

## **Gravity Trade Models For the Egyptian Exports of Medical and Aromatic Plants: Case Study on Coriander and Cumin**

**Dr. Hadil Taher Mohamed Hassanain**

**Agric. Economic Department – Faculty of Agriculture – Zagazig Univ.**

### **Introduction**

Medical and aromatic plants represents an important position in the Egyptian economy, whereas they have a major role in achieving the objectives of agricultural policy in increase the Egyptian export capacity, meanwhile reducing the import counterpart as well as providing employment opportunities within the agriculture sector. These plants are not traditional crops as they are, in first class, export crops. They are in the third place after rice and cotton in exports list as their contributions in the Egyptian agricultural sector about 5.3%, 13.4% of the total value of agricultural, horticultural exports, respectively, which estimated with about 1794.3 and 661million pounds, respectively, in terms of the real prices as an average of the period( 1995 to 2009) (FAO). Medical and aromatic plants are the most important export crops for Egypt which is in the first place where the percentage of export to production as near of 90% of production is exported, as they have reached 50 thousand tons which bring economic gains estimated as 45 million dollars (Central Agency for Public Mobilization and Statistics) which is a low share if it is compared with the size of the global market for medical and aromatic plants, which exceeds70 billion dollars, as United States of America and European Union are of the biggest importers of the Egyptian medical and aromatic plants.

Cumin, coriander, are considered as important exports of medical and aromatic plants in terms of quantity and value, the value of each reached about 1.83, 2.19 thousand dollars respectively represent about 4.8%, 5.9% of the value of exports of medical and aromatic plants in 2013.

### **The Research Problem**

Despite Egypt has a comparative advantage in the production of medical and aromatic plants, the exporting system of these plants is facing many problems which are associated with the multiplicity of importing countries and differing in export prices for each of the importing states as well as the different circumstances in importing countries and the maximum import capacity in addition to the competition which these plants are faced in external markets and especially the crops of cumin and coriander and their impacts on the quantities export.

In addition , there are annual fluctuations in the productivity of these plants in , such fluctuations reflected on the limited export capacity, which is minimized to about 3% of the total value agricultural exports during the period (2006 - 2008) .In addition to this obvious fluctuation in the demand market for foreign medical and aromatic plants in Egypt.

### **The Research Objective:**

This study aimed to shed highlight on the competitive position of Egyptian exports of medical and aromatic plants for both (cumin and coriander) ,So it is necessary to study the following objectives:

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- Studying the most competitive countries to Egypt in exporting the medical and aromatic plants for cumin and coriander crops.
- Measuring the growth rate on exports of medical and aromatic plants crops under study.
- Studying the geographical distribution for Egyptian exports of medical and aromatic plants (crops under study).
- Identifying the most important factors affect the flow of medical and aromatic plants exports (crops under study) to the global market and measure the impact of these factors.

**Methodology and data sources:**

The research has depended on two of economic analysis methods, the descriptive and the quantitative, using the mathematical and statistical methods, such as the multi-regression analysis in estimating the general trends for the quantities evolution and the export prices of medical and aromatic plants. As well as this study is relied on Gravity trade models, based on the Ordinary least squares (OLS) to estimate the model equations in the form of individual equations to determine the factors affecting the trade flow between different regions and economic blocs, as well as using the Three stages least squares (3SLS) for estimating those models of the study in the form of the Simultaneous equation by applying statistical analysis program that is known Shazam software in estimating model parameters under study as Gravity trade model based on a theoretical basis and consistent with recent studies that seek to interpret the flow for both trade and goods.

It also takes into account the largest possible number of explanatory variables to the level of trade between the countries, as the model used to identify the fundamental factors affecting the Egyptian exports of crops under study in the most important foreign markets. In addition, the style of the individual equations for estimating the trade flow between the countries does not take into account the interaction effects for both the explanatory variables. Exogenous variables, and the variables that determine within the form Endogenous variables, so this method have a significant effect on the estimators for these variables , also on the accuracy and efficiency of the estimated parameters values, so it is used by the decision-makers to avoid this imbalance in appreciation.

The model can be characterized as follows:

$$F_{ij} = f(\text{GDP}_i, \text{PROD}_i, P_{ij}, R_{ti}, P_{cj})$$

Whereas:

$F_{ij}$  = Quantity of exports from Egypt (i) to the importing country (j).

$\text{GDP}_i$  = Per capita of gross domestic product in Egypt (i).

$\text{PROD}_i$  = Productivity of commodities under study in Egypt (i).

$P_{ij}$  = Export price of the commodity from Egypt (i) to the global market (j).

$R_{ti}$  = Exchange rate (i) of Egyptian pound against the American dollar.

$P_{cj}$  = export price of the commodity from the competitive country (c) to the global market (j).

The research has also depended on the published data on the international network of information for both the United Nations (UN) and the Food and Agriculture Organization (F.A.O) and the database of foreign trade of the Central Agency for Public Mobilization and Statistics as well as some of data and information that could be obtained from the international information network.

## Results

**Total Egyptian agricultural export value and the total exports value of Egyptian exports of medical and aromatic plants and their relative importance to the total value of Egyptian agricultural exports.**

**1- The evolution of total Egyptian agricultural export value.**  
The evolution of Egypt's total agricultural export value during the period (2000-2013) is shown in table (1), where its data is fluctuated during that period where the minimum value is 518 million \$ in 2000 and the maximum value is 5031 million dollars in 2011, and its average is about 2201.6 million dollars during that period, and the equation of time trend of the evolution of Egyptian agricultural exports is estimated during the same period which is described by equation (1) in table (2) and its cleared that it increased in a statistic significance direction that reached about 350.69 million dollars and equivalent about 15.93% during the studied period and the determination coefficient was about 0.815 meaning that about 81.5% of the changes in total value of Egyptian agricultural exports during the study period due to the variables that reflected the time coefficient.

**Table (1) The evolution of both Egyptian agricultural exports value and Egyptian exports value of medical and aromatic plants during the period (2000-2013).**

Year	Value of Egyptian agric. Exports (million \$)	value of medical and aromatic exports (million \$)	% of total value
2000	518.14	28.20	5.44%
2001	620.49	31.90	5.14%
2002	771.78	29.90	3.87%
2003	937.75	24.10	2.57%
2004	1314.30	24.60	1.87%
2005	1167.54	25.10	2.15%
2006	1086.38	29.90	2.75%
2007	1502.26	32.90	2.19%
2008	2115.48	31.70	1.50%
2009	4372.96	43.10	0.99%
2010	2845.93	36.30	1.28%
2011	5031.36	33.40	0.66%
2012	4056.93	36.50	0.90%
2013	4481.06	37.59	0.84%
Average	2201.60	31.80	2.30%

**Source:** Central Agency for Public Mobilization and Statistics, External Trade Bulletin, various issues.

**2-The evolution of total value of Egyptian exports of medical and aromatic plants.**

The data in Table (1) is showed the evolution of the total value of Egyptian exports of medical and aromatic plants during the period (2000-2013) which is found that they had taken in volatility during that period where the minimum value is about

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24.1 million \$ in 2003, and the maximum value is 43.1 million \$ in 2009 and its average about \$ 31.8 million during that time period, and the equation of time trend of the evolution of Egyptian exports value of medical and aromatic plants during the same period which is described by equation (2) in table (2) and its cleared that it increased in a statistic significance direction that reached about 0.89 million dollars and equivalent about 2.8% during the studied period and the determination coefficient was about 0.469 meaning that about 47% of the changes in the total value of Egyptian exports of medical and aromatic plants during the studied period due to the variables that reflected time coefficient.

**Table 2 Time trends equations of both Egyptian agricultural exports and Egyptian exports value of medical and aromatic plants during the period 2000-2013.**

Item	Equation	R Square	f	t-value	average	Yearly change rate	% of Yearly change rate
1.Value of Egyptian agricultural exports	$\hat{y} = -77.91 + 350.69x$	0.815	52.72	7.26	2201.597	350.69	15.93%
2.Value of Egyptian Medical and aromatic exports	$\hat{y} = 26.02 + 0.89x$	0.469	10.63	3.26	31.79929	0.89	2.80%

$\hat{y}$  = The estimated value of variable under study in the year (i).  
 $X_i$  = time variable where  $n = (1, 2, \dots, 14)$

**Source:** collected and calculated from data in table (1).

**The geographical distribution of Egyptian exports of coriander, cumin crops.**

**1-The geographical distribution of Egyptian exports of coriander crop.**  
 Data in table (3) showed the Geographical distribution of Egyptian exports of coriander to the most important importing countries of coriander crop during the period (2000-2012) showed that Libya was in the first rank as the largest importer of coriander during that period, as the value of Egyptian exports is about 4.42555 million dollars which represent 17.21 % of total Egyptian exports value of coriander during that period, Germany was in second rank, where Egyptian exports value of coriander is about 3.62636 million dollars which represent 14.1% of the total value of Egyptian exports of coriander during that period, then the Netherlands, Saudi Arabia, Tunisia were in third, fourth and fifth ranks respectively, where Egyptian exports value of coriander to them about 180.73 , 1796.36 and 1.24168 million dollars respectively, representing 7.16% , 6.99% and 4.83%, respectively of the total value of Egyptian exports of coriander during the same period.

**2-The geographical distribution of Egyptian exports of cumin crop.**  
 Data in table (3) showed the geographical distribution of Egyptian exports of cumin to the main importing countries of cumin during the period (2000-2012) which showed that the Morocco is the most importing countries of cumin during that period, as the Egyptian exports value is about 20517.29 thousand dollars, which represents 67.14 % of the total value of Egyptian exports of cumin during the same period, and Libya is in the second rank, and the value of Egyptian exports of cumin to it about 3423.14 thousand dollars, which is represented 11.2% of the total value of Egyptian exports of cumin during that period, then USA , Saudi Arabia and Mexico occupied the III, IV and V ranks where the value of Egyptian exports of cumin were 781.54 , 459.97 and 4251 thousand dollars, respectively, representing 2.56% , 1.51%

and 1.39% respectively of the total value of Egyptian exports of cumin during that period.

**Table (3) The geographical distribution of Egyptian exports crops for both coriander and cumin to the most important imported countries during the period (2000-2012) .**

Cumin			Coriander		
Country	Value (1000\$)	%	Country	Value (1000\$)	%
Morocco	20517.29	67.14	Libya	4425.55	17.21
Libya	3423.14	11.20	Germany	3626.36	14.10
USA	781.54	2.56	Netherlands	1840.73	7.16
Saudi Arabia	459.97	1.51	Saudi Arabia	1796.36	6.99
Mexico	425.41	1.39	Tunisia	1241.68	4.83
Israel	293.41	0.96	France	830.37	3.23
Canada	236.31	0.77	Italy	435.38	1.69
Others	4421.12	14.47	Other	11515.22	44.78
<b>total</b>	<b>30558.19</b>	<b>100</b>	<b>total</b>	<b>25711.65</b>	<b>100</b>

**Source:** Central Agency for Public Mobilization and Statistics, External Trade Bulletin, various issues.

**The current situation of Egyptian exports of coriander and cumin crops.** The Egyptian exports of coriander and cumin crops has been studied through the evolution of quantity and value exports as well as price export as they affected on exports of crops under study, during the period 1994-2013, In addition the estimation of the total arithmetic average and the total growth rate during the studied period, as the studied period were divided into two periods: the first (1994-2003) and the second (2004-2014) to follow the evolution of the previous variables, also the average and growth rate for each period have been estimated separately.

### **1-The coriander crop**

Data in Table (4) showed that the Egyptian quantity exported of coriander are fluctuated during the period of study between a minimum value which is about 0.860 thousand tons in 2008 and a maximum estimated at 3.7 thousand tons in 1994 and its average is 1.87 thousand tons and the growth rate decreased by 6.65%. In the first period (1994-2003), it is cleared that the average of Egyptian exports quantity of coriander for that period was about 2.340 thousand tons, and during the same period the annual growth rate decreased by 11.77%, while in the second period (2004-2013) it is shown that the average of the Egyptian exports of coriander for that period was about 1.4 thousand tons, and during the same period, the annual growth rate of Egyptian quantity exported of coriander has not changed in that period.

The Egyptian exports value of coriander have evident fluctuations between increases and decreases during the studied period, reached to a minimum value 0.77 thousand dollars in 2003 and a maximum value 3.34 thousand dollars in 2009 , as its total average is about 1.64 thousand dollars and the total growth rate increased by 0.45% during the studied period. In the first period (1994-2003) it is cleared that the average of Egyptian exports value of coriander for that period was about 1.33 thousand dollars, and during the same period the annual growth rate of the Egyptian exports value of coriander decreased about 9.14%, while in the second period ( 2004-

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2013) is illustrated that the average of Egyptian exports value of coriander for that period was about 1.95 thousand dollars, and during the same period the annual growth rate of the Egyptian exports value of coriander in that period increased about 7.75%.

As it can be seen from the study that the price per ton of coriander is oscillated between increasing and decreasing, reached the minimum price per ton 0.538 \$/ton in 2002, and the maximum price per ton is about 2.34 \$/ ton in 2013 and total average is estimated about 1.02 \$/ton and the total growth rate is by 7.6% increased during the studied period. In the first period (1994-2003) is illustrated that the average of price per ton of coriander is amounted to 0.58 dollars / ton, and during the same period the annual growth rate increased about 2.99%, while in the second period (2004-2013) , its illustrated that the average price per ton of Egyptian coriander exports is amounted to about \$ 1.45 / ton, and during the same period the annual growth increased by 8.1%.

**Table (4) : Quantity , value and prices of exports for both crops coriander and cumin during the period (1994-2013).**

Year	Coriander			Cumin		
	quantity (1000 ton)	value (1000\$)	price (ton/\$)	quantity (1000 ton)	value (1000\$)	price (ton/\$)
1994	3.70	2.00	0.540	0.08	0.06	0.83
1995	2.35	1.34	0.572	0.03	0.03	0.82
1996	2.51	1.36	0.543	0.07	0.04	0.53
1997	2.44	1.62	0.667	0.02	0.02	0.64
1998	2.32	1.34	0.575	0.13	0.10	0.75
1999	1.96	1.12	0.570	0.23	0.28	1.25
2000	3.20	1.72	0.537	1.11	1.64	1.47
2001	1.78	0.96	0.541	0.80	1.06	1.33
2002	2.07	1.12	0.538	0.43	0.80	1.86
2003	1.06	0.77	0.725	0.42	0.72	1.69
<b>average(1994-2003)</b>	<b>2.34</b>	<b>1.33</b>	<b>0.581</b>	<b>0.33</b>	<b>0.47</b>	<b>1.12</b>
<b>growth rate (1994-2003)</b>	<b>-11.77%</b>	<b>-9.14%</b>	<b>2.99%</b>	<b>18.79%</b>	<b>27.51%</b>	<b>7.34%</b>
2004	0.96	1.04	1.076	0.34	0.55	1.63
2005	1.01	0.84	0.839	0.23	0.38	1.66
2006	1.20	0.88	0.738	0.06	0.08	1.30
2007	1.76	1.51	0.856	0.35	0.68	1.92
2008	0.86	1.51	1.759	1.13	3.96	3.52
2009	1.56	3.34	2.137	2.06	5.63	2.73
2010	1.61	2.75	1.705	1.19	3.78	3.19
2011	1.34	2.79	2.091	1.64	4.80	2.94
2012	2.72	2.66	0.977	2.18	6.53	3.00
2013	0.94	2.19	2.338	0.53	1.83	3.44
<b>average(2004-2013)</b>	<b>1.40</b>	<b>1.95</b>	<b>1.45</b>	<b>0.97</b>	<b>2.82</b>	<b>2.53</b>
<b>growth rate (2004-2013)</b>	<b>0%</b>	<b>7.75%</b>	<b>8.07%</b>	<b>4.56%</b>	<b>12.71%</b>	<b>7.79%</b>
<b>Average</b>	<b>1.87</b>	<b>1.64</b>	<b>1.02</b>	<b>0.65</b>	<b>1.65</b>	<b>1.83</b>
<b>growth rate</b>	<b>-6.65%</b>	<b>0.45%</b>	<b>7.60%</b>	<b>10.22%</b>	<b>18.33%</b>	<b>7.36%</b>

**Source: The United Nations, Food and agriculture Organization (FAO),WWW.FAOSTAT.COM.**

## 2. The cumin crop

It can be seen from data in Table 4 that the quantity of Egyptian exports of cumin are fluctuated during the study period between a minimum value which is about 0.02 thousand tons in 1997 and a maximum value is estimated at 2.18 thousand tons in 2012 and its total average is 0.65 thousand tons and the total growth rate is increased approximately 10.22%. During the first period (1994-2003), it is cleared that the average quantity of Egyptian exports of cumin for that period was about 0.33

thousand tons, and during the same period the growth rate increased by 18.79%, while in the second period (2004-2013) it is shown that the average quantity of the Egyptian exports of cumin for that period was about 0.97 thousand tons, and during the same period, the annual growth rate of Egyptian exports of coriander increased by 4.56%.

The Egyptian exports value of coriander have evident fluctuations between increases and decreases during the studied period, reached to its minimum value 0.02 thousand dollars in 1997 and a maximum value is estimated 0.65 thousand dollars in 2012 , as its total average is about 1.65 thousand dollars and the total growth rate is increased by 18.33% during the studied period. In the first period (1994-2003) it is cleared that the average of Egyptian exports value of cumin for that period was about 0.47 thousand dollars, and during the same period the annual growth rate of the Egyptian exports value of cumin increased about 27.5%, while in the second period ( 2004-2013) is illustrated that the average of Egyptian exports value of cumin for that period was about 2.82 thousand dollars, and during the same period the annual growth rate of the Egyptian exports value of cumin in that period increased about 12.71%.

As it can be seen from the study that the price per ton of cumin is oscillated between increase and decrease, reached the minimum price per ton 0.53 \$/ton in 1996, and the maximum price per ton is about 3.52 \$/ ton in 2008 and the total average is estimated about 1.83 \$/ton and the total growth rate is increased by 7.36% during the studied period. In the first period (1994-2003) is illustrated that the average price per ton of cumin is 1.12 dollars / ton, and during the same period the annual growth rate increased about 7.34%, while in the second period (2004-2013) , its illustrated that the average price per ton of Egyptian cumin exports is amounted to about 2.53 \$ / ton, and during the same period the annual growth increased by 7.79%.

### **The external demand determinants for both Egyptian exports crops coriander and cumin during the period 1994-2013.**

The studying of external demand determinants on the agricultural crops are considered very important when making any policy for the exports development and to identify the reasons for the increasing or decreasing the volume of exports and to know the competition that faced those crops in the import markets , therefore the most important independent variables that impact on the quantity of Egyptian exports to the importing country by thousand tons (the dependent variable) have been identified, based on the principles of economic theory , the economic logic and the available data represented in :

$X_1$  = The Egyptian export price by dollars / ton.

$X_2$  = Per capita of gross domestic product in Egypt by thousand dollars.

$X_3$  = The exchange rate of Egyptian pound against the US dollar.

$X_4$ = The Indian exports price by (dollar/ ton), considering that India is the biggest exporters of studying crops all over the world.

$X_5$  = The Egyptian productivity of crops under study by tons / Fadden during the period (1994-2013).

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The study has used the multiple regression analysis (ordinary least square) and (3 stages least squares) on the logarithmic model to identify the most important determinants of foreign demand for Egyptian export of crops under study in the most important imported markets, where the study found the most suitable mathematical methods, which are consistent with the statistical and mathematical logic as shown as follows:

**The foreign demand equation of Egyptian coriander crop .**

**a. The Saudi Market**

It is shown from the equation No. 3 in Table 5 that there is a positive relationship between the quantity of Egyptian exports of coriander to Saudi Arabia and both of Egyptian export price of coriander and per capita of gross domestic product, while It is revealed an inverse relationship with the exchange rate of Egyptian pound , the Indian exports price , and the Egyptian productivity of coriander. In addition, the equation 3 is explained a significant relationship between the Egyptian quantity exported of coriander to Saudi Arabia and the following variables: Per capita of gross domestic product, the exchange rate and the Egyptian productivity of coriander at the 0.05 level. Also It is shown the significance of estimated mathematical model as the value of the F-ratio is significant and is amounted to 4.07. The value of determination coefficient is estimated and amounted to 0.593 ,which is indicated that 59.3 % of the variation in the quantity Egyptian exports of coriander to Saudi Arabia due to per capita of gross domestic product and the exchange rate.

**Table 5 : The statistical estimation by ordinary least squares (OLS) of the external demand equations for both crops coriander, and cumin to the most important imported markets during the period (1994-2013).**

Crop	Market	Equation
Coriander	Saudi Arabia	(3) $\ln y = 1.62 + 0.52 \ln x_1 + 3.34 \ln x_2 - 4.95 \ln x_3 - 0.81 \ln x_4 - 7.81 \ln x_5$ (0.66) (2.98) (-4.01) (-0.65) (-2.19) R Square = 0.593 F=4.074
	Germany	(4) $\ln y = 0.21 + 0.29 \ln x_1 + 0.99 \ln x_2 - 1.99 \ln x_3 - 1.02 \ln x_4 - 4.77 \ln x_5$ (1.1) (2.72) (-4.94) (-2.49) (-2.12) f=14.218 R Square = 0.835
Cumin	Saudi Arabia	(5) $\ln y = -0.32 - 0.07 \ln x_1 + 0.48 \ln x_2 - 1.88 \ln x_3 + 0.51 \ln x_4 + 0.28 \ln x_5$ (-0.17) (0.86) (-2.64) (0.57) (0.38) f = 3.379 R Square = 0.5468
	USA	(6) $\ln y = -1.67 + 0.45 \ln x_1 - 1.87 \ln x_2 - 0.79 \ln x_3 + 4.66 \ln x_4 + 0.86 \ln x_5$ (0.53) (-1.63) (-0.53) (2.58) (0.56) R Square = 0.5054 f = 2.861

**Source:** Collected and calculated from data Table 1 in appendix.

It can be seen from Table 6 the significant relationship between the Egyptian quantity exported of coriander to the Saudi market and both of per capita of gross domestic product and the exchange rate of the Egyptian pound against the dollar at a significant level 0.01. The value of determination coefficient was estimated at 0.5563, that is indicated that 55.63% of the change of the Egyptian quantity exported of coriander to the Saudi market due to per capita of gross domestic product and the exchange rate of the Egyptian pound.



The value of the income elasticity coefficient of per capita of gross domestic product is amounted to 0.89 that any increase in the average of per capita of gross domestic product about 1% resulted to increase the Egyptian exports quantity of coriander imported to the Saudi market at about 0.8%. As the value of the price elasticity coefficient of the Egyptian exports price is amounted to 0.05 so any increase in the Egyptian export price about 1% is resulted to increase the Egyptian exports quantity of coriander imported to the Saudi market at 0.04%.

**Table (6): The statistical estimation by the three stages least squares (3SLS) of the gravity trade model for the Egyptian quantity exported of coriander imported from Egypt to the Saudi market during the period (1994-2013).**

VARIABLES	COEFFICIENT	T-CALCULATED	ELASTICITY
Egyptian export price	0.536	0.658	0.046
Per capita of gross domestic product	3.222	2.709	0.899
Rate of exchange	-4.746	-3.696	-4.753
Indian export price	-0.891	-0.682	-0.168
Egyptian productivity	-7.296	-1.920	-0.484
R- square	0.5563		
Degree of freedom	14		

**Source:** Collected and calculated from data Table 1 in appendix.

While the value of the price elasticity coefficient for the Indian export price is amounted to -0.17, as the increase of the Indian export price about 1% consequent the decrease of the Egyptian exports quantity of coriander imported to the Saudi market about 0.17%. The value of the expenditure elasticity coefficient of the Egyptian productivity of coriander is amounted to -0.48 that the increase of the productivity about 1% consequent the decrease in the Egyptian quantity exported of coriander imported to the Saudi market at about 0.48%.

#### **b. The German market**

As it has seen from the equation No. 4 in Table 5 that there was a positive relationship between the Egyptian quantity exported of coriander imported to Germany, and both of the Egyptian export price and per capita of gross domestic product, while it is revealed an inverse relationship with the exchange rate, the Indian exports price and the Egyptian productivity of coriander, also the equation No. 4 was explained a significant relationship between the Egyptian exports quantity of coriander imported to Germany, and the following variables: Per capita of gross domestic product, the exchange rate, the Indian exports price and the Egyptian productivity of coriander at the level of significance 0.05. The equation 4 is also showed the significance of the estimated mathematical model where the value of the F-ratio is significance and amounted to 14.22. The determination coefficient is estimated at 0.835, which shows that 83.5% of the variation in the Egyptian exports quantity of coriander imported to Germany due to the change in: Per capita of gross domestic product, the exchange rate, The Indian export price and the Egyptian productivity of coriander.

It can be seen from Table 7 the significant relationship between the Egyptian quantity exported of coriander to the German market and the following variables: Per capita of gross domestic product, the exchange rate of the Egyptian pound against

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the American dollar , the Indian export price and the Egyptian productivity of coriander at a significant level 0.01. The value of determination coefficient was estimated at 0.843, that is indicated that 84.3% of the change of the Egyptian quantity exported of coriander to the German market due to per capita of gross domestic product , the exchange rate of the Egyptian pound against the American dollar , the Indian export price and the Egyptian productivity of coriander.

**Table (7):The statistical estimation by the three stages least squares (3SLS) of the gravity trade model for the Egyptian quantity exported of coriander imported from Egypt to the German market during the period (1994-2013).**

VARIABLES	COEFFICIENT	T-CALCULATED	ELASTICITY
Egyptian export price	0.318	1.277	0.029
Per capita of gross domestic product	1.033	2.838	0.309
Rate of exchange	-1.995	-5.080	-2.142
Indian export price	-1.086	-2.717	-0.219
Egyptian productivity	-4.947	-4.255	-0.352
R- square	0.8429		
Degree of freedom	14		

**Source:** Collected and calculated from data Table (1) in appendix.

The value of the income elasticity coefficient of per capita of gross domestic product is amounted to 0.31 that any increase in the average of per capita of gross domestic product about 1% resulted to increase the Egyptian quantity exported of coriander imported to the German market at about 0.31%. As the value of the price elasticity coefficient of the Egyptian exports price is amounted to 0.03 so any increase in the Egyptian export price about 1% is resulted to increase the Egyptian exports quantity of coriander imported to the German market at 0.03%.

While the value of the price elasticity coefficient for the Indian export price is amounted to -0.22 , as the increase of the Indian export price about 1% consequent the decrease of the Egyptian quantity exported of coriander imported to the German market about 0.22% . The value of the expenditure elasticity coefficient of the Egyptian productivity of coriander is amounted to - 0.35 that the increase of the productivity about 1 % Consequent the decrease in the Egyptian exports quantity of coriander imported to the German market at about 0.35%.

**1. The foreign demand equation of Egyptian cumin crop .**

**a. The Saudi Market**

It is shown from the equation No. 5 in Table 5 that there is a positive relationship between the quantity of Egyptian exports of cumin imported to Saudi Arabia and per capita of gross domestic product, the Indian exports price and the Egyptian productivity of cumin, while It is revealed an inverse relationship with the Egyptian export price of cumin and the exchange rate of Egyptian pound. In addition, the equation 5 is explained a significant relationship between the Egyptian quantity exported of cumin imported to Saudi Arabia and the exchange rate at the 0.05 level. Also It is shown the significance of estimated mathematical model as the value of the F-ratio is significant and amounted to 3.38. The value of determination

coefficient is estimated and amounted to 0.547, which is indicated that 54.7 % of the variation in the quantity Egyptian exports of cumin to Saudi Arabia due to the exchange rate.

It can be seen from Table 8 the significant relationship between the Egyptian quantity exported of cumin to the Saudi market and the exchange rate of the Egyptian pound against the dollar at a significant level 0.01. The value of determination coefficient was estimated at 0.5503, that is indicated that 55.03% of the change of the Egyptian exports quantity of cumin to the Saudi market due to the exchange rate of the Egyptian pound.

**Table (8): The statistical estimation by the three stages least squares (3SLS) of the gravity trade model for the Egyptian quantity exported of cumin imported from Egypt to the Saudi market during the period (1994-2013).**

VARIABLES	COEFFICIENT	T-CALCULATED	ELASTICITY
Egyptian export price	-0.064	-0.16	-0.009
Per capita of gross domestic product	0.525	0.926	0.067
Rate of exchange	-1.889	-2.677	-0.865
Indian export price	0.404	0.458	0.068
Egyptian productivity	0.269	0.368	0.052
R- square	0.5503		
Degree of freedom	14		

**Source:** Collected and calculated from data Table 1 in appendix.

The value of the income elasticity coefficient of per capita of gross domestic product is amounted to 0.07 that any increase in the average of per capita of gross domestic product about 1% resulted to increase the Egyptian quantity exported of cumin imported to the Saudi market at about 0.07%. As the value of the price elasticity coefficient of the Egyptian exports price is amounted to -0.01 so any increase in the Egyptian export price about 1% is resulted to decrease the Egyptian quantity exported of cumin imported to the Saudi market at 0.01%. While the value of the price elasticity coefficient for the Indian export price is amounted to 0.07, as the increase of the Indian export price about 1% consequent the increase of the Egyptian quantity exported of cumin imported to the Saudi market about 0.07%. The value of the expenditure elasticity coefficient of the Egyptian productivity of cumin is amounted to 0.05 that the increase of the productivity about 1% Consequent the increase in the Egyptian quantity exported of cumin imported to the Saudi market at about 0.05%.

#### **b. The American Market**

It is shown from the equation No. 6 in Table 5 that there is a positive relationship between Egyptian quantity exported of cumin imported to American market and both of the Indian exports price and the Egyptian productivity of cumin, while It is revealed an inverse relationship with per capita of gross domestic product and the exchange rate of Egyptian pound. In addition, the equation 6 is explained a significant relationship between the Egyptian quantity exported of cumin imported to American market and the Indian exports price at the 0.05 level. Also It is shown the significance of estimated mathematical model as the value of the F-ratio is

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significant and amounted to 2.86. The value of determination coefficient is estimated and amounted to 0.505, which is indicated that 50.5% of the variation in the Egyptian quantity exported of cumin to American market due to the Indian exports price.

It can be seen from Table 9 the significant relationship between the Egyptian quantity exported of cumin to the American market and the Indian export price at a significant level 0.01. The value of determination coefficient was estimated at 0.514, that is indicated that 51.4% of the change of the Egyptian quantity exported of cumin to the American market due to the Indian export price of cumin.

**Table (9): The statistical estimation by the three stages least squares (3SLS) of the gravity trade model for the Egyptian quantity exported of cumin imported from Egypt to the American market during the period (1994-2013).**

VARIABLES	COEFFICIENT	T-CALCULATED	ELASTICITY
Egyptian export price	0.439	0.54	-0.055
Per capita of gross domestic product	-1.979	-1.705	0.238
Rate of exchange	-0.728	-0.504	0.313
Indian export price	4.789	2.65	-0.752
Egyptian productivity	0.846	0.566	-0.152
R- square	0.5144		
Degree of freedom	14		

**Source:** Collected and calculated from data Table 1 in appendix.

The value of the income elasticity coefficient of per capita of gross domestic product is amounted to 0.24 that any increase in the average of per capita of gross domestic product about 1% resulted to increase the Egyptian quantity exported of cumin imported to the American market at about 0.24%. As the value of the price elasticity coefficient of the Egyptian exports price is amounted to -0.06 so any increase in the Egyptian export price about 1% is resulted to decrease the Egyptian quantity exported of cumin imported to the American market at 0.06%. While the value of the price elasticity coefficient for the Indian export price is amounted to -0.75, as the increase of the Indian export price about 1% consequent the decrease of the Egyptian quantity exported of cumin imported to the American market about 0.75%. The value of the expenditure elasticity coefficient of the Egyptian productivity of cumin is amounted to -0.15 that the increase of the productivity about 1% consequent the decrease in the Egyptian quantity exported of cumin imported to the American market at about 0.15%.

**Recommendations**

- 1- This study is relied on Gravity trade models, based on the Ordinary least squares (OLS) and three stages least squares (3 S.L.S) to estimate the parameters that impact on Egyptian quantity exported of coriander to the importing country represented in both Saudi Arabia and German markets as it has been identified the most important factors influencing the flow of Egyptian coriander in those markets, therefore the study found:

- It is explained a significant relationship between the Egyptian coriander exports to the Saudi market, and both of per capita of gross domestic product and the exchange rate of the Egyptian pound against the US dollar.
  - It is explained a significant relationship between the Egyptian coriander exports to the German market and the following variables : Per capita of gross domestic product, the exchange rate of the Egyptian pound against the US dollar , the Indian export price of coriander and the Egyptian productivity of coriander.
- 2- The study is estimated the parameters that impact on the Egyptian quantity exported of cumin to the importing country represented in both Saudi Arabia and American markets as it has been identified the most important factors influencing the flow of Egyptian cumin in those markets, therefore the study found:
- It is explained a significant relationship between the Egyptian exports of cumin to the Saudi market, and the exchange rate of the Egyptian pound against the US dollar.
  - It is explained a significant relationship between the Egyptian exports of cumin to the to the American market and the Indian export price of cumin.
- 3- Do more efforts to improve the export productivity and efficiency of medical and aromatic plants (crops under study), especially when making production and export plans, which prepares for the start of global markets competition to achieve the growth target achieved for those exports and increase their competitiveness.
- 4- The necessity of export expansion and exploit export opportunities under the new policy of the exchange rate.
- 5- The efficiency degree of marketing operations associated with the export of crops subject of the study can be Increased the interest as collection, sorting, packaging , shipping process, and supply the exporters with information about the external market demands in addition to modifying the technical specifications in line with the standard specifications for the expansion of exports of those crops.
- 6- Reconsidering the geographical distribution of the Egyptian agricultural exports, especially medical and aromatic plants and increased the interest of markets, which indicates an increase in demand while maintaining of the traditional markets.

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**Table 1: The external demand determinants for both Egyptian exported crops coriander and cumin during the period 1994-2013.**

year	Coriander							Cumin				
	Egyptian export quantity to Saudi ton	Egyptian export quantity to Germany ton	Egyptian export price \$/ton	Gross domestic product (\$)	Exchange rate (\$/pound)	Egyptian productivity (ton/Fadden)	Indian export price (\$/ton)	Egyptian export quantity to Saudi 1000ton	Egyptian export quantity to America 1000ton	Egyptian export price \$/ton	Egyptian productivity (ton/Fadden)	Indian export price (\$/ton)
1994	190.55	346.74	0.54	847.00	3.39	0.84	0.53	31.63	25.13	0.83	0.31	1.39
1995	295.12	316.23	0.57	963.60	3.39	0.90	0.58	53.71	19.95	0.82	0.54	1.33
1996	398.11	295.12	0.54	1063.40	3.39	0.94	0.69	75.88	66.07	0.53	0.47	1.52
1997	501.19	524.81	0.67	1211.30	3.39	0.84	0.75	58.88	12.88	0.64	0.38	1.33
1998	724.45	257.04	0.58	1286.80	3.39	0.95	0.52	37.25	1.12	0.75	0.45	1.34
1999	426.58	489.78	0.57	1351.60	3.40	0.94	0.51	72.44	7.95	1.25	0.48	1.39
2000	323.59	398.11	0.54	1461.00	3.47	0.94	0.62	29.55	75.86	1.47	0.49	1.80
2001	707.95	346.74	0.54	1402.80	3.97	0.94	0.69	38.99	25.81	1.33	0.46	1.94
2002	218.78	478.63	0.54	1238.90	4.50	0.76	0.59	57.59	50.12	1.86	0.48	1.59
2003	269.15	269.15	0.72	1147.80	5.85	0.76	0.73	10.49	14.13	1.69	0.50	1.45
2004	147.91	338.85	1.08	1071.30	6.20	0.79	0.55	16.28	13.81	1.63	0.53	1.49
2005	10.47	199.53	0.84	1196.70	5.78	0.90	0.59	21.39	19.49	1.66	0.53	1.56
2006	43.65	95.51	0.74	1409.20	5.73	0.91	0.73	15.51	25.12	1.30	0.75	1.57
2007	53.71	112.21	0.86	1681.30	5.64	0.90	0.88	46.77	70.79	1.92	0.64	2.29
2008	72.44	141.26	1.76	2061.60	5.43	0.96	1.29	38.91	63.11	3.52	0.58	2.30
2009	309.02	165.96	2.14	2349.30	5.54	0.97	0.99	30.19	54.95	2.73	0.61	2.14
2010	316.23	169.82	1.70	2668.00	5.62	0.98	1.20	31.63	57.54	3.19	0.60	2.17
2011	301.99	154.89	2.09	2816.70	5.93	0.99	1.05	29.51	42.66	2.94	0.61	2.90
2012	338.84	194.99	0.98	3068.20	6.06	0.99	0.84	34.68	60.26	3.00	0.62	2.45
2013	329.80	98.98	2.34	3104.20	6.87	0.98	1.33	38.00	48.00	3.44	0.64	2.24

Source: Food and agriculture Organization (FAO), The United Nations.

## نماذج الانسياب السلعي للصادرات المصرية من النباتات الطبية والعطرية :

### دراسة حالة علي محصولي الكسبرة والكمون

د/ هديل طاهر محمد حسنين

قسم الاقتصاد الزراعي - كلية الزراعة - جامعة الزقازيق

#### الملخص

تعد النباتات الطبية والعطرية من المحاصيل التصديرية غير التقليدية ذات الاهمية الاقتصادية الكبيرة والتي تتعقد عليها الامال في تنمية الصادرات الزراعية المصرية ، وتعتبر مصر من الدول ذات البيئة اللائمة لانتاج الكثير من النباتات الطبية والعطرية حيث تساهم تلك النباتات في القطاع الزراعي المصري بحوالي ٥,٣% و ١٣,٤% بالنسبة لقيمة الصادرات الزراعية والبستانية علي الترتيب واللاتي تقدران بحوالي ١٧٩٤,٣ و ٦٦١ مليون جنية علي التوالي وذلك خلال الفترة (١٩٩٥-٢٠٠٩) ، وتعتبر الولايات المتحدة الامريكية والاتحاد الاوروبي من اكبر مستوردي صادرات النباتات الطبية والعطرية المصرية.

وتعد محاصيل الكمون و الكسبرة من اهم النباتات الطبية والعطرية من حيث الكمية وقيمة صادراتها بالنسبة لقيمة الصادرات المصرية للنباتات الطبية والعطرية حيث بلغت قيمة كل منهما حوالي ٣٣,٧٨ و ٢٠,١ مليون جنية علي الترتيب بنسبة ٧,٣% و ٤,٣% من قيمة صادرات النباتات الطبية والعطرية في عام ٢٠٠٩. وعلى الرغم من ان مصر لديها ميزة نسبية في إنتاج النباتات الطبية والعطرية ، إلا انها تواجه العديد من المشاكل التي تتعلق بزيادة اعداد البلدان المستوردة والاختلاف في أسعار التصدير لكل من الدول المستوردة فضلا عن المنافسة التي تواجهها هذه المحاصيل في الأسواق الخارجية وخاصة محاصيل الكمون والكسبرة وتأثيرها على الكميات المصدرة بالإضافة إلى التقلبات السنوية في إنتاجية هذه النباتات والتي تنعكس على محدودية صادرات تلك المحاصيل حيث انخفضت إلى حوالي ٣% من مجمل قيمة الصادرات الزراعية خلال الفترة (٢٠٠٦-٢٠٠٨)، لذلك استهدفت الدراسة التركيز علي الوضع التنافسي للصادرات المصرية من النباتات الطبية والعطرية للمحاصيل موضوع الدراسة ( الكسبرة والكمون) وبالتالي تم دراسة الدول الأكثر تنافسية لمصر في تصدير الكمون والكزبرة ، وقياس معدل نموهم ، بالإضافة الي دراسة التوزيع الجغرافي وتحديد أهم العوامل التي تؤثر على تدفق صادراتهم إلى اهم الدول المستوردة لهما، لذلك اعتمدت الدراسة على نموذج انسياب وتدفق التجارة Gravity trade models باعتباره نموذج يرتكز علي أساس نظري واضح ويتفق مع الدراسات الحديثة التي تسعى إلي تفسير قيام التجارة وتدفقها وانسيابها ، كما أنه يأخذ في اعتباره أكبر عدد ممكن من المتغيرات المفسرة لمستوي التجارة بين الدول.

وتوصلت الدراسة ان كلا من السوق السعودي والسوق الالمانى من اهم الاسواق المستوردة لصادرات مصر من الكسبرة ، كما اوضحت ان كلا من متوسط نصيب الفرد من الناتج المحلي الاجمالي وسعر صرف الجنية المصري مقابل الدولار من اهم العوامل المؤثرة علي كمية صادرات الكسبرة المصري الي السوق السعودي ، بينما اوضحت ان من اهم العوامل المؤثرة علي كمية صادرات الكسبرة المصري الي

## ١٣٠١ Gravity Trade Models For the Egyptian Exports of Medical and Aromatic Plants: Case Study on Coriander and Cumin

السوق الالمانى هم متوسط نصيب الفرد من الناتج المحلى الاجمالي ، سعر صرف الجنيه المصرى ، وسعر تصدير دولة الهند من الكسبرة وإنتاجية مصر من الكسبرة. كما اوضحت الدراسة ان كلا من السوق السعودى والسوق الامريكى من اهم الاسواق المستوردة لصادرات مصر من الكمون وتوصلت الي ان سعر صرف الجنية المصرى مقابل الدولار من اهم العوامل المؤثرة علي كمية صادرات الكمون المصرى الي السوق السعودى ، بينما يؤثر سعر تصدير الهند من الكمون علي كمية صادرات الكمون المصرى الي السوق الامريكى.

لذا توصي الدراسة بضرورة بذل المزيد من الجهود لتحسين الإنتاجية التصديرية وكفاءة النباتات الطبية والعطرية للمحاصيل تحت الدراسة ، من خلال وضع خطط للإنتاج والتصدير من اجل منافسة الأسواق العالمية، وضرورة التوسع في الصادرات واستغلال فرص التصدير بموجب السياسة الجديدة لسعر الصرف ، بالإضافة الي إعادة النظر في التوزيع الجغرافي للصادرات الزراعية المصرية، وخاصة النباتات الطبية والعطرية وزيادة الاهتمام بالأسواق الجديدة مع الحفاظ على الأسواق التقليدية.