An Economic Study of Egyptian Garlic Exports to Foreign Markets

Hussein Hassan Aly Adam and Amal Zien El-Abdeen Mohamed

Agricultural Economics, Faculty of Agriculture and Natural Resources, Aswan University
The General Directorate of Drug Control
hhussienadam@yahoo.com

Abstract: In 2013, Egypt recorded the world fifth garlic producer after China, India, Korea, and Russia, with production quantity estimated at 218.48 thousand tons, of which 13.23 thousand tons worth US$10.66 million have been exported to global markets. Average vegetable planted area in Egypt amounted to 1969 thousand feddans representing 59.92% of the average area under horticultural crops, and 14.12% of the average agricultural planted area for the period 2004-2013. Garlic is one of the major promising export crops for Egypt. Average garlic planted area amounted to 15.68 thousand feddans representing about 0.79% of the total vegetable planted area in Egypt. Studying the main markets importing Egyptian garlic indicated that Italian market occupied the top rank in terms of Egyptian garlic imports volume over the two study periods, with stable imports over a full decade. Studying the competitive price position indicated that Egypt has been facing fierce competition from Saudi Arabia, India, and the UAE during the past decade, in addition to Iran during the last five years. Elasticities obtained from estimating the demand function for Egyptian garlic exports to the Italian market indicated that 1% increase in Egyptian garlic export price leads to 1.41% increase in quantity demanded by 1.41%, which contradicts the economic logic as it indicates a positive relationship between the price and quantity demanded. However, the estimated cross elasticities indicated that 1% increase in the prices of garlic exported by competing countries (France, Spain, and Holland), leads to reducing the quantity demanded from France and Holland by 2.14% and 0.87%, respectively, whilst a 1% increase in the price of Spanish garlic leads to increasing demand for Egyptian garlic by 1.51%. The two results regarding the cross elasticity of French and Dutch garlic contradict the logic of economic theory; but the result regarding the cross elasticity of Spanish garlic (which indicated increasing the demand for Egyptian garlic as the price of Spanish garlic increases) matches the logic of economic theory. Such result can be explained by the real competition between Egyptian and Spanish garlic exports because both are produced in the same time, and belong to the same climatic Zone, i.e., the Mediterranean Sea Zone.

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1. Introduction

Despite the great attention paid to developing Egyptian agricultural exports as one of the national goals aiming to reduce deficit in the Balance of Trade, the hoped for results have not been fully achieved. In addition, developing Egyptian agricultural exports, which is a key strategic goal of Egypt's Agricultural Development Strategy, has not reached the levels commensurate with the available potentials due to the fierce competition in global markets. The designed export development goals aim for Egypt to have a growing and stable presence in foreign markets in general, and particularly in the European market that absorbs around 30% of Egypt's total agricultural exports. Therefore, it is very important for the economy of Egypt to reach a reasonable level of merging into the global market under the new prevailing conditions, which can be done by designing clear basis for export development strategies applied to total exports in general, and agricultural exports in particular.

Horticultural crops have great importance in the structure of Egyptian agricultural production and exports. In terms of production, vegetable, fruits, medicinal and aromatic plants, and cut flowers are very important horticultural crops. During the period (2004-2013), average area under horticultural crops reached 3285.6 thousand feddans representing 22.5% of Egypt's total agricultural area [(5)], whilst average value of horticultural crops amounted to LE 26 billion representing 36.2% of Egypt's Gross Agricultural Product. Moreover, average value of agricultural exports amounted to LE 1.388 billion representing 30.5% of the average value of agricultural exports for the mentioned study period.

Garlic is one of the vegetable crops cultivated in Egypt in September and October during the winter season. It is cultivated either single or intercropped with other winter crops. Garlic is cultivated for domestic consumption and exports. It has several uses besides food utilization; these are food preservation and medicinal uses. Garlic is one of the major export

crops, either to Arab or European markets. It is worth noting that Minya, SharKia, and Bani Swaif are the top Governorates in terms of export-led garlic production, where their garlic production is free of rust disease, and stands storage better than that produced in other Governorates like Dakahlia, Gharbia, and Kalioubia, the production of which is mostly sold at local markets, and only a small part is exported at the end of the season. Egyptian garlic is usually exported in April and May, during which there is no commercial competition, which allows receiving rewarding prices in comparison to other periods when foreign garlic varieties start to appear, due to the fact that they outperform Egyptian garlic in terms of the number, size, and spicy flavor of cloves, in addition to standing longer storage period, and containing larger amount of dissolved solids. Such characteristics attract higher demand for foreign garlic varieties upon appearing in the markets, and therefore Egypt must benefit from the period during which such varieties are not available yet. Egypt recorded the world's fifth garlic producer in 2013 [7] after China, India, Korea, and Russia. In 2013, Egypt's garlic production amounted to 218.48 thousand tons, of which 13.23 thousand tons worth US$10.66 million have been exported to global markets. Average vegetable planted area in Egypt amounted to 1969 thousand feddans representing 59.92% of the average area under horticultural crops, and 14.12% of the average agricultural planted area for the period (2004-2013). Garlic is one of the major promising export crops for Egypt. Average garlic planted area amounted to 15.68 [5] thousand feddans representing about 0.79% of the total vegetable planted area in Egypt.

Research Problem

Despite the expansion in garlic production in Egypt, and the increases in exported quantities in recent years, the percent exported of domestic production has been declining, where it declined from 22.7 in 2004 to as low as 6.07 in 2013. Therefore, the research problem is to identify the reasons for such huge decline in garlic exports during the period (2004-2013).

Research Objective

The research aims to identify the reasons for the diminishing exports of Egyptian garlic relative to domestic production during recent years by estimating the appropriate economic and statistical indicators.

2. Methodology and Sources Of Data

The researcher applied both descriptive and quantitative methods including mathematical and statistical methods, and some economic and statistical analysis methods. As for the references and sources of data, the researcher used scientific references closely related to the research subject, and obtained data from several sources including: Economic Affairs Sector of the Ministry of Agriculture and Land Reclamation; the Central Agency for Public Mobilization and Statistics; Food and Agriculture Organization of The United Nations (FAO); electronic Website of the United Nations (Comtrade); and some other relevant agencies.

Research Methodology

To achieve the research objectives the researcher estimated the following indicators: competitive price position; revealed comparative advantage; market penetration ratio; relative prices; Almost Ideal Demand Model; in addition to some economic indicators related to foreign trade. Each of the mentioned indicators has been estimated as described in what follows.

Competitive Price Position

It can be estimated by finding the relative price, i.e., Egypt's export prices relative to the export prices of countries competing Egypt in exporting a certain commodity to a certain market. If the obtained value is less than one, Egypt is said to have a comparative advantage in exporting this commodity.

Revealed Comparative Advantage (RCA)

Is an index obtained by dividing the relative advantage of the country's exports of a certain good (or a class of goods) in the country's total exports, over the relative advantage of the world exports of the same good/goods in the world total exports. RCA is calculated as follows:

$$\mathbf{RCA = X_{je}/X_{ae} \div X_{iw}/X_{aw}}$$

Where,

RCA= Revealed Comparative Advantage of the country's exports of a certain good to the world market,

$\mathbf{X_{je}}$ = Exports value of good j exported from Egypt to the world market,

$\mathbf{X_{ae}}$ = Value of total Egyptian agricultural exports to the world market,

$\mathbf{X_{iw}}$ = World exports value of good j,

$\mathbf{X_{aw}}$ = World total agricultural exports value.

RCA's value ranges between zero and infinity. A value of RCA higher than one indicates that the country has a revealed comparative advantage in exporting the crop. RCA index has been adjusted so that it can be used for comparison purposes. Adjusted RCA can be calculated as follows:

RCA= (RCA-1)/ (RCA+1)

It ranges between +1 and -1. A positive value means the country has a revealed comparative advantage in exporting the commodity, whilst a negative value indicates the opposite.

Market Share

Market share is a measure that expresses the percent exported of a certain good to a certain market relative to that specific market's total imports of the

given good from the world markets. Market share is calculated as follows:

$MSH_{ji} = (X_jC_i/M_CW_i) \times 100$

MSH_{ji} = Country j's market share of commodity i exports to a certain market,

X_jC_i = Country j's exports of commodity i to country c,

M_CW_i = Country c's total imports of commodity i from the world market.

Market Penetration Ratio

Market penetration is one of the most important measures of competitiveness, where it reflects the market performance of the given country. It measures the studied market's viability of absorbing imports from different countries and thus is considered an indicator of the existence or lack of a real market for a certain commodity in a certain country. It is a relative indicator expressed by the ratio between main importing countries' imports of a certain commodity and revealed consumption of that commodity. It is calculated as follows:

MPRjic = Mcij /(Qci + Mci - Xci)

MPR_{jic}= Market Penetration Ratio of country j's exports of commodity i to country c,

M_{cij} = country c's imports of commodity i from country j,

Q_{ci} = country c's production of commodity i,

M_{ci} = country c's total imports of commodity i,

Xci = country c's total exports of commodity i,

Market penetration ratio should range between zero and one. The higher the calculated value for a certain market is, the wider and easier to penetrate that market is, and vice versa.

Relative Prices

Relative prices are calculated by comparing the export prices of an Egyptian good with the export prices of the competing country's good inside the European Union market. It provides an important indicator export price's responsibility for Egyptian exports of the concerned good.

Demand Function For Egyptian Garlic

Almost Ideal Demand model differs from traditional models used for demand estimation in that it takes into consideration differences between the sources of goods. In addition, it imposes a special condition on demand functions regarding the sources of goods; explains changes in demand for the commodity; and clarifies the degree of competition between different sources. Moreover, it provides economic policy designers with estimates regarding the supply response for prices and expenditure on imports. The model helps getting rid of the aggregation bias, and the estimated expenditure function reflects the import behavior and pattern that separates the sources of import. Moreover, it helps identify the main factors affecting the sources of import, in addition to analyzing the competitive relationship between them. The model depends on the value of expenditure on the given commodity, i.e., commodity's share of total expenditure on the commodities instead of separately on each commodity.

This model, which has first been introduced by Deaton Mullbauer [6], is characterized by flexibility and ease of use. It is more applicable in economic studies, but when used, it is subject to the following two assumptions:

First Assumption: aggregation at the commodity level, in which case commodities are not classified according to the source of import. It is a possible assumption to assume in case the commodity prices change at the same rate, but is difficult to apply for the exports of agricultural products for various reasons, including differences in quality and custom tariffs; differences in procurement contracts; and differences in the conservation and transportation services for such products.

Second Assumption: the complete separation between goods according to the source of import, which contradicts logic. But due to the importance of differentiating between import sources in analyzing the demand for imports, some economic studies suggested using the following model, which differentiates between the sources of import without imposing the condition of full separation.

Assuming that the Expenditure Function of Utility U, which assumes differentiating between commodities according to sources, the model can be derived as follows:

$$\text{Ln } [E(P,U)]=(1-U) \text{ Ln } [a(P)]+U \text{ Ln } [b(P)] \quad (1)$$

$$\text{Ln } [a(P)]=\alpha_o+\sum \alpha_k \text{ Ln } P_k+1/2\sum_k\sum_j\gamma_{kj} \text{ Ln } P_k \text{ Ln } P_j \quad (2)$$

$$\text{Ln } [b(P)]= \text{Ln } [a(P)]+B_o\prod_k P_k^{B_k} \quad (3)$$

Solving equations (2) and (3) in equation (1), the Expenditure Function can be formed as follows:

$$\text{Ln } [E(P,U)]= \alpha_o+\sum \alpha_k \text{ Ln } P_k+1/2\sum_k\sum_j y_{kj} \text{ Ln } P_k \text{ Ln } P_{j+} B_o U\prod_k P_k^{B_k} \quad (4)$$

Differentiating Ln [E(P,U)] with respect to its own price Lnp_i, the following imported commodity's share of expenditure W_i is obtained:

$$\frac{\partial \text{Ln } [E(P,U)]}{\partial Lnp} = \frac{\frac{Piqi}{E(P,U}}{\frac{Piqi}{E(P,U}} = W_i \quad (5)$$

Therefore, equation (4) can be rewritten as follows:

$$W_i= \alpha_i +\sum_j y_{ij} \text{Ln}P_j +B_iU \alpha_o\prod_k P_k^{B_k} \quad (6)$$

Solving equation (4) with respect to utility (U), and substituting in equation (6), we obtain the following:

$$(\frac{E}{P\ index}) + B_i \ln = \alpha_i + \sum_j y_{ij} \ln P_j \quad W_i \quad (7)$$

Where,

$$\ln (P\ index) = \alpha i + + \sum k\ \alpha k \ln \quad Pk + 1/2 \sum k \sum jykj \ln Pk \ln Pj \quad (8)$$

(P_{index}) is considered non-linear, and is subject to estimation difficulties. Therefore, it has been substituted by the Stone Price Index as follows:

$$\ln(Pspi) = \sum i\ Wi\ \ln Pi \quad (9)$$

And due to the fact that W_i refers to the percent of expenditure, and in the same time represents the dependent variable in the equations, using this index number may cause some problems in the set of simultaneous equation, therefore, lag periods are used as follows:

$$\ln(Pspi) = \sum i\ W,i\ \ln Pi \quad (10)$$

Where,

$$W,I = \tfrac{1}{2} (Wit + Wit\text{-}i(\quad (11)$$

It should be noted that P_{index} can be considered a linear approximation of the index P_{spi} in case a high degree of multicollinearity exists between prices. Therefore, equation (7) becomes:

$$Wi = \alpha i + \sum j\ yij \ln Pj + Bi \ln(\frac{E}{Pspi}) \quad (12)$$

in the light of applying the demand conditions on equation (12), including:

- Adding-up:
- $O = Bi \sum j\ o, = \sum j\ yij = I, i\ \alpha i \sum$
- Homogeneity

$0 = \sum j\ yij$

- Symmetry
- $yij = yji$ for $i \neq j$

The importance of these conditions lies in that they insure the model's compliance to the theory of demand, where the adding-up condition guarantees that the sum of expenditures equals one; the homogeneity condition guarantees homogeneity of the demand functions; and finally the symmetry condition satisfies the Slutsky condition.

Where αand β are the function's parameters; P_i is the price of commodity from source I; a () , b () are functions in the parameters and prices; m is the number of exported commodity's sources; W_i is the imported commodity's share of expenditure; qi and pi are the quantity and prices of commodity from source i; E is the total expenditure on the commodity from all sources; P_{index} is the price index; and P_{spi} is the Stone Price Index.

Own, cross, and expenditure elasticities are obtained as follows:

- Own and cross elasticity is expressed in an (m x m) matrix:
- $) - B_i (W_{j/} W_i) \quad W_i / y_{ij}) + {}_{ij}\delta - =$ own cross ε
- Own price elasticity (diagonal elements):
- where i= j) ,1= ${}_{ij}\delta($
- Cross price elasticity (off diagonal elements):
- where i≠ j) ,o= ${}_{ij}\delta($
- Elasticity of expenditure:
- $(W_i / B_i = 1 + ({}_{expend}\varepsilon$

Verifying the obtained results are correct is done by measuring the commodity's share of expenditure using the relationship between the estimated elasticities of expenditure as follows:

$\sum_i W_{iexpend} = 1$

* In case the estimated price elasticity equals zero, the commodity is zero elastic; in case it is less than one, the commodity is inelastic; in case it equals one, the commodity is unitary elastic; in case it is larger than one, the commodity is elastic; and in case it is infinite, the commodity is infinitely elastic.

* In case the estimated cross elasticity is positive, the tow commodities are substitutes; and in case it is negative, the two commodities are complements.

* In case the expenditure elasticity is negative, then the commodity is inferior; and in case it is positive, the commodity is normal.

Autocorrelation has been tested for using Breusch Godfrey test; homogeneity of the error term has been tested for using Engel test; Jarque-Bera test has been applied to test whether the error term is normally distributed or not (in case insignificant, no errors of measurement in the equation). In order to estimate the model parameters in equation (12) simultaneously, Seemingly Unrelated Regression (SUR), a model developed by Zellner, has been applied to solve the system of simultaneous equations.

3. Results and Discussion

Production and Export Capacity of Egyptian Garlic

This part of the research reviews the trends in main economic variables related to production and export capacities of garlic crop over two periods: (2004-2008) and (2009-2013). It is clear from Tables (1) and(2) that average planted area of garlic amounted to 7193.6 and 24166 feddans for the two periods, respectively, and followed a statistically significant increasing trend, with a rate of change between the two study periods' averages estimated at 235.94%. In addition, average yield per feddan reached 9.42 and 9.77 tons for the two study periods, respectively, and followed a statistically significant increasing trend, with a rate of change between the two study periods' averages estimated at 3.71%. Average production of garlic reached 66696 and 235771.6 tons for the two study periods, respectively, and followed a statistically significant increasing

trend, with a rate of change between the two study periods' averages estimated at 253.5%.

Moreover, average quantity of garlic exports amounted to 3940.6 and 9109.2 tons for the two study periods, respectively. Garlic exports have been fluctuating over the two study periods, with a rate of change between the two study periods' averages estimated at 131.16%. The quantity of garlic exports proved statistically significant during the study period. Average value of garlic exports amounted to US$ 2146.2 and 8046.2 thousand per ton for the two study periods, respectively. Garlic exports value have been fluctuating over the two study periods, with a rate of change between the two study periods' averages estimated at 274.9%. The value of garlic exports over the study period proved statistically significant. Average export price of garlic amounted to US$ 0.51 and 1.05 thousand/ton for the two study periods, respectively. Garlic export price has been fluctuating over the two study periods, with a rate of change between the two study periods' averages estimated at 105.49%. Garlic export price over the study period proved statistically significant.

Table (1): Evolution of Some Economic Variables Regarding Egyptian Garlic Crop Over the Two Periods (2004-2008) and (2009-2013)

Year	Area* (Feddan)	Yield * (Ton/fed)	Total Production* (ton)	Exports Quantity (ton)	Exports Value (US$ 1000/ton)	Export Price (US$ 1000)	Percent of Exports to Total Production
2004	1970	9.45	18783	4242	2331	0.55	22.74
2005	1701	9.53	16207	1894	913	0.48	11.69
2006	1730	9.49	16425	2031	849	0.42	12.37
2007	2485	9.44	23457	4145	1861	0.45	17.67
2008	28082	9.21	258608	7361	4777	0.65	2.85
Average	**7193.6**	**9.42**	**66696**	**3940.6**	**2146.2**	**0.51**	**13.46**
2009	17450	10.01	174659	2865	4000	1.40	1.64
2010	23034	9.59	220902	2945	4247	1.44	1.33
2011	28916	9.51	275119	13242	10659	0.80	4.81
2012	29277	9.9	289749	13245	10661	0.80	4.57
2013	22153	9.86	218429	13249	10664	0.80	6.07
Average	**24166**	**9.77**	**235771.6**	**9109.2**	**8046.2**	**1.05**	**3.68**
*** Rate of Change**	**235.94**	**3.71**	**253.50**	**131.16**	**274.90**	**105.49**	**-72.64**

* Rate of Change: (2nd period's average - 1st period's average)/1st period's average x 100

Source: http://www.fao.org

- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Bulletin of Agricultural Economics, Different Issues.

Table (2): General Regression Equations for Some Economic Variables Regarding Egyptian Garlic Crop Over the Two Periods (2004-2013)

Variable	*Regression Equations*	R^2	F	*Annual Average*	*Rate of Change (%)*
Area (feddan)	$=3041+3403.8x\hat{Y}$ (0.62)(4.32)**	0.70	18.68	15679.8	21.71
Yield (ton/feddan)	$=9.34+0.05x\hat{Y}$ (63.21)(2.12)*	0.32	3.77	9.59	0.48
Total Production (ton)	$=32548+33414.9x\hat{Y}$ (0.73)(4.65)**	21.86	0.73	151233.8	22.09
Exports Quantity (ton)	$=415+1261.9x\hat{Y}$ (0.19)(3.55)**	0.61	12.60	6524.9	19.34
Exports Quantity (US$ 1000/ton)	$=1525.9+1204x\hat{Y}$ (-1.17)(5.74)**	0.80	33.04	5096.2	23.63
Export Price (US$ 1000)	$=0.44+0.06x\hat{Y}$ (1.92)(2.23)*	0.25	2.72	0.78	7.87

Where: $\hat{Y}$ is the estimated value of the economic variable under study; R^2= Coefficient of Determination; F= is the model's significance value; the value between parenthesis is the calculated t value; ** indicates "at 0.01 confidence level"; * indicates "at 0.05 confidence level".

Source: Calculated from Table (1)

Geographic Distribution of Egyptian Garlic Exports

Table (3) presents the geographic distribution of Egyptian garlic exports over the two study periods (2004-2008) and (2009-2013). Results indicate that about 52.18% and 42.68% of Egypt's total garlic exports went to the Italian market during the two

study periods, respectively, where average exported quantity amounted to 1653.5 and 1659.3 tons for the mentioned periods, respectively. Lebanon, France, Holland, and Spain followed Italy during the first study period, whilst the Russian Federation, Germany, Syria, and France followed Italy during the second study period. Quantities exported to the mentioned countries during the first study period amounted to 569.3, 398.1, 173.7, and 94, respectively, not exceeding altogether 38.9% of the average quantity exported to those countries. Quantities exported to the mentioned countries during the second study period amounted to 384.1, 337.4, 286.4, and 283.4, respectively, not exceeding altogether 33.22% of the average quantity exported to those countries. As for quantity exported to the rest of countries, it ranged between a maximum of 92.4 and 265.2 tons for Mauritius and the UK markets, and a minimum of 51.3 and 174.7 tons for the Russian Federation and Ireland during the two study periods, respectively. Data in the table indicate that average price per ton of garlic exported to Mauritius and Ireland, estimated at LE 1977.27 and 7487.69, is the highest received price over the two study periods, respectively. In addition, the lowest export price per ton over the two study periods, estimated at LE 773.90 and 691.49, has been recorded for Tunisia and the Russian Federation, respectively. It is therefore clear that the Italian market occupied the top rank in terms of Egyptian garlic imports volume over the two study periods, with stable imports over a full decade. In terms of price, Mauritius and Ireland recorded the highest prices over the two study periods, but imports by the two markets have not been stable. Italy and the UK recorded the second highest price after Ireland during the second study period, with stable imports over the past decade. Lebanon, Germany, USA, Switzerland, and France demonstrated full stability in terms of importing Egyptian garlic over the period 2004-2013.

Table (3): Geographic Distribution of Egyptian Garlic Exports Over the Two Study Periods (2004-2008) and (2009-2013)

Country	Number of Years	Quantity (ton)	%	Value (LE 1000)	Average Export Price
First Period's Average (2004-2008)					
Spain	2	94.0	2.97	73.9	786.17
Lebanon	5	569.3	17.97	503	883.54
Italy	5	1653.2	52.18	2298.1	1390.09
France	5	398.1	12.57	450.1	1130.62
Mauritius	1	92.4	2.92	182.7	1977.27
Germany	5	81.7	2.58	144.3	1766.22
Tunisia	2	54.4	1.72	42.1	773.90
UK	5	51.3	1.62	70.1	1366.47
The Netherlands	3	173.7	5.48	221.1	1272.88
Second Period's Average (2009-2013)					
Syria	4	286.4	7.37	268.5	937.50
Poland	1	235.6	6.06	682.5	2896.86
Germany	5	337.4	8.68	1038.6	3078.25
UK	5	265.2	6.82	1447.6	5458.52
The Netherlands	5	261.3	6.72	695.6	2662.07
Ireland	2	174.4	4.49	1308.1	7487.69
Italy	5	1659.3	42.68	2887.3	2945.40
Russian Federation	3	384.1	9.88	265.6	691.49
France	5	283.4	7.29	722.4	2549.05

Source: The Central Agency For Public Mobilization and Statistics, Info Bank.

Egyptian Garlic Penetration Rate In Main Importing Markets

It is clear from Table (4) that market penetration rates calculated for main importing markets recorded low values during the two study periods (2004-2008) and (2009-2013), indicating that Egyptian garlic has weak potentials for penetrating the markets of such countries, which in turn means that Egypt does not enjoy a competitive advantage in those markets. However, results indicate that market penetration rate has been relatively high in the markets of South Africa, Mauritius, and Lebanon during the first study period, where it reached 0.086, 0.074, and 0.051 for the mentioned countries, respectively; and in the markets of Ireland, South Africa, Cameron, and Italy during the second study period, where it reached 0.178, 0.045, 0.040, and 0.035 for the mentioned countries, respectively.

Table (4): Market Penetration Rate For Egyptian Garlic In Main Importing Counties During (2004-2008) and (2009-2013)

Country	Exports Quantity (ton)	Average Quantity of Imports (ton)	Average Exports Quantity (ton)	Average Production (ton)	Penetration Rate
First Period's Average (2004-2008)					
Spain	94.0	11035	56967	177742	0.001
Germany	81.7	13217	568	-	0.006
Italy	1653.2	24099	7558	31668	0.034
France	398.1	28550	15367	35683	0.008
Mauritius	92.4	1252	65	58	0.074
Holland	173.7	11535	16046	12003	0.023
Lebanon	569.3	3187	187	14504	0.051
South Africa	42	663	189	-	0.085
Second Period's Average (2009-2013)					
Germany	337.4	16075	1238	-	0.023
Ireland	174.7	987	19	-	0.178
Russian Fed.	384.1	41927	38	245704	0.001
Syria	286.4	3204	765	38943	0.007
Cameron	24	578	32	-	0.040
UK	265.2	15965	2426	-	0.020
Italy	1659.3	29327	9261	27778	0.035
France	283.4	27905	12949	24443	0.007
South Africa	38	987	192	-	0.045

Source: The Central Agency For Public Mobilization and Statistics, Info Bank.

Market Shares Of Egyptian Garlic In Main Importing Countries

This part aims to study the market shares of Egyptian garlic exports in order to identify the main foreign markets with high importing capacity, and to assess the ability such exported quantities can cover the demand by these markets, which helps raise the export potentials therein. Results presented in Table (5) indicate that the market share of countries importing Egyptian garlic amounted to 9.19 thousand tons representing 0.92% of their total imports capacity, estimated at 401.42 thousand tons during the first study period. Results also indicate Egypt has low market shares in the markets of heavy importing countries like Brazil, USA, France, UAE, Japan, Russian Federation, Italy, Saudi Arabia, Germany, Philippine, and Spain, where the estimated market share reached a maximum of 6.86% of Italy's imports capacity, estimated at 24.099 thousand tons, and a minimum of 0.002% of the Russian Federation's imports capacity, estimated at 21.032 thousand tons. Another result is that Egypt has a high market share in countries with low imports capacity, where the estimated market share reached a maximum of 46.15% and 45.48% of the total imports capacity of Tanzania-Zanzibar and Democratic Republic of the Congo, estimated at 16 and 31 tons, respectively. As for the second study period, results indicate that Egyptian garlic's market share in the markets of importing countries reached 10.49 thousand tons representing 2.45% of their total importing capacity, estimated at 428.799 thousand tons. Results also indicate that Egypt has low market shares in the markets of the previously mentioned heavy importing countries, in addition to Pakistan and Canada, where the estimate market share reached a maximum of 5.66% of Italy's imports capacity, estimated at 29.33 thousand tons, and a minimum of 0.9% of Canada's imports capacity, estimated at 12.76 thousand tons. Another result is that Egypt has a high market share in countries with low imports capacity, where the estimate market share reached a maximum of 17.7% and 8.94% of the total imports capacity of Ireland and Syria, estimated at 987 and 3204 tons, respectively. Based on such results, it is recommended to increase Egyptian garlic exports by 30% during the second period; reduce Egyptian garlic exports' share of the total imports capacity of Italy, Lebanon, France, Holland, and Spain; increase Egyptian garlic exports' share of the total imports capacity of the Russian Federation, Germany, and Syria; and entering the Irish market by 19% of its total imports capacity.

Competitive Price Position

Relative price is one of the main determinants influencing the competitive position of a country in the world markets; where countries seek to reduce the prices of their products to that level that enables them attract the highest possible number of different markets based on the fact that a crop's competitive advantage increases as its export prices decrease relative to the export prices of competing countries. Data in Table (6) indicates that Egypt enjoys a

relative price advantage over all competing countries on average during the first study period, except for Saudi Arabia and India. As for the second study period, results indicate that Egypt enjoys a relative price advantage over all competing countries on average, except for Saudi Arabia, India, and the UAE, which indicates that Egypt has been facing fierce competition from the three countries over the last decade, in addition to competition from Iran during the last five years.

Table (5): Market Share Of Egyptian Garlic Exports To Main Importing Markets During (2004-2008) and (2009-2013)

Country	First Period's Average (2004-2008)			Country	Second Period's Average (2009-2013)		
	Exports Quantity (ton)	Imports Quantity (ton)	Market Share		Exports Quantity (ton)	Imports Quantity (ton)	Market Share
Spain	94.0	11035	0.85	Spain	46.1	13372	0.34
Germany	81.7	132.17	0.62	Germany	337.4	16075	2.10
Ukraine	10	29	34.48	Ireland	174.7	987	17.70
Russian Federation	2	21032	0.01	Russian Federation	384.1	41927	0.92
Bahrain	2	1221	0.16	Algeria	24.5	8091	0.30
Brazil	24	88695	0.03	Syria	286.4	3204	8.94
Libya	46	75	61.33	Sudan	56.1	2007	2.80
Sudan	23	229	10.04	Cameroon	24	578	4.15
Philippines	29	12584	0.23	Saudi Arabia	2.1	28292	0.01
Saudi Arabia	24	17608	0.14	UK	265.2	15965	1.66
UK	52	8757	0.59	Norway	0.9	749	0.12
USA	28	37953	0.07	USA	12	68025	0.02
Japan	8	27404	0.03	Japan	4.1	27019	0.02
Italy	1653.2	24099	6.86	To whom	62	7735	0.80
UAE	3	29617	0.01	Greece	53.2	2276	2.34
France	398.1	28550	1.39	Italy	1659.3	29327	5.66
Country	3	1326	0.23	Pakistan	112.5	48946	0.23
Mauritius	92.4	1252	7.38	Poland	236.3	9014	2.62
Netherlands	173.7	11535	1.51	UAE	7.9	30425	0.03
Republic of Lebanon	569.3	3187	17.86	Romania	133.2	10279	1.30
Democratic Republic of the Congo	15	31	48.39	France	283.4	27905	1.02
Tanzania - Zanzibar	9	16	56.25	Netherlands	263.2	21201	1.24
Other countries	275.6	61972	0.44	South Africa	38	987	3.85
Total	3689	401424	0.92	Canada	0.9	12757	0.01
				New Zealand	1.6	1614	0.10
				Other countries	29.4	42	70.00
				Total	4498.5	428799	1.05

Source: The Central Agency For Public Mobilization and Statistics, Info Bank.
http://www.fao.org

Revealed Comparative Advantage (ACR)

Table (7) presents the values of the adjusted Revealed Comparative Advantage Index calculated for garlic exports from Egypt and main competing countries during the two study periods (2004-2008) and (2009-2013). It is clear that Egypt enjoyed an ACR during the two study periods, except for the last three years, as it declined to reach an average of 0.05 during the second period compared to 0.14 during the first period. It is also clear that the UAE, China, Argentina, and Spain enjoyed an ACR during the two study periods; whilst Chili and Mexico enjoyed having an ACR during the first study period only. However, France, Italy, USA, UK, and Saudi Arabia did not enjoy having any ACR in garlic exports as all the obtained ACR Index values have been negative. China obtained the highest value of ACR Index during the two study periods, followed by Argentina, Spain, UAE, and finally Egypt.

Estimating the Demand Function For Egyptian Garlic Exports To The Italian Market

Results of studying the geographic distribution of Egyptian garlic exports indicate that 52.18% and 12.68% of the total exported quantity went to the Italian market during the two study periods, respectively. It should be noted that France, Spain, and Holland are the main countries competing Egypt in this market.

Table (6): Competitive Price Position Of Egyptian Garlic Relative To Some Competing Countries During The Two Study Periods (2004-2008) and (2009-2013)

Country	**Average Export Price (US$ 1000/ton)**		**Relative Price Egypt/Competing Country**	
	(2004-2008)	**(2009-2013)**	**(2004-2008)**	**(2009-2013)**
Spain	1.4	1.9	0.29	0.32
Argentina	0.9	0.9	0.44	0.67
China	0.6	0.6	0.67	1.00
Philippines	0.9	0.8	0.44	0.75
Hungary	0.9	1.7	0.44	0.35
Mexico	2.2	1.3	0.18	0.46
Saudi Arabia	0.3	0.4	1.33	1.50
United kingdom	1.1	1.8	0.36	0.33
India	0.4	0.4	1.00	1.50
America	1.5	1.7	0.27	0.35
Italy	1.8	2.4	0.22	0.25
United Arab Emirates	0.7	0.5	0.57	1.20
Chilean	1.1	1.1	0.36	0.55
France	1.9	2.8	0.21	0.21
Egypt	0.4	0.6	1.00	1.00
Netherlands	1.1	1.9	0.36	0.32

Source: The Central Agency For Public Mobilization and Statistics, Info Bank.

Table (7): Adjusted Revealed Comparative Advantage Index For Garlic Exports During The Two Study Periods (2004-2008) and (2009-2013)

Year	The Netherlands	Egypt	France	Chilean	UAE	Italy	America	UK	Saudi Arabia	Mexico	China	Argentina	Spain
2004	-0.43	0.02	-0.28	0.58	0.82	-0.30	-0.67	-0.88	-0.67	0.64	0.76	0.73	0.60
2005	-0.42	0.26	-0.17	0.53	0.72	-0.24	-0.67	-0.76	-0.78	0.51	0.83	0.71	0.66
2006	-0.38	0.13	-0.15	0.42	0.19	-0.24	-0.70	-0.57	-0.88	0.55	0.86	0.66	0.61
2007	-0.63	0.07	-0.23	0.46	0.72	-0.22	-0.75	-0.82	-0.03	0.40	0.88	0.48	0.57
2008	-0.60	0.50	-0.28	0.41	0.57	-0.15	-0.79	-0.71	-0.24	0.00	0.89	0.55	0.53
Average	-0.42	0.14	-0.21	0.47	0.71	-0.23	-0.70	-0.75	-0.46	0.59	0.84	0.69	0.62
2009	-0.62	0.21	-0.30	0.17	0.19	-0.20	-0.81	-0.75	-0.23	-0.04	0.91	0.57	0.53
2010	-0.55	-0.29	-0.33	-0.07	0.25	-0.32	-0.82	-0.86	-0.50	-0.03	0.90	0.54	0.52
2011	-0.53	-0.36	-0.34	-0.29	0.04	-0.30	-0.86	-0.54	-0.75	-0.21	0.91	0.49	0.45
2012	-0.39	-0.10	-0.32	-0.55	0.26	-0.26	-0.87	-0.90	-0.73	-0.25	0.91	0.51	0.47
2013	-0.46	-0.23	-0.33	-0.42	0.15	-0.28	-0.87	-0.72	-0.74	-0.23	0.91	0.50	0.46
Average	-0.51	0.05	-0.32	-0.11	0.29	-0.26	-0.84	-0.75	-0.54	-0.12	0.91	0.52	0.49

Source: The Central Agency For Public Mobilization and Statistics, Info Bank.

Table (8) indicates lack of estimation problems that may negatively affect the model's efficiency (autocorrelation, non-homogeneity, non-normality). Results of testing the model for adding-up, homogeneity, and symmetry conditions proved statistically insignificant, thus the model is statistically significant. The estimated price elasticity of demand for Egyptian garlic indicates that 1% increase in its own price leads to 1.41% increase in quantity demanded by 1.41%, which contradicts the economic logic as it indicates a positive relationship between the price and quantity demanded. However, the estimated cross elasticities indicate that 1% increase in the prices of garlic exported by competing countries (France, Spain, and Holland), leads to reducing the quantity demanded from France and Holland by 2.14% and 0.87%, respectively, whilst a 1% increase in the price of Spanish garlic leads to increasing the demand for Egyptian garlic by 1.51%. The two results regarding the cross elasticity of French and Dutch garlic contradict the logic of economic theory; but the obtained result of the cross elasticity of Spanish garlic (which indicates that demand for Egyptian garlic increases as the price of Spanish garlic increases), matches the logic of economic theory. Such result can be explained by the real competition between Egyptian and Spanish garlic as both are produced in the same time, and belong to the same climatic Zone, i.e., the Mediterranean Sea Zone.

Table (8): Results of The Almost Ideal Demand Model Estimated For Egyptian Garlic Exports to The Italian Market During the Period(1998-2013)

Country	Egypt			France			Spain			Holland		
	Coeffi	t-stat	prob	Coeffi	t-stat	prob	Coeffi	t-stat	Prob	Coeffi	t-stat	prob
	-0.3.845	-0.96	0.34	1.084	2.71	0.01	-1.335	-3.34	0.00	1.635	4.08	0.00
Lnp2	0.132	2.77	0.01	-0.143	-3.20	0.00	0.336	7.30	0.00	-0.326	-6.87	0.00
Lnp3	-0.144	-4.92	0.00	0.024	0.69	0.49	0.074	2.50	0.01	0.045	1.2	0.20
Lnp4	0.078	1.46	0.15	0.079	1.60	0.11	-0.493	-8.8	0.00	0.337	6.08	0.00
Lnp5	-0.067	-0.83	0.41	0.040	0.51	0.61	0.079	0.99	0.32	-0.053	-6.66	0.51
$Ln(E/P_{spi})$	0.037	1.31	0.19	-0.063	-2.23	0.03	0.137	4.90	0.00	-0.111	-3.94	0.00
Adj.RSq	1.99			0.71			0.48			0.44		
Auto	0.69		0.38	0.70		0.36	0.02		4.67	0.25		1.54
Hetro	0.82		0.05	0.14		2.45	0.75		0.01	0.58		0.31
Non-Norm	1.80		0.40	1.16		0.56	0.10		0.95	5.39		0.06

- Adj.R-Sq: Adjusted Coefficient of Determination
- Auto: Lagrange Multiplier For Autocorrelation
- Hetro: Lagrange Multiplier For non-stability of the Variance
- Non-Norm: Lagrange Multiplier For non-normality of the error term

Source: Calculated from Table (1)

In addition, a 1% increase in Egyptian garlic's export price leads to changing its demand by -0.339%, 0.917%, and -0.943%, respectively, indicating the following: a complementary relationship between Egyptian and French garlic exports in case the export price of any of them increases; a complementary relationship between Egyptian and Dutch garlic exports in case Dutch and Egyptian export prices increase, respectively; and a substitution relationship between Egyptian and Spanish garlic exports, which matches the logic of economic theory. It was also found that the substitution relationship between Egyptian and

Spanish garlic exports is greater in case Spanish export prices increase than the substitution relationship in case Egyptian export prices increase. Moreover, the estimated elasticity of expenditure indicates that 1% increase in total real expenditure on garlic in the Italian market leads to 1.60% increase in expenditure on Egyptian garlic, indicating that Egyptian garlic is a normal good in the Italian market, as clear from Table (9).

Table (9): Elasticities Estimated For Egyptian Garlic Exports To The Italian Market Using Almost Ideal Demand Model

Country	Own and Cross Elasticity				Elasticity of Expenditure	W_i
	Egypt	France	Spain	Holland	ε_{expend}	
Egypt	1.41	-2.14	1.51	-0.87	1.60	6.08
France	-0.34	-0.58	0.67	0.49	0.71	21.97
Spain	0.92	0.45	-1.55	0.46	1.24	56.60
Holland	-0.94	1.48	3.38	-0.17	0.28	15.35
Verifying The Model's Statistical Significance					$\varepsilon_{expend} = 100 \sum_i W_i$	

Source: http://comtrade.un.org/db

Summary

In 2013, Egypt recorded the world fifth garlic producer after China, India, Korea, and Russia, with production quantity estimated at 218.48 thousand tons, of which 13.23 thousand tons worth US$10.66 million have been exported to global markets. Average vegetable planted area in Egypt amounted to 1969 thousand feddans representing 59.92% of the average area under horticultural crops, and 14.12% of the average agricultural planted area for the period 2004-2013. Garlic is one of the major promising export crops for Egypt. Average garlic planted area amounted to 15.68 thousand feddans representing about 0.79% of the total vegetable planted area in Egypt.

As for trade, it is noted that Egyptian garlic's position in foreign markets has been retreating, especially in the EU markets, the most important of which is the Italian market that is considered the main import market. The research aimed to identify the reasons for the diminishing exports of Egyptian garlic relative to domestic production during recent years by

estimating the appropriate economic and statistical indicators.

Studying the main markets importing Egyptian garlic indicated that Italian market occupied the top rank in terms of Egyptian garlic imports volume over the two study periods, with stable imports over a full decade. In terms of price, Mauritius and Ireland recorded the highest prices over the two study periods, but imports by the two markets have not been stable. Italy and the UK recorded the second highest price after Ireland during the second study period, with stable imports over the period 1998-2013. Lebanon, Germany, USA, Switzerland, and France demonstrated full stability in terms of importing Egyptian garlic over the period (2004-2013).

Results returned low values of market penetration rates for main importing markets during the two study periods, indicating that Egypt does not enjoy a competitive advantage in the markets of main importing countries. However, results indicated that market penetration rate has been relatively high in the markets of South Africa, Mauritius, and Lebanon during the first study period; and in the markets of Ireland, South Africa, Cameron, and Italy during the second study period.

Results obtained from studying the market shares of Egyptian garlic exported to main importing countries indicated the following: a 30% increase in Egyptian garlic exports during the second study period; low Egyptian garlic exports' share of the total import capacities of Italy, Lebanon, France, Holland, and Spain; and high Egyptian garlic exports' share of the total imports capacity of the Russian Federation, Germany, and Syria; and entering the Irish market by 19% of its total imports capacity. Studying the competitive price position indicated that Egypt has been facing fierce competition from Saudi Arabia, India, and the UAE during the past decade, in addition to Iran during the last five years. Elasticities obtained from estimating the demand function for Egyptian garlic exports to the Italian market indicated that 1% increase in Egyptian garlic export price leads to 1.41% increase in quantity demanded by 1.41%, which contradicts the economic logic as it indicates a positive relationship between the price and quantity demanded. However, the estimated cross elasticities indicated that 1% increase in the prices of garlic exported by competing countries (France, Spain, and Holland), leads to reducing the quantity demanded from France and Holland by 2.14% and 0.87%, respectively, whilst a 1% increase in the price of Spanish garlic leads to increasing demand for Egyptian garlic by 1.51%. The two results regarding the cross elasticity of French and Dutch garlic contradict the logic of economic theory; but the result regarding the cross elasticity of Spanish garlic (which indicated increasing the demand for Egyptian garlic as the price of Spanish garlic increases) matches the logic of economic theory. Such result can be explained by the real competition between Egyptian and Spanish garlic exports because both are produced in the same time, and belong to the same climatic Zone, i.e., the Mediterranean Sea Zone.

Moreover, it was found that 1% increase in Egyptian garlic's export price leads to changing its demand by -0.339%, 0.917%, and -0.943%, respectively, indicating the following: a complementary relationship between Egyptian and French garlic exports in case the price of any of them increases; a complementary relationship between Egyptian and Dutch garlic in case Dutch and Egyptian export prices increase, respectively; and a substitution relationship between Egyptian and Spanish garlic exports, which matches the logic of economic theory. It was also found that the substitution relationship between Egyptian and Spanish garlic exports is greater in case the price of Spanish export price increases than the substitution relationship in case Egyptian export price increases. Moreover, the estimated elasticity of expenditure indicated that 1% increase in the real total expenditure on garlic in the Italian market leads to 1.60% increase in expenditure on Egyptian garlic, indicating that Egyptian garlic is a normal good in the Italian market.

Based on the achieved results, the following recommendations are offered:

1. Facing export problems and challenges by establishing the systems and mechanisms required to incorporate international standards and Total Quality Systems in Egypt's production sector and ensuring their implementation.
2. Devoting more attention to the Italian market that absorbed 52.18% and 42.68% of Egypt's total garlic exports during the two study periods, respectively.
3. Linking scientific research activities to the export sectors, and improving the standards of the local filling & packing Industry to act as an integrated system, which is considered crucial for exports development, especially that competition in the European market mainly depends on quality.
4. Designing awareness programs for exporters, large farmers, and rural leaders in order to explain the Articles and Items of the Egyptian-European Partnership Agreement, and how it can be benefited from, in addition to publishing studies about the European markets for main Egyptian export commodities and the available opportunities of exports.
5. Devoting care for the product's quality, especially in the light of the direct relationship between export price and exports value, i.e., an

increase in export price leads to a growing increase on Egyptian product, in addition to reflecting the impact on improving the product's quality.

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Annex

Table (1): Quantity and Price of Italian Market Imports From Main Exporting Countries Over The Period (1998-2013) Export Price in US$/ton & Quantity in ton

year	***Egypt***		***France***		***Spain***		***Holland***	
	Import Quantity	***Import Price***	***Import Quantity***	***Import Price***	***Import Quantity***	***Import Price***	***Import Quantity***	***Import Price***
1998	958	976	26307	1502.3	2683.1	1539	2524.7	1091.5
1999	654	882	26583	1321.559	7636.4	997.9	1208.6	882.2
2000	1170	676	26018	1093.704	10283.7	862.3	1229	859.1
2001	1171	835	32178	1236.652	12393.5	1109.8	773.7	1119.1
2002	1642	1063	31659	1492.309	11285.9	1300.2	975.9	1471.5
2003	3536	1034	28525	1501.42	14591.1	1162.1	1149.8	1280.8
2004	1521	887	28234	1514.309	15016.8	1189.2	1832.7	1477.3
2005	1027	913	27498	1724.344	10458.9	1633.6	3262.4	1686.7
2006	1435	1097	29358	2010.287	11811.4	2099.1	2918.1	2086
2007	1245	1179	25899	2253.639	11100.9	2412.9	2288.4	2586.2
2008	1016	1247	22992	2381.133	8828.1	2312.5	2696.4	2424.7
2009	1210	1248	23338	2242.651	11821.3	2314.6	2698.5	2428.4
2010	1225	1249	23850	3308.637	11823.2	2316.9	2701.4	2582.2
2011	1230	1251	22358	3476.608	11834.1	2319.8	2711.3	2583.1
2012	1236	1250	23361	3327.769	11840.2	2320.8	2714.3	2584.2
2013	1240	1253	23367	3327.984	11842.1	2325.5	2716.5	2586.2

Source: http://comtrade.un.org/db

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