Nat. Volatiles & Essent. Oils, 2021; 8(4): 16541-16557

NVEO
Natural Volatiles &
Essential Oils

An Analytical Study Of The Causal Relationship Of The Variables That Affecting On Onion Exports

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Abstract

The study showed the stability of the time series at the first difference, that is, it is integrated of the first degree. It is evident that the presence of one vector of co-integration at significance level 5%, that is, there is a long-run equilibrium relationship between the study variables. It becomes clear that Granger causality test indicated that there is a one-way causal relationship from the value of onion export to onion production, and from onion export price to onion export value, in addition to onion export price to onion production.

The results of applying the Error Correction Vector Model (VECM) showed that the error correction parameter ECT was negative and significance which estimated at (-2.25), means that speed of adjustment in the short run to equilibrium in long run is 225% per year. which means that there is a quick response. The model coefficients showed that there is a positive and important effect of onion production on onion export value in the short run, In addition, the impact of the onion export price on the onion export value is significant, and there is a positive effect in the short run, It was found that the quality of the vector error-correction model (VECM).

Keywords: Cointegration - Granger Causality - VECM - Variance Decomposition.

1.Introduction

In the light of the changes that Egypt is witnessing to achieve the requirements of economic development, agricultural exports play an important role in providing foreign exchange to contribute to reducing the deficit in the trade balance, in addition to competitive comparative advantage that helps in penetration into foreign markets, where the value of agricultural exports amounted by about 7.1 billion dollars in 2020 (com trade, 2020), which causes increasing in income, which is reflected in raising living standards and providing job opportunities. Therefore, increasing in production quantity which contributes in increasing of export quantity. Thus The aim of the state is not to increase the export volume only, but rather to create stability in the current foreign markets in addition to open new markets, which requires special production for export and not export surplus domestic consumption only.

Moreover, onion crop is considered one of the important economic vegetables crops in Egypt, in addition to export specifications that needed by foreign markets. Thus, The cultivated area of it reached about 202.6 thousand feddans, with a total production by about 2.9 million tons distributed over its three main seasons (MALR, 2020), and its cultivation is spread in most of the republic's governorates, and the winter onion crop is considered one of the most important productive crops where most of its production is allocated for export, and onions occupy the second place after potatoes with about 10.7% of the total vegetable area in 2020 and the amount of its exports amounted by about 12.9% of the total production.

2. Research problem

According to the economic importance of the onion crop and its export in Egypt, where it provides foreign exchange and thus reducing the deficit in the trade balance, so the research problem is to investigate the causal relationship between the most important variables represented in the onion production quantity and the export price that affected on the export value of Egyptian onions, by building a standard model , thus providing decision makers with complete information that helps them to develop this important export crop.

3. Research Objective

The primary aim of this research was to investigate the relationship between the Egyptian onion exports value and the most important factors affecting it represented in the production quantity and export price, by studying the following sub-objectives:

1- Studying the export and production situation of the crop by identifying its relative importance and its production and economic indicators.
2- Studying the causal relationship in the short and long run between onion exports value, production quantity and its export price.
3- Using the Vector Error Correction Model (VECM) between variables

4.Data and Methodology

Data used in this paper are annual figures covering the period 2000 – 2020. Data are taken from the food agriculture Organization, world bank, Egyptian Agriculture statistics bulletin. The variables of the study are onion exported value, onion production, and onion export price. The Augmented Dickey-Fuller (ADF) and Unit Root Tests are employed to test the integration level and the possible co-integration among the variables (Dickey and Fuller, 1981). However, the most common test in the time – series analysis is Augmented and simple Dickey-Fuller test. The Augmented Dickey-Fuller test is a correction of the simple formula by adding lagged time to removes the effect of autocorrelation problem in the time series by using the following formula:

$$(1)\Delta Y_t = \beta_0 + \beta_{1t} + \lambda Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + u_t$$

Where: y is the series; t = time (trend factor); β_0 = constant term; m = the lag order; Δ =the first difference of series; u_t= random error.(Gujarati,2004).

In addition, the research used to test the existence of a Unit root in the series using the following formula:

$$(2)\Delta Y_t = \beta_0 + YY_{t-1} + \beta_{1t} + \alpha_i \sum_{i=1}^{m} \beta_j \Delta Y_{t-i-1} + u_t$$

The number of lags "m" in the dependent variable was chosen by the Akaike Information Criteria (AIC) to ensure that the errors are white noise. One problem with the presence of the additional estimated parameters is that it reduces degrees of freedom and the power of the test. On the other hand, the study may fail to reject the null hypothesis of a unit root ($\gamma = 0$) because of a misspecification concerning the deterministic part of the regression. Therefore, (Doldado, J, Jenkinson, T, Sosvilla-Rivero 1990) also suggest starting from the most general model to test for a unit root when the form of the data generating process is unknown. The general principle is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses (Hamilton, 1994a). If the intercept or time trend is inappropriately omitted, the power of the test can go to zero (Campbell and Perron, 1991).

A linear combination of integrated variables is said to be co integrated if the variables are stationary. Many economic models entail such co integrating relationships (Enders, 1995). After the order of integration is determined, co integration between the series should be tested to identify any long run relationship. Johansen trace test is used for the co integration test in this study. (Cheung and Lai 1993a) mention that the trace test is more robust than the maximum eigenvalue test for co integration. The Johansen trace test attempts to determine the number of co integrating vectors among variables. There should be at least one co-integrating vector for possible co integration. (Dueker and Startz (1998), Cheung and Lai 1993b) and (Baillie and Bollerslev 1994) implemented a fractional co integration approach where the series have different orders of integration. For example, in a linear combination of two or more series, two series might be I (1) and another might be I(0) or I(d) where ($0 < d < 1$) is known as fractional co integration. Fractional co integration refers to situations where the reduction in the order of integration of the co integrating series can take fractional values. The Johansen approach (Johansen and Juselius, 1990) was preferred in this study. The finding that many macro time series may contain a unit root has spurred the development of the theory of non-stationary time series analysis. Empirical studies have shown that the existence of non- stationarity in the time series considered can lead to spurious regression results and invalidate the conclusions reached using Granger Causality. (Toda and Phillips 1993) have led the methods to deal with Granger causality in I (1) systems of variables. A causal long run relationship between non-stationary time series when they are co integrated could be inferred. Therefore, if co integration analysis is omitted, causality tests present evidence of simultaneous correlations rather than causal relations between variables. Also, The presence of co-integration between the variables means that they move together in a joint movement, even if they are temporarily away as it took a random direction, but it does not stray too far from its equilibrium in the long run, due to a certain trend mechanism through the error correction vector model (VECM), which is derived from the VAR vector model, because it determines the causal relationship between the variables in the short and long run, as well as The speed of reaching equilibrium in the long run from any imbalance that occurs in the short term. Thus VECM is based on estimating the following two equations:

$$(3)\Delta \ln Y_t = C_0 + \sum_{i=1}^{K} \beta_i \Delta \ln Y_{t-i} + \sum_{i=1}^{K} \alpha_i \Delta \ln X_{t-i} + P_i \, ECT_{\ t-1} + u_t$$

$$(4)\Delta \ln X_t = C_0 + \sum_{i=1}^{K} \gamma_i \Delta \ln X_{t-i} + \sum_{i=1}^{K} \varsigma_i \Delta \ln Y_{t-i} + \eta_i \, ECT_{\ t-1} + \varepsilon_t$$

Where: Y is onion exported value, X stands for onion production, and onion export price, and P_i is the adjustment coefficient while $ECT_{\ t-1}$ expresses the error correction term of export equation, Δ indicates first difference operator. In equation (3), X variables Granger causes onion export value if α_i and P_i are significantly different from zero. In equation (4), onion export value Granger causes X variables if ς_i and

η_i are significantly different from zero. F-statistic is used to test the joint null hypothesis of α_i, ς_i = 0, and t test was estimated the significance of the error coefficient. A statistically significant F statistics and t statistics for ECM terms would be enough to have causation from X to Y in equation (3) and from Y to X in equation (4).

The existence of Cointegration will lead us to long run/short-run causality analysis. Vector Error Correction Mechanism (VECM) can be applied if we find a Cointegration in our model. Otherwise, vector auto-regressive mechanism should be used for causality analysis. Once, Cointegration is proved in the model, we can proceed for VECM mechanism to find the causality in the model. Assuming that all the models with a proved Cointegration, the VECM mechanism is given below to perform causality analysis in the models.

5. Results and Discussions:

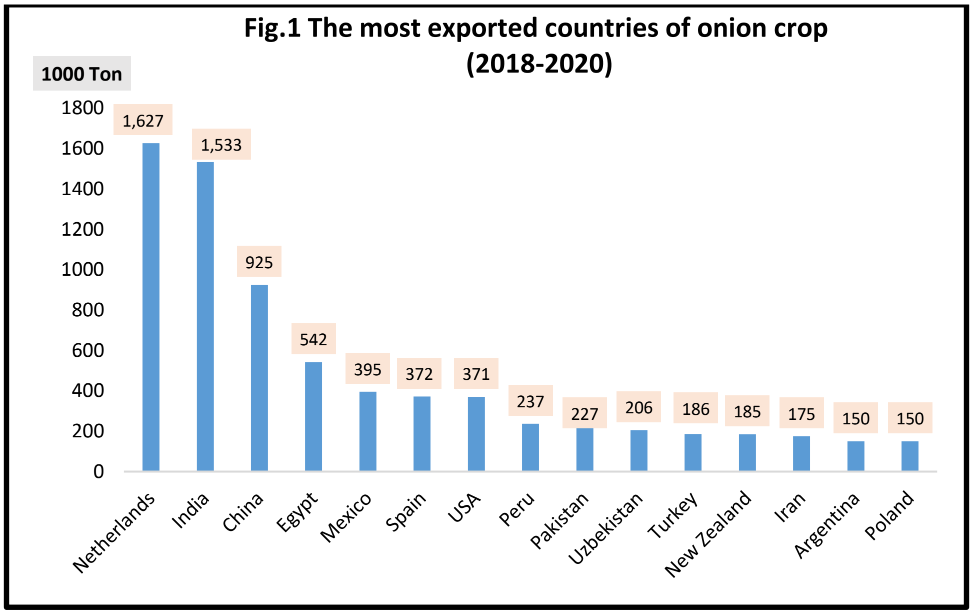
5.1 Study of onion export and production

According to statistics data obtained from Food and Agriculture Organization (FAO) (FAOSTAT,2020) during average period, Egypt is the one of top four exporting countries in onions, after Netherlands, India, china (Fig.1). Moreover, it turns out that China, Mali, Japan, Korea and Tunisia were among the five largest countries of world onion production with about 873, 631, 521, 453, 284 thousand tons, respectively. Although Egypt had advantage in world onion export but it was not representing any relative importance in world onion production (Fig. 2). Table 1 showed that the ratio average area of winter onion crop during (2018-2020) was amounted by about 94% to the total area of onions in Egypt, with an average area by about 193.4 thousand feddans of total area of onions by about 205.8 thousand feddans, and the ratio of average production of winter onions was amounted by about 94.8% of the total Egyptian onion production, with an average production 2842.4 thousand tons of the total production by about 2998.9 thousand tons. Also it was evident that the important of average winter onions area to the total vegetables area in Egypt during the study period was amounted by about 10.5%, where the total vegetables area was about 1849.5 thousand feddans, while the ratio of exports from production was about 17.8%.

The results showed the statistical analysis of the study variables during the period 2000-2020, where the average value of onion exports amounted by 1.2 billion pounds, while its maximum value was 4 billion pounds, and its minimization value was 43 million pounds, in other hand the average of onion production was 1841 thousand tones, while its maximum was 2917.5 thousand tones, and its minimum was 860 thousand tones, in addition the average of onion export price was 2743 pounds/ ton, while its maximum was 7813 pounds/ ton, and its minimization was 291 pounds/ ton. It was clear from Jargue – Bera value for all of the study variables follow a normal distribution. In terms of standard deviation value; it indicates that the onion export price is the most fluctuation, while the exchange rate has the least fluctuation. Table 2.

(Fig. 3). show the instability of the time series of study variables during (2000-2020), but it does not show whether the instability was due to the presence of a unit root or not, therefore there is an urgent need to test a unit root.

Econometric modeling using time series and conventional methods is based on the assumption of stationary of model's time series variables; unit root test is examined on each variable which used in research's model to study of the stationary condition. For this purpose, augmented Dickey–Fuller method was used, where run for all the series at both level and first difference, with constant, constant and trend, and none in the equation. Stationary tests on each variable used in study have been evaluated, which in turn, results obtained are shown in Table 3. As can be seen, all study variables are non-stationary in level. On the other hand, it was found that the calculated values are greater than the critical values at the first difference which meaning that all of them were stationary at the first difference. Therefore, the alternative hypothesis is accepted, thus, there was a long run or equilibrium relationship between the time series. It is clear from (Fig. 4). that the condition of stability has been fulfilled, which indicates the possibility of relying on the calculated results.



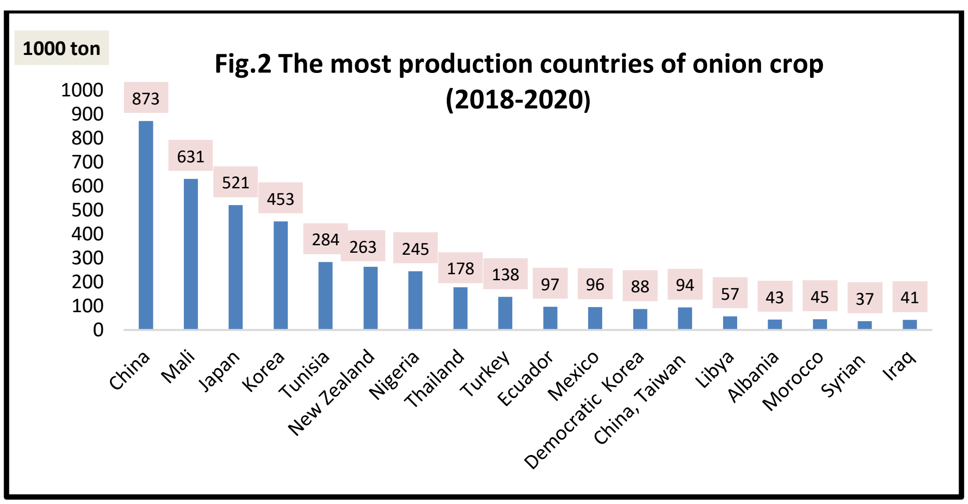


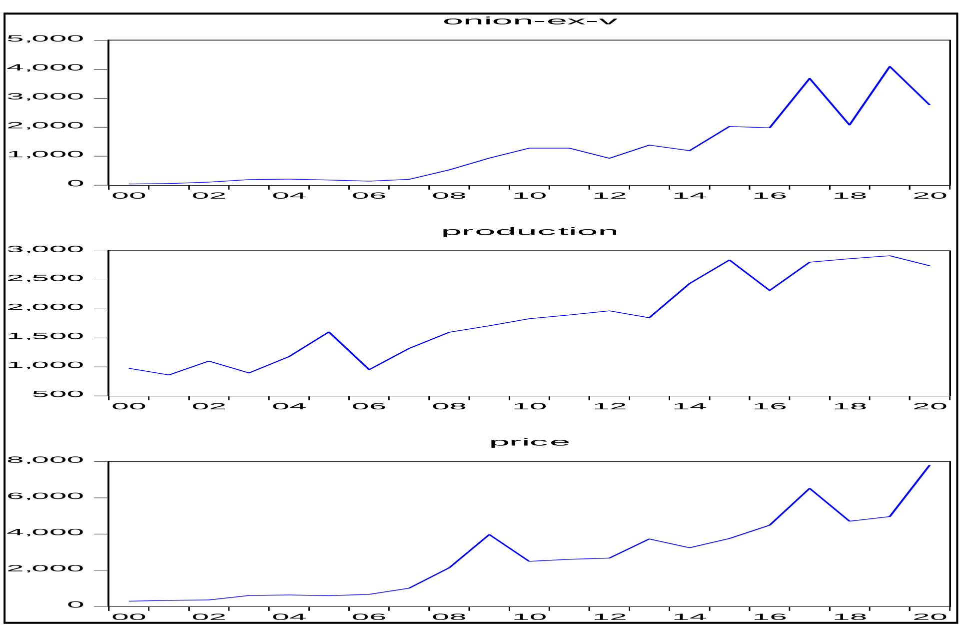
Table 1. The importance of the winter onion crop during the average period (2018-2020)

Item / Year	winter onion Area (1000 fed.)	winter onion Production (1000 ton)	Total area of onion (1000 fed.)	Total production of onion (1000 ton)	% Area of winter onion	% Production of winter onion	Total area of vegetables (1000 fed.)	% Area of winter onion to total vegetables area	Onion export quantities (1000 ton)	% Onion export quantities to production
2018	195.0	2865.9	207.2	3018.2	94.1	95.0	1907.2	10.2	446.0	15.6
2019	195.9	2917.5	207.7	3068.9	94.3	95.1	1876.3	10.4	825.38	28.3
2020	189.4	2743.7	202.6	2909.5	93.5	94.3	1765.0	10.7	354.28	12.9
AVE	**193.4**	**2842.4**	**205.8**	**2998.9**	**94.0**	**94.8**	**1849.5**	**10.5**	**541.9**	**17.8**

Table. 2. Descriptive Statistics of Variables Used during (2000-2020).

Item	Onion-ex-v	Production	ex-Price
Mean	1204.05	1840.91	2743.37
Median	932.87	1831.29	2602.14
Maximum	4099.66	2917.47	7813.12
Minimum	42.98	859.80	290.89
Std. Dev.	1199.17	719.75	2173.47
Jargue – Bera	3.827	1.598	1.529
Observations	21	21	21

Fig.3 The instability of the time series of study variables during (2000-2020)



5.2 Johansen's Cointegration Test

Before used Johannes's Cointegration technique, the optimum lag length for co-integration was selected based on Akaike and Shwarz Information Criteria by using vector autoregressive test. Table 4 showed that the optimum lag length was 2, and based on trace test and maximum Eigen values table 5 it was clear to reject the null hypotheses of co-integrating vectors and accepted the alternative hypotheses. It turns out that there are one vector of co-integration for both the trace and the eigenvalue tests, although the presence of co-integration, it did not specify the kind of the relationship, so important to realize estimated Granger Causality Test and VECM vector error correction model.

Table 3. ADF Test Statistics

Variable	Intercept		Intercept and Trend		Non	
	ADF	P- Value	ADF	P- Value	ADF	P- Value
Level						
Onion-ex-v	1.49	0.99	1.14	0.89	0.44	0.51
Production	0.65	0.84	3.20	0.12	0.79	0.87
ex-Price	0.07	0.94	3.49	0.06	1.19	0.93
Critical Values	**3.02**		**3.67**		**1.95**	
1*Difference						
Onion-ex-v	13.42	0.00	3.79	0.04	10.74	0.000
Production	6.61	0.00	5.70	0.001	5.84	0.000
ex-Price	4.61	0.002	4.21	0.02	4.06	0.000
Critical Values	3.03		3.70		1.96	

-significant 5% level of significance.

Fig.4

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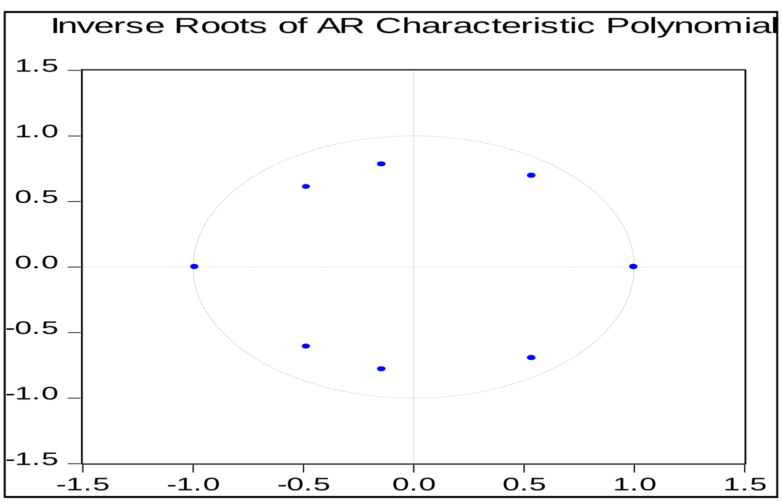


Table 4. Optimum lag selection criterions

Lag	LogL	LR	FPE	AIC	SC	HQ

0	-453.3820	NA	1.47e+17	48.04021	48.18933	48.06545
1	-429.7174	37.36518	3.19e+16	46.49657	47.09305	46.59752
2	-413.0980	20.99284*	1.57e+16*	45.69453*	46.73838*	45.87119*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 5: Result of Johansen's Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.799451	43.61292	42.91525	0.0425
At most 1	0.395931	14.69241	25.87211	0.6002
At most 2	0.268149	5.619200	12.51798	0.5101

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.799451	28.92051	25.82321	0.0189
At most 1	0.395931	9.073210	19.38704	0.7169
At most 2	0.268149	5.619200	12.51798	0.5101

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

5.3 Granger Causality Test

After confirming co-integration test, it was important to know whether there was a causal relationship between the study variables or not and what is the direction of it Unidirectional or bidirectional, thus The purpose of this section is to test the Granger causality between Egyptian onion exports value, onion production, and onion export price during the period 2000-2020, (Granger, 1988), where the null hypothesis (H0) indicates the absence of Granger Cause while the alternative hypothesis (H1) indicates the existence of Granger Cause. Table 6 gives causality test results for the variables of the study. In addition, it showed that in the presence of co integration there must be at least one direction:

Unidirectional or bidirectional. However, the limited number of observations in this study, maximum lag is set to 2 and the models of the study are estimated for each lag length. Higher lag lengths than 2 did not give significant results. (Pindyck and Rubinheld 1991) pointed out that it would be best to run the test for two different lag structures on (one lag length and tow lag length) and make sure that the results were not sensitive to the choice of lag length. As can be seen from Table 6, unidirectional causality exists from onion export value to onion production the and from onion export price to the onion export value, In addition onion export price to onion production. Where F value and for ECM terms are statistically significant.

Table 6. the results of causality tests according to Granger for variables study.

Null Hypothesis	**F – Statistic**	**prob**	**F – Statistic**	**Prob**
	Lag 1		**Lag 2**	
DPRODUCTION does not Granger Cause DONION_EX_V	0.391	0.540	0.404	0.675
DONION_EX_V does not Granger Cause DPRODUCTION	13.356	0.002*	3.492	0.043*
DPRICE does not Granger Cause DONION_EX_V	7.345	0.015*	4.802	0.026*
DONION_EX_V does not Granger Cause DPRICE	0.037	0.850	0.021	0.980
DPRICE does not Granger Cause DPRODUCTION	19.496	0.000*	5.089	0.022*
DPRODUCTION does not Granger Cause DPRICE	0.686	0.419	0.820	0.461

*significant 5% level of significance.

5.4 Vector Error Correction Model (VECM)

The co-integration test confirms the existence of a long-run equilibrium relationship between the value of onion exports and the production and its export price, the error correction vector model (VECM) (Abou-Talib 2008) helps to determine the direction of this relationship in the long and short run, where the error correction parameter ECT or the adjustment speed indicates the amount of change In the dependent variable as a result of the deviation of the independent variable in the short run from its equilibrium value in the long term by one unit, and this coefficient is expected to be negative, because it indicates the rate at which the short-term relationship tends towards the long-term relationship. The parameters Coefficient indicate the direction of the relationship in the short run, and the table 7 shows the results of the Granger causality test using a vector error correction model VECM: which The first part shows that the error correction parameter ECT was negative and significant has been estimated at (-2.25), shows a 225% correction of a short-run fluctuation in a year. It is evident that by using VECM approach there is a significant long–run equilibrium relationship. in other words, the error correction ECT indicates that the error in the relationship of the value of onion exports and the onion production and onion export price is corrected during one-time period (a year), and this indicates that correcting the error needs approximately four months and four days for the dependent variables to return to equilibrium level in the long run that mean there is rapid responsible. The second part shows The coefficients of the model, which indicate the effect of the variables in the short run, thus There is a positive and significant effect of onion production on onion export value in the short run, where an increase in onion production with one and two lag time by one unit leads to an increase in onion export value by 2.2, 1.3 respectively. In addition, the effect of onion export price on onion export value is significant, and there is a positive effect in the short run, as the increase in onion export price with one and two lag time by one unit increase total onion export value by 0.79. 0.46 respectively. In addition, Log likelihood statistic amounted by 16.48. The coefficient of R^2 of changes in onion export value equals 0.72, meaning that approximately 72% is explained by independent variables in the model, and the remaining 28% is due to errors or other variables not included in the model. In addition, F-statistic value showed there is a significance relationship between study variables in the model.

Table 7. Estimated parameters of the VECM model

The direction of the relationship in the long run			
Error Correction:	**D(DONION_EX_V)**	**D(DPRODUCTION)**	**D(DPRICE)**
CointEq1	-2.252959	0.280505	-1.177009
	(0.54418)	(0.26750)	(0.58198)
	[-4.14007]	[1.04864]	[-2.02243]

The direction of the relationship in the short run			
D(DONION_EX_V (-1))	0.858299	0.198603	0.680927
	(0.39984)	(0.19654)	(0.42761)
	[2.14663]	[1.01050]	[1.59242]
D (DONION_EX_V (-2))	0.782126	0.007426	0.163491
	(0.32927)	(0.16186)	(0.35214)
	[2.37530]	[0.04588]	[0.46427]
D (DPRODUCTION (-1))	2.210321	0.596765	1.019958
	(0.64649)	(0.31779)	(0.69139)
	[3.41893]	[1.87788]	[1.47522]
D (DPRODUCTION (-2))	1.331830	0.532462	0.581722
	(0.47068)	(0.23136)	(0.50336)
	[2.82962]	[2.30143]	[1.15567]
D (DPRICE (-1))	0.790043	0.360866	0.649549
	(0.44386)	(0.21818)	(0.47469)
	[1.77993]	[1.65398]	[1.36837]
D (DPRICE (-2))	0.461656	0.287196	0.620515
	(0.42044)	(0.20667)	(0.44964)
	[1.09803]	[1.38965]	[1.38003]
C	0.098762	0.032074	0.117407
	(0.04243)	(0.02086)	(0.04538)
	[2.32738]	[1.53764]	[2.58709]
R-squared	0.725651	0.723444	0.410130
Adj. R-squared	0.533607	0.529855	-0.002778
Sum sq. resids	0.168800	0.040786	0.193061
S.E. equation	0.129923	0.063864	0.138947
F-statistic	3.778567	3.737013	0.993271
Log likelihood	16.48380	29.26717	15.27517
Akaike AIC	-0.942644	-2.363018	-0.808353
Schwarz SC	-0.546924	-1.967298	-0.412632
Mean dependent	0.078712	0.022057	0.074169
S.D. dependent	0.190244	0.093141	0.138754

D(DONION_(EX_V)= 0.099 + 0.86D (DONION_(EX_V (-1))) +0.78D (DONION_(EX_V (-2))) +2.21D (DRODUCTION (-1))+1.33D(D(DRODUCTION (-2)) + 0.79 D(DPRICE(-1))+ 0.46D(DPRICE(-2))

5.5 Variance Decomposition:

The main objective of Variance decomposition is to investigate the amount of error in the variance for the study variables in var model, the results of Variance decomposition test were reached as shown in Table 8. Where Onions export value explain 100% of the variance errors due to the same variable during the first period, while 74.79% in the second period are due to the same variable. This percentage decline until it reached its lowest percentage during the sixth period, where it reached 42.27%, and then began to fluctuate between decrease and increase until it reached about 44.38% in the tenth period. We also note that changes in onion production explain about 8% of the prediction error in the onion exports value in the second period, and the highest explanation for onion production during the fourth period was about 18.7%, while it decreased during the tenth period by 16.99%. Therefore, the shocks in onion production explain the Variance in the prediction error of onion exports value in the long run greater than the short run. It is also inferred from the same table that the change in onion exports value is affected by the change in the price of onion exports, as changes in it explain 17.2% of the prediction error in onion exports value during the second period, and it increased significantly during the following periods until it reached 40.45% in The sixth period, which is considered the highest percentage during all periods, and then decreased until it reached 38.61% in the tenth period, and this indicates that there is an impact of changes in the onion exports price on changes in the onion exports value. Therefore, the shocks in onion export price explain the Variance in the prediction error of onion exports value in the long run greater than the short run. From the previous results, the “strongest” independent variables can explain the variance in the dependent variable over time as follows: the price of onion exports and then onion production.

Impulse Response Function

The impulse response function shows the response of each of the internal variables in the model to unexpected shocks within the error limits of one standard deviation. By studying the impulse response function of the study variables to a random shock in onion exports value, it was clear that there was a statistically significant relationship between the study variables. (Fig.5).

5.6 Model validity test:

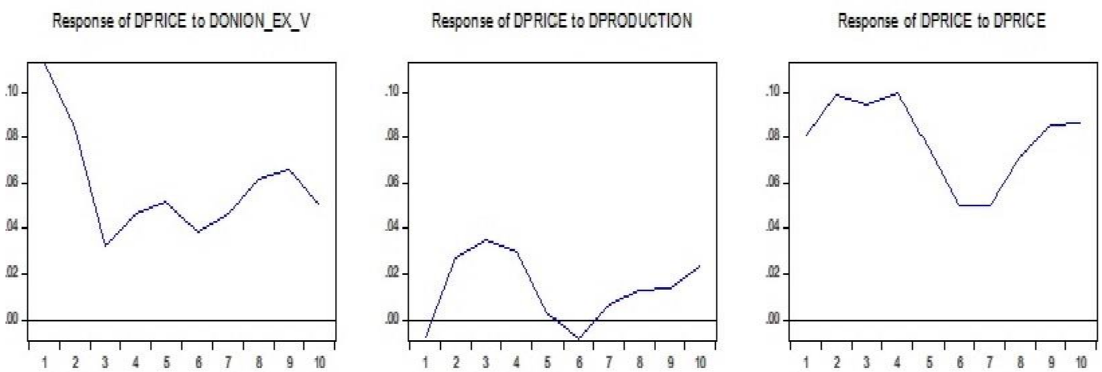
To investigate that the VECM model is good and free from standard problems, the following tests should be performed:

Table 8: Variance Decomposition of DONION_EX_V.

Variance Decomposition of				
		DONION_EX_	DPRODUCTIO	
Period	S.E.	V	N	DPRICE
1	0.129923	100.0000	0.000000	0.000000
2	0.167210	74.79349	8.001210	17.20530
3	0.231918	64.70352	9.749589	25.54689
4	0.288723	43.73535	18.70218	37.56247
5	0.313980	44.74455	16.44870	38.80674
6	0.324296	42.27146	17.27185	40.45669
7	0.334455	45.34796	16.31696	38.33508
8	0.344857	44.43224	16.74449	38.82327
9	0.368348	48.30556	15.21972	36.47472
10	0.390190	44.38591	16.99742	38.61667

Cholesky Ordering: DONION_EX_V DPRODUCTION DPRICE

Fig.5 The impulse response of study variables.



1- Roots table Test :

Table 9 confirms the previous result thus the unit root coefficients are less than or equal one. It can also be confirmed by the following equation:

The number of roots equal to one = the number of study variables - the number of co-integration relationships

It becomes clear that the equation is correct as: the number of roots equal to one is 2, the number of variables in the study is 3, and the number of co-integration relations is 1.

2- Residual Normality test:

To test the residuals of VECM follow a normal distribution or not, it is clear that Jarque -Bera statistic estimate at 1.49 by probability 0.96, where it is greater than 0.05 at significance level (5%), This means that we could not reject the null hypothesis that the series of residuals follow the normal distribution, that is, the residuals of the VECM follow a normal distribution table 10.

3- White heteroskedasticity test :

Table 11 shows that the probability of Chi- sq is greater than 0.05 at significance level (5%), and accordingly we reject the heterogeneity problem and therefore accept the hypothesis of stability of variance.

4- LM test :

To test the autocorrelation problem, it is noted from the table 12 that the probability of calculated F-statistic value at all lag time from 1 to 2 is greater than 0.05 at significance level 5%, therefore we accept the null hypothesis that The estimated model is free from the autocorrelation problem.

5- Wald Test :

table 13 shows that the probability of Chi- square statistic is less than 0.05, accordingly it is emphasized that the effect of the independent variables in the model on the dependent variable in the short run.

regarding from the previous results it was found that the quality of the vector error-correction model (VECM) is confirmed by results of Roots test, Residual Normality test, White heteroskedasticity test , LM test, and Wald test.

Table 9. AR root Table

Modulus Root	
1.000000	1.000000
1.000000	1.000000
-0.989229	0.989229
0.536968 - 0.694944i	0.878227
0.536968 + 0.694944i	0.878227
-0.143104 - 0.780913i	0.793917
-0.143104 + 0.780913i	0.793917
-0.483775 - 0.608306i	0.777222
-0.483775 + 0.608306i	0.777222
VEC specification imposes 2 unit root(s).	

Table 10. Normality Tests

	Component	Jarque-Bera prob	df
1	0.686617	2	0.7094
2	0.082046	2	0.9598
3	0.721268	2	0.6972
Joint	1.489930	6	0.9602
*Approximate p-values do not account for coefficient estimation.			

Table 11 White heteroskedasticity test

Heteroskedasticity Tests		
Joint Test		
Chi-sq	**df**	**prob**
87.4927	84	0.376

Table 12. LM test

Null hypothesis: No serial correlation at lag h						
Lag	**LRE* stat**	**df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	8.728649	9	0.4627	1.007893	(9, 12.3)	0.4821
2	5.778391	9	0.7619	0.603522	(9, 12.3)	0.7730
Null hypothesis: No serial correlation at lags 1 to h						
Lag	**LRE* stat**	**df**	**Prob.**	**Rao F-stat**	**df**	**Prob.**
1	8.728649	9	0.4627	1.007893	(9, 12.3)	0.4821
2	14.29545	18	0.7096	0.596439	(18, 6.1)	0.8168
*Edgeworth expansion corrected likelihood ratio statistic.						

Table 13. Wald Test

Wald Test: System: %system			
Test Statistic	**Value**	**df**	**Probability**
Chi-square	20.91042	3	0.0001
Null Hypothesis: C(1)=C(2)=C(3)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		**Value**	**Std. Err.**
C(1)		-2.252959	0.544184
C(2)		0.858299	0.399836
C(3)		0.782126	0.329274

Conclusions and Recommendations:

In light of the changes that Egypt is witnessing to achieve the requirements of economic development, agricultural exports play an important role in providing foreign exchange to contribute in reducing the trade balance deficit. The onion crop is one of the important economic vegetable crops in Egypt, in addition to the export specifications that foreign markets need. thus It is cultivated in most governorates of the Republic. The winter onion crop is considered one of the most important productive and export crops, where its exports amounted by 12.9% of the production quantity. The main aim of this study is to know the relationship between the value of Egyptian onion exports and the most important factors that affect it, represented in the production quantity and export price during the study period (2000-2020), based on integration causal relationship in the long and short run, in addition using the vector error correction model (VECM) between variables.

It was found that Egypt is one of the largest onion exporters, the study showed the stability of the time series at the first difference, that is, it is integrated of the first degree. In addition, Johansen's co-integration test rejected the null hypothesis and accept the alternative hypothesis, It is evident that the presence of one vector of co-integration at significance level 5%, that is, there is a long-run equilibrium relationship between the study variables. It becomes clear that Granger causality test indicated that there is a one-way causal relationship from the value of onion export to onion production, and from onion export price to onion export value, in addition to onion export price to onion production. The results of applying the Error Correction Vector Model (VECM) showed that the error correction parameter ECT was negative and significance which estimated at (-2.25), means that speed of adjustment in the short run to equilibrium in long run is 225% per year. This indicates that it takes four months and four days approximately to correct the error in the dependent variables to return to the equilibrium level in the long run, which means that there is a quick response. The model coefficients showed that there is a positive and important effect of onion production on onion export value in the short run, there is a positive relationship between onion production with one and two lagged time and onion export value by 2.2, 1.3, respectively. In addition, the impact of the onion export price on the onion export value is significant, and there is a positive effect in the short run, as an increase in the onion export price by one unit increases the total onion export value by 0.79,0.46, respectively. It was found that the quality of the vector error-correction model (VECM) is confirmed by results of roots test, the normal distribution test, the variance instability test, the LM test, and Wald's test.

In the light of the research results, there are some recommendations as follows:

1- Encouraging farmers to adopt high-yielding varieties that meet the requirements of local consumption and export.
2- Establish price incentives to encourage farmers to join the contract farming system to ensure the marketing of the crop.
3- The existence of a database that provides producers and traders with information of required quantities with standard specifications and appropriate export prices, which help in maintaining the current markets and the possibility of opening new markets.

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