 ton, and 4569 ton in periods I, II, III respectively. China and Libya are the main two countries compete with Egypt. In period (I); Libya was in the 1st rank with 77.7% market share followed by Egypt 2.1%, and China 1.2% market share. In period (II) Libya was in the 1st rank with 45.1% market share followed by Egypt 43.7% and China 9.9% market share. In period (III); Egypt was in the 1st rank with 81.3% market share, followed by China 16.8%, and Libya.3% market share.

In Jordon market, the imports were about 2360 ton, 5095.7 ton, and 7570 ton in periods I, II, III respectively. China is the main country competes with Egypt. In period (I); China was in the 1st rank with 61.4% followed by Egypt 7.2%, market share. In period (II) China was in the 1st rank with 62.8% followed by Egypt 32.4%. In period (III); China was in the 1st rank with 48.2% followed by Egypt 12.3% market share.

In Netherlands market, the imports were about 166519.5 ton, 252161 ton, and 326893.9 ton in periods I, II, III respectively. Argentine, China and USA are the main countries compete with Egypt in exporting groundnuts. In period (I); Chin was in the 1st rank with 32.2% market share followed by Argentine 30.8%, and USA 26.7% market share. In period (II) Netherlands was in the 1st rank with 57.5% market share followed by China 15.8%, USA 13.3% market share. In period (III); Argentine was in the 1st rank with 61% market share, followed by USA 13.3%, and China 5.6% market share. Moreover; Egypt market share was less than 1% in the three periods.

Table 2. Market Shares of Top Rivals in Main Importing Markets from Egyptian Shelled Groundnut (1987-2018)

The Exporters/ Rivals	The Importer Market	1987-2000		2001-2010		2011-2018	
		Quantity (Ton)	Market Share %	Quantity (Ton)	Market Share %	Quantity (Ton)	Market Share %
Greece	Argentine(Arg);	2805.8	29.0	2811.1	22.2	5738.1	47.6
	China (Chi);	2158.9	22.3	8780.3	69.5	5405.4	44.9
	Egypt(Egy);	1383.8	14.3	353.1	2.8	15.9	0.1
	India(Ind);	785.2	8.0	0	0.0	151	1.3
	Netherland(Neth)	1706.4	17.6	377.4	3.0	451.4	3.7
	Other countries	851.7	8.8	318.8	2.5	281.5	2.3
	Total	9691.8	100	12640.7	100	12043	100
Italy	Argentine(Arg);	4915.9	48.0	8044.9	58.0	13319.5	70.0
	China (Chi);	262.9	2.6	1556.9	11.2	1256	6.6
	Egypt(Egy);	221.3	2.2	53.1	0.4	19.1	0.1
	Netherland(Neth)	1844.3	18.0	1230.2	8.9	677.1	3.6
	U.S.A.(US)	1743.9	17.0	1122.4	8.1	1683.8	8.8
	Other countries	1253.5	12.2	1856.2	13.4	2084.9	10.9
	Total	10241.8	100.0	13863.7	100.0	19040.4	100.0
Turkey	Argentine(Arg);	105.5	2.7	342.4	5.7	4263	57.2
	China (Chi);	660.4	16.9	118.9	2.0	320.6	4.3
	Egypt(Egy);	1647.4	42.1	5342.7	89.0	2491.4	33.4
	Other countries	1498.7	38.3	200.1	3.3	383.6	5.1
	Total	3912	100	6004.1	100.0	7458.6	100.0
Tunisia	China (Chi);	87.7	1.2	921.4	9.9	766	16.8
	Egypt(Egy);	158	2.1	4066.7	43.7	3716	81.3
	Libya(Lib);	5708	77.7	4200.2	45.1	14	0.3
	Other countries	1395	19.0	117.5	1.3	73	1.6
	Total	7349	100	9305.7	100	4569	100
Jordon	China (Chi);	1450	61.4	3200.3	62.8	3655.7	48.2
	Egypt(Egy);	170	7.2	1651.7	32.4	930.3	12.3
	Other countries	740	31.4	243.7	4.8	2984	39.5
	Total	2360	100.0	5095.7	100	7570	100.0
Netherlands	Argentine(Arg);	51255.2	30.8	145019.6	57.5	199544.9	61.0
	China (Chi);	53617.8	32.199	39859.3	15.8	18367.6	5.6
	Egypt(Egy);	2	0.001	54.8	0.1	124.7	0.1
	USA(USA);	44504.6	26.7	33621.8	13.3	43613.3	13.3
	Other countries	17139.9	10.3	33605.5	13.3	65243.4	20.0
	Total	166519.5	100.0	252161	100.0	326893.9	100.0

Source: FAOSTAT, Comtrade.

VECM results

Table (3) summarizes the results of Augmented Dickey-Fuller Test (ADF)[i] in level and 1st differences of rivals' groundnut prices in six importing markets; Greece, Italy, Jordon, Netherlands, Tunisia, and Turkey[ii]. The null hypothesis of unit root (non-stationary) cannot be rejected for all variables, while it is strongly rejected at the 1st differences at significance level 1%.Overall,it is concluded that shelled groundnuts prices are integrated of order one P~I(1),so the co-integration test could be applied. Akaik Information Criterion (AIC)[iii] is applied to select the lag length of the VECM. One lag is the optimal length for all series due to limit number of observations.

Table 3. Augmented Dickey-Fuller Test of Stationary for Rivals' Prices of Shelled Groundnut (1987-2017)

Model	Variables	Level (H_0: Series has a Unit Root)		1st Differences (H_0: Series has a Unit Root)	
		t-statistic	p-value	t-statistic	p-value
Greece	P_{Arg}	-1.433	0.553	-5.51***	0.0001
	P_{Chi}	-2.621	0.103	-7.279***	0.0000
	P_{Egy}	-2.114	0.241	-8.574***	0.0000
	P_{Ind}	-2.178	0.218	-6.025***	0.0000
	P_{Neth}	-0.725	0.824	-6.214***	0.0000
Italy	P_{Arg}	-1.264	0.633	-5.584***	0.0001
	P_{Chi}	-1.461	0.539	-6.203***	0.0000
	P_{Egy}	-1.782	0.379	-5.043***	0.0005
	P_{Neth}	-1.192	0.663	-5.785***	0.0001
	P_{USA}	-1.236	0.644	-11.563***	0.0000
Turkey	P_{Arg}	-0.420	0.892	-6.653***	0.0000
	P_{Chi}	-3.401	0.019**	-5.641***	0.0001
	P_{Egy}	-2.381	0.156	-6.062***	0.000
Tunisia	P_{Chi}	-1.919	0.319	-5.758***	0.0001
	P_{EGY}	0.086	0.959	-8.568***	0.000
	P_{LIB}	-2.861	0.064	-5.537***	0.0002
Jordon	P_{Chi}	-1.6	0.461	-7.433***	0.0000
	P_{EGY}	-1.148	0.682	-7.134***	0.0000
Netherlands	P_{Arg}	-1.332	0.597	-6.779***	0.0000
	P_{Chi}	-0.969	0.751	-6.118***	0.0000
	P_{Egy}	-2.401	0.149	-6.601***	0.0000
	P_{USA}	-1.478	0.531	-5.173***	0.0002

Notes: triple asterisks (***) indicate statistical significance at the 1% level.
Source: own calculation using E-VIEWS10

Table (4) depicts Johansen co-integration test for the six markets based on trace test[i]. The null hypothesis of no co-integration (r=0) is rejected at 5% level of significance for all models. The results of likelihood ratio in the six markets indicated that there is only one co-integration equation at 5% level of significance for the six models that confirm the existence of long run relationship among rivals 'prices of shelled groundnut in each market.

Table 4. Johansen Co-integration Tests for Rivals' Prices of Groundnut (1987-2018)

Model	H_0: No co-integration, r=0			H_0: At most one co-integration, r=1		
	Statistic	Critical Value	P value	Statistic	Critical Value	P value
Greece Market (P_{Arg}, P_{Chi}, P_{Egy}, P_{Ind}, P_{Neth})	36.6**	33.87	0.023	12.171	21.131	0.531
Italy Market (P_{Arg}, P_{Chi}, P_{Egy}, P_{Neth}, P_{USA})	32.426**	30.439	0.028	16.064	24.159	0.416
Turkey Market (P_{Egy} P_{Arg}, P_{Chi})	34.3**	29.79	0.01	10.29	15.49	0.259
Tunisia Market (P_{Egy} P_{Chi}, P_{Lib})	37.897**	29.79	0.005	10.42	15.495	0.249
Jordon Market (P_{Egy} P_{Chi})	43.576**	15.495	0.000	0.308	3.841	0.579
Netherlands Market (P_{Arg}, P_{Chi}, P_{Egy}, P_{USA})	32.865**	27.584	0.009	20.368	21.132	0.064

Source: own calculation using E-Views 10.

The equations system of VECM consists of six market models. Greece Market consists of five equations for the five competitors (Egypt, Argentine, China, India, and Netherlands), Egypt equation is as follow:

$$D(P_{EGY}) = \alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)} + \beta_{(1,2)}*P_{ARG(-1)} + \beta_{(1,3)}*P_{CHI(-1)} + \beta_{(1,4)}*P_{INDI(-1)} + \beta_{(1,5)}*P_{NETH(-1)} + \beta_{(1,6)}] + \gamma_{(1,1)}*D(P_{EGY(-1)}) + \gamma_{(1,2)}*D(P_{ARG(-1)}) + \gamma_{(1,3)}*D(P_{CHI(-1)}) + \gamma_{(1,4)}*D(P_{INDI(-1)}) + \gamma_{(1,5)}*D(P_{NETH(-1)}) + const.$$

Italy Market consist of five equations for the five competitors (Egypt, Argentine, China, Netherlands, and USA), Egypt equation is as follow:

$$D(P_{EGY}) = \alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)} + \beta_{(1,2)}*P_{ARG(-1)} + \beta_{(1,3)}*P_{CHI(-1)} + \beta_{(1,4)}*P_{NETH(-1)} + \beta_{(1,5)}*P_{USA(-1)} + \beta_{(1,6)}] + \gamma_{(1,1)}*D(P_{EGY(-1)}) + \gamma_{(1,2)}*D(P_{ARG(-1)}) + \gamma_{(1,3)}*D(P_{CHI(-1)}) + \gamma_{(1,4)}*D(P_{NETH(-1)}) + \gamma_{(1,5)}*D(P_{USA(-1)}) + const.$$

Turkey Market consists of three equations for the three competitors (Egypt, Argentine, and China), Egypt equation is as follow:

$$D(P_{EGY})=\alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)}+\beta_{(1,2)}*P_{ARG(-1)}+\beta_{(1,3)}*P_{CHI(-1)}+ \beta_{(1,4)}]+ \gamma_{(1,1)}*D(P_{EGY(-1)}) + \gamma_{(1,2)}*D(P_{ARG(-1)}) + \gamma_{(1,3)}*D(P_{CHI(-1)}) + const.$$

Tunisia Market consists of two equations for the two competitors (Egypt, China, and Libya), Egypt equation is as follow:

$$D(P_{EGY})=\alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)}+\beta_{(1,2)}*P_{CHI(-1)}+\beta_{(1,3)}*P_{LIB(-1)}+ \beta_{(1,4)}]+ \gamma_{(1,1)}*D(P_{EGY(-1)}) + \gamma_{(1,2)}*D(P_{CHI(-1)}) + \gamma_{(1,3)}*D(P_{LIB(-1)}) + const.$$

Jordon Market consists of two equations for the two competitors (Egypt, China), Egypt equation is as follow:

$$D(P_{EGY})=\alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)}+\beta_{(1,2)}*P_{CHI(-1)}+\beta_{(1,3)}]+ \gamma_{(1,1)}*D(P_{EGY(-1)})+ \gamma_{(1,2)}*D(P_{CHI(-1)}) + const.$$

Netherlands Market consists of four equations for four competitors (Egypt, Argentine, China, and USA), Egypt equation is as follow:

$$D(P_{EGY}) = \alpha_{(1,1)}*[\beta_{(1,1)}*P_{EGY(-1)} + \beta_{(1,2)}*P_{ARG(-1)} + \beta_{(1,3)}*P_{CHI(-1)} + \beta_{(1,4)}*P_{USA(-1)} + \beta_{(1,5)}] + \gamma_{(1,1)}*D(P_{EGY(-1)}) + \gamma_{(1,2)}*D(P_{ARG(-1)}) + \gamma_{(1,3)}*D(P_{CHI(-1)}) + \gamma_{(1,4)}*D(P_{USA(-1)}) + const.$$

Table (5) shows the Error Correction Terms (ECTs) of rival 'prices among the surveyed six markets. ECTs of rivals of Egypt even are insignificant or have positive signs, proving that competitors of Egypt don't adjust their prices disequilibrium as a response to Egypt. ECTs of Egypt equation have negative signs and statistically significant values at 1%, with less than one as expected in all market models except Tunisian market model. The coefficients of ECTs are: (-0.0678) in Greece, (-0.228) in Italy, (-0.706) in Turkey, (-0.753) in Jordon, and (-0.581) in Netherlands. The ECTs indicate that 6%, 22.8%, 70.6%, 75.3%, and 58.1% of the long run disequilibrium or deviation of Egypt price from other rivals 'prices would be adjusted each year. In Tunisia, ECTs of Egypt and other rivals (China and Libya) are statistical insignificant revealing that neither exporters have influence on the others nor follow a leader price, referring to that Tunisia is a regular competitive market.

Table 5. Error Correction Coefficients for Rivals' prices of Groundnut (1987-2018)

Market	Dependent Variable	ECT	t-statistic	P-value
Greece	$D(P_{Egy})$	-.0678	-3.279	0.001
	$D(P_{Arg})$	-0.006	-0.107	0.914
	$D(P_{Chi})$	-0.122	-1.669	0.098
	$D(P_{Ind})$	0.033	0.782	0.435
	$D(P_{Neth})$	0.076	0.788	0.432
Italy	$D(P_{Egy})$	-.228	-5.928	0.000
	$D(P_{Arg})$	0.023	0.411	0.682
	$D(P_{Chi})$	-0.100	-1.209	0.229
	$D(P_{Neth})$	-0.069	-0.675	0.501
	$D(P_{USA})$	0.049	0.470	0.639
Turkey	$D(P_{Egy})$	-0.706	-2.938	0.004
	$D(P_{Arg})$	0.150	0.909	0.366
	$D(P_{Chi})$	-0.116	-0.350	0.727
Tunisia	$D(P_{Egy})$	-0.468	-1.853	0.069
	$D(P_{Chi})$	0.537	1.2	0.218
	$D(P_{Lib})$	0.0929	0.186	0.853
Jordon	$D(_{PEgy})$	-0.753	-2.514	0.015
	$D(_{PChi})$	-0.031	-0.111	0.912
Netherlands	$D(P_{Egy})$	-0.581	-2.265	0.026
	$D(P_{Arg})$	-0.158	-1.100	0.274
	$D(P_{Chi})$	0.115	0.764	0.447
	$D(P_{USA})$	-0.040	-.0312	0.756

Source: own calculation using E-Views 10.

price leadership evidence

Table (6) shows the price leadership status check. To determine whether the price of each rival drives the prices of other rivals in each market of the six models, weak exogeneity test is applied by imposing the restriction coefficient β's≠ 0. (Tim Llyod 2014) concluded that if the competitor is a leader, β couldn't be zero (X^2 is significant), otherwise if β is significantly equal zero, i.e. the competitor is a follower.

In Greece Market, investigating the four rivals of Egypt found that the null hypothesis β(1,Arg)=0 is rejected at 5% significance level as (X^2 =0.647), p-value is higher than 5% . Investigating the null hypotheses β(1,Chi)= β(1,Ind)= β(1,Neth)=0 couldn't be rejected as p-value of X^2 statistics are less than 5%.Consequantly,Argantine (Arg) is considered a price leader while other rivals; China, India, and Netherlands are followers.

In Italy Market, investigating the four rivals of Egypt found that the null hypothesis β(1,Arg)=0 is rejected at 5% significance level as (X^2 =0.643), p-value is higher than 5% . Investigating the null hypotheses β(1,Chi)= β(1,Chi)=β(1,Neth)= β(1,USA)=0 couldn't be rejected as p-value of X^2 statistics are less than 5%. Consequently, Argentine (Arg) is considered a price leader also in Italy market while other rivals; China, Netherlands and USA are followers.

In Turkey Market, investigating the two rivals of Egypt found that the null hypothesis β(1,Chi)=0 is rejected at 5% significance level as (X^2 =1.508), p-value is higher than 5% . Investigating the null hypotheses β(1,Arg)= 0 couldn't be rejected as p-value of X^2 statistics are less than 5%.Consequantly,China is considered a price leader in Turkey market while Argentine is a follower.

In Tunisia Market, investigating the two rivals of Egypt found that the null hypotheses β(1,Chi)= β(1,Lib)=0 couldn't be rejected as p-value of X^2 statistics are less than 5%.Consequantly,China and Libya are considered price followers, i.e. no influence on the market. In other words, in the absence of exporter leader in the market, the exporters of China, Libya in addition to Egypt are considered free competitive exporters which mean the Tunisian market is a regular price competitive.

In Jordon Market, investigating the sole rival of Egypt found that the null hypothesis β(1,Chi)=0 is rejected at 5% significance level as (X^2 =2.754), p-value is higher than 5%.Consequantly,China is considered a price leader in Jordon market.

In Netherlands Market, investigating the three rivals of Egypt found that the null hypothesis β(1,Arg)=0 is rejected at 5% significance level as (X^2 =2.032), p-value is higher than 5% . Investigating the null hypotheses β(1,Chi)= β(1,USA)=0 couldn't be rejected as p-value of X^2 statistics are less than 5%.Consequantly,Argentine (Arg) is considered a price leader while other rivals; China, and USA are followers.

Table 6. Price Leadership Check in Importing Markets from Egyptian Groundnut (1987-2018)

Market	Weak Exogeneity H0:(β^)=0	X^2	P-value	Leadership Status
Greece	Dependent Variable: $D(P_{Egy})$			
	β(1,Arg)=0	0.647	0.723	Leader
	β(1,Chi)=0	12.758	0.001	Follower
	β(1,Ind)=0	19.547	0.000	Follower
	β(1,Neth)=0	18.2	0.000	Follower
Italy	Dependent Variable: $D(P_{Egy})$			
	β(1,Arg)=0	0.643	0.422	Leader
	β(1,Chi)=0	4.405	0.0358	Follower
	β(1, Neth)=0	8.695	0.003	Follower
	β(1,USA)=0	14.121	0.00017	Follower
Turkey	Dependent Variable: $D(P_{Egy})$			
	β(1,Arg)=0	13.773	0.0002	Follower
	β(1,Chi)=0	1.508	0.219	Leader
Tunisia	Dependent Variable: $D(P_{Egy})$			
	β(1, Chi)=0	17.061	0.0000	Follower
	β(1,Lib)=0	3.570	0.05	Follower
Jordon	Dependent Variable: D(PEgy)			
	β(1, Chi)=0	2.754	0.097	Leader
Netherlands	Dependent Variable: D(PEgy)			
	β(1,Arg)=0	2.032	0.154	Leader
	β(1,Chi)=0	8.048	0.005	Follower
	β(1, USA)=0	7.736	0.005	Follower

Source: own calculation using E-Views 10.

Impact of price leadership on Egyptian groundnut production and export

Table (7) shows the multiple regression of the impact of price leadership on Egyptian production and exports 'groundnut using Ordinary Least Square (OLS) in the double logarithm form. Explanatory variables are the average exporting 'prices of groundnut for Egypt (P_{EGY}), Argentine (P_{ARG}), and China (P_{CHI}). Equation (1) shows that the Egyptian production is affected by its own export price, and price of its other two main rivals at the statistical significance level 1%, however, the elasticity coefficients of production show that 1% increase of P_{EGY}, P_{ARG}, P_{CHI} result in an increase of Egyptian production estimated by 0.389 , 2.428, and 0.02 respectively. Equation (2) shows that the Egyptian exports is affected only by Argentine price at the statistical significance level 1%, however, the elasticity coefficients of production show that 1% increase of P_{ARG} result in an increase of Egyptian production estimated by5.475. It is concluded that Egyptian production and exports are highly sensitive of Argentine as a leader price other than china and own export price.

Table 7. Multiple regression Equations of the impact of price leadership on the Egyptian production and exports groundnut (1987-2018)

Eequation	Dependent Variable(ton)	β^1 (P_{EGY})	β^2 (P_{ARG})	β^3 (P_{CHI})	F	$R^{\wedge 2}$
1.	Production	0.389 (4.273)***	2.428 (4.173)***	0.020 (4.588)***	56.23***	0.84
2.	Exports	0.238 (1.349)	5.457 (3.963)***	1.052 (1.668)	59.11***	0.85

Source: own calculation using E-Views 10.

Prospects of groundnut prices2025

Table (8) shows the prediction of groundnut prices for Egypt and its rivals in five[i] importing markets year 2025. The Egyptian exporting price will deviate 23% from Argentinian price in Greece market, 1% in Italy market, and 31% in Netherlands. However, it will deviate 13.7% from Chinese price in Jordon market, and 27.6% in Turkey market. The producer' price of groundnut is specified as a proxy variable to reflect the Egyptian farmer' cost, which will be $1.544thousand/ton in 2025, lower than the Egyptian exporters 'prices in all importing markets.

Table 8. Prediction of Groundnuts prices and policy decision 2025

Market	Exporting leader	Leader price	Egypt exporting price	Egypt producer price	Decision
Greece Market	Argentine	1.821	2.367	1.544	Decrease 23%
Italy Market	Argentine	1.925	1.941	1.544	Decrease 1%
Jordon Market	China	1.562	1.809	1.544	Decrease 13.7
Netherlands Market	Argentine	1.717	2.515	1.544	Decrease 31%
Turkey Market	China	2.013	2.782	1.544	Decrease 27.6%

Source: own calculation using E-Views 10.

CONCLUSION

Simulating Stackelberg price leadership rules between oligopolistic firms, the Egyptian exporters should behave as followers in pursuing leader's price transmissions without deviation. The high price they will charge, the less market share, and may get out of the market. The low price they will charge, they gain a part of the market share of the leader, consequently, the leader will decrease the price as an action, and it will be a war. Equilibrium price is the only efficient price that Egyptian exporters should charge as it is higher than production cost, so it is recommended to pursue the decreasing prices policy that equalize the leader price, and consequently, allure importers to redirect to the Egyptian market.

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التقدير القياسى لأثر القيادة السعرية العالمية على إنتاج وتصدير الفول السودانى بجمهورية مصر العربية

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يهدف البحث إلى تقييم تكامل السوق لأسعار صادرات الفول السودانى بين مصر والدول المنافسة ،وذلك فى أهم الأسواق المستوردة من مصر ، وهى اليونان وإيطاليا وتركيا وتونس والأردن وسوريا وهولندا . وتحديدا، فإن البحث يهدف إلى إختبار فرضية وجود سعر قيادى يهيمن على الأسعار بين الدول المنافسة. إستخدم البحث نموذج متجه تصحيح الخطأ (VECM) لاختبار وجود التكامل المشترك بين الأسعار فى الفترة (1987-2017). أوضحت نتائج اختبار ديكي فولر الموسع (ADF) إستقرار جميع الأسعار بعد الفروق الأولى (I (1 ~ P) كما أوضحت نتائج إختبار جوهانسن إلى وجود معادلة تكامل مشترك واحدة فقط على الأكثر فى كل سوق ،بما يشير إلى وجود علاقة طويلة المدى بين سعر الصادرات المصرية وأسعار الدول المنافسة. وأوضحت معلمات تصحيح الخطأ (ECTs) التأثير الأحادي الاتجاه لأسعار الدول المنافسة على السعرالمصري . وأوضحت قيمة تلك المعلمات أن 6٪ و 22.8٪ و 70.6٪ و 75.3٪ و 58.1٪ من إختلال التوازن بسعر التصدير المصرى بالمدى الطويل يتم إستعادته سنويًا في أسواق اليونان وإيطاليا وتركيا والأردن وهولندا على الترتيب. وأثبت اختبار ضعف الأثر الخارجي Weak exogeneity أن الأرجنتين تعتبر قائدًا سعريا بكل من اليونان وإيطاليا وهولندا ، وتعتبر الصين قائدًا سعريا في كل من تركيا والأردن،بينما يعتبر سعرتونس تنافسيًا. وأظهرت توقعات أسعار تصدير الفول السوداني عام 2025 أن ينحرف السعر المصري عن الأرجنتيني في اليونان وإيطاليا وهولندا إلى الأعلى بنسبة 23٪ و 1٪ و 31٪ على التوالي ، بينما ينحرف عن السعر الصيني في كل من الأردن وتركيا بنسبة 13.7٪ و 27.6٪ على التوالي. ويوصى البحث أن يتبنى المصدرون المصريون سياسة تخفيض الأسعار لإغراء المستوردين لإعادة التوجيه إلى السوق المصري.

الكلمات المفتاحية: القيادة السعرية ، إختبارالتكامل المشترك ، نموذج متجه تصحيح الخطأ VECM، إختبارضعف الأثر الخارجى.

[i] **If the two time series of prices P_{t1} , P_{t2} are non-stationary , or I(1), the residual ($z^{\wedge}_t$) should be stationary or $P^{\wedge}_1 - P^{\wedge}_2 \sim I(0)$. Dickey Fuller test has the form: $Z_t = \varphi Z_{t-1} + \mu_t$.**

[ii] **Syrian model is dropped result in limited observations.**

[iii] **Akaike Information Criterion (AIC) specify the lag length of time series as follow: $AIC = 2k - 2\ln(L)$, k is the parameters, and (L) is ML function for the estimated model.**

[i] **Johansen (1988) and Johansen and Juselius (1990) applied the likelihood ratio (LR) test, to determine the number of co-integrating vectors in a co-integration regression using Trace test and Maximum Eigenvalue test (Ikudayisi and Salman 2014) as follow: $LR_{Trace} = -T\sum_{j=r+1}^{k} \ln(1-\hat{\lambda_i})$, $LR_{Max\ Eigen} = -T\ln(1-\hat{\lambda_i})$**

r = 0, 1, 2….k-1, k-number of variables in the system, λ – Max Eigenvalue, T – sample size. The null hypothesis that r = 0, while alternative hypothesis r+1 of co-integrating vectors.

[i] **The Tunisian market is out of the price leadership hypothesis.**