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استجابة عرض محصولي النعناع البلدي والبردقوش في مصر

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المستخلص

توضح نتائج التحليل الإحصائي لدالة استجابة عرض محصول النعناع البلدي بالأسعار الثابتة خلال فترة الدراسة (2008–2022) أن الصورة الخطية هي أفضل الصور من الناحية الاحصائية، حيث بزيادة السعر المزرعي لمحصول النعناع البلدي في العام السابق بمقدار جنيه للطن يؤدي ذلك إلى زيادة غير معنوية في مساحة النعناع البلدي في العام الحالي بمقدار 5.1 فدان، في حين بزيادة المساحة المزروعة من الكمون في العام السابق بمقدار فدان يؤدي ذلك إلى انخفاض معنوي في مساحة النعناع البلدي في العام الحالي بمقدار 0.22 فدان، في حين بزيادة السعر المزرعي للكمون بالأسعار الثابتة في العام السابق بمقدار جنيه للفدان يؤدي إلي انخفاض معنوي لمساحة النعناع البلدي في العام الحالي بمقدار 0.46 فدان، في حين بزيادة تكاليف إنتاج فدان الكمون بالأسعار الثابتة في العام السابق بمقدار جنيه للفدان يؤدي إلي زيادة معنوية لمساحة النعناع البلدي في العام الحالي بمقدار 1.8 فدان.

كما تبين من دالة استجابة عرض محصول البردقوش بالأسعار الثابتة بزيادة السعر المزرعي للبردقوش في العام السابق بمقدار جنيه للطن يؤدي ذلك إلى زيادة معنوية في محصول البردقوش في العام الحالي بمقدار 0.76 فدان، في حين بزيادة المساحة المزروعة من البردقوش في العام السابق بمقدار فدان يؤدي ذلك إلى زيادة معنوية في مساحة البردقوش في العام الحالي بمقدار 67.0 فدان.

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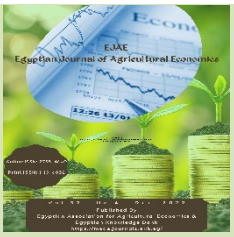

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Competitiveness Indicators of Egyptian potato and onion crops in their foreign markets

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ABSTRACT

The results of the statistical analysis of the mint supply response function at constant prices during the study period (2008-2022) show that the linear form is the best form from a statistical standpoint, as increasing the farm price of the mint crop in the previous year by one pound per ton leads to a non-significant increase in The area of local mint in the current year increased by 5.1 Feddans, while increasing the cultivated area of cumin in the previous year by an Feddan. This leads to a significant decrease in the area of local mint in the current year by 0.22 Feddans, while increasing the agricultural price of cumin at fixed prices in the previous year by an amount One pound per Feddan leads to a significant decrease in the area of local mint in the current year by 0.46 Feddans, while increasing the production costs of an Feddan of cumin at fixed prices in the previous year by one pound per Feddan leads to a significant increase in the area of local mint in the current year by 1.8 Feddans As shown by the response function of the marjoram crop supply at fixed prices, increasing the agricultural price of marjoram in the previous year by one pound per ton leads to a significant increase in the marjoram crop in the current year by 0.76 Feddans, while increasing the cultivated area of marjoram in the previous year by an Feddan leads to A significant increase in the area of marjoram in the current year by 0.67 Feddans.

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introduction:

Egyptian medicinal and aromatic plants occupy a distinguished position in the world, despite the small cultivated areas compared to other traditional agricultural crops and varieties. This calls for the need to raise awareness of their importance and their rewarding economic returns, to encourage their expansion, especially since the Ministry of Agriculture aims to expand the areas cultivated with medicinal and aromatic plants To reach 250 thousand Feddans by 2030, as these crops are exported to many countries such as “Italy - Spain - America - Australia - the United Kingdom - Germany - France”, which are used in many industries, including the production and extraction of pharmaceutical compounds to treat various diseases.

The supply response of producers to reduce or increase the cultivated area depends on their price expectations, as it has an impact on the cultivated area, and the expected prices do not depend only on the prices of the previous year but on a series of previous years, and also include the yield of the crop and crops competing for the same The agricultural area in the same cultivated area, as well as the costs of the crop and competing crops and their prices, and that these factors directly affect the decisions of producers to reduce or increase the cultivated area of the main crop or competing crops, and this is reflected in the production of the crop. The study focuses on the crops of mint (green) and marjoram during the period (2008-2022).

Research problem:

Medicinal and aromatic plants have not received appropriate attention despite the increase in global demand for safe food and medicine, as the medicinal and aromatic plant production sector still suffers from fluctuation in production and its growth at low rates that do not achieve the desired goals, which has been reflected in exports. As a result of the effect of the area cultivated of medicinal and aromatic plants on the farm prices of the previous year, in addition to other variables such as the area planted with the crop in the previous year, the net per-Feddan yield, the

costs per Feddan, the farm price, or competing crops, a change may occur in the farmer's decisions and he may or may not convert to cultivating another crop. Which affects the crop structure, leading to changes in the amount of medicinal plants available locally and for export. Therefore, the response to the production behavior of the local mint and marjoram crops must be studied.

Search goal:

The research aims to identify the most important factors that can affect the cultivated areas of mint and marjoram crops, determine the response to these variables, and identify the most influential factors that are supposed to affect the cultivated area of these two crops, which allows understanding production behavior, developing correct agricultural policies, and making appropriate decisions, in addition to the possibility of Directing agricultural productive resources to achieve increased returns for the farmer.

Research method and data sources:

The research relied on descriptive and quantitative analysis methods in describing and analyzing the topics it included, and used some different statistical tools, including estimating percentages, averages, relative importance, and analyzing general trend and multiple regression models by applying the supply response function method, using current and fixed prices. This is due to the difference in the monetary value of the pound. Especially in recent years.

The study also relied on secondary data sources: represented in secondary data published from various sources such as the Economic Affairs Sector - the Central Administration for Agricultural Economics - the Ministry of Agriculture and Land Reclamation - the agricultural departments affiliated with the Ministry of Agriculture - the Central Agency for Public Mobilization and Statistics.

Analysis results:

1- Local mint crop (green):

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1-1- Development of the cultivated area of the local mint crop (green):

It is clear from Table (1) that the cultivated area of the local mint crop (green) reached a minimum of 1,308 Feddans in 2008, and a maximum of 5,873 Feddans in 2017, with an average of about 2,675 Feddans during the study period (2007-2022). By studying the general time trend equation in Table (2), it was found that the Linear Form is the best picture from a statistical standpoint, as it was shown that the cultivated area of the local mint crop (green) increased by a statistically significant amount, amounting to about 149.5 Feddans annually, which represents 5.6% of the average period of the study. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 36% of the changes occurring in the cultivated area of the local mint crop (green) are due to independent variables whose effect reflects the time element.

2-1- The development of production costs, the net return per Feddan, and farm-gate price of the local mint crop (green) at current prices:

A- Development of production costs per Feddan at current prices:

It is clear from Table (1) that tthe costs of production an Feddan at current prices for the local mint crop (green) reached a minimum of 3,230 pounds/Feddan in 2007, and a maximum of 13,110 pounds/Feddan in 2021, with an average of about 6,454 pounds/Feddan during the study period (2007-2021). . By studying the general time trend equation in Table (2), it was found that the linear form is the best form from a statistical standpoint, as it was shown that tthe costs of production an Feddan at current prices for the local mint crop (green) increase by a statistically significant amount, amounting to about 729.2 pounds/Feddan annually, which represents 11.3% of the average. The study period. The significance was

Table (1): Development of production costs, net return per Feddan, and farm price in pounds for the local mint crop (green) at current and real prices in Egypt during the period (2007-2021).

Year	Price index*	Area in Feddans	Current prices			Real prices		
			Costs	Net Return	Farm Price	Costs	Net Return	Farm Price
2007	67.97	1382	3230	2578	287	4752	3793	422
2008	80.42	1308	3477	5868	419	4324	7297	521
2009	89.88	1977	3576	7230	515	3979	8044	573
2010	100.00	1990	3472	8747	593	3472	8747	593
2011	110.06	1743	3939	10298	714	3579	9357	649
2012	117.89	1844	4286	9572	745	3636	8119	632
2013	129.06	1455	4366	8587	759	3383	6653	588
2014	142.05	3615	4084	4580	777	2875	3224	547
2015	156.78	3733	5091	6197	785	3247	3953	501
2016	178.44	3389	6789	5072	790	3805	2842	443
2017	231.09	5834	8317	5061	800	3599	2190	346
2018	264.38	2156	9739	4068	814	3684	1539	308
2019	288.57	3066	11012	7877	827	3816	2730	287
2020	303.13	2749	12320	8389	847	4064	2767	279
2021	318.94	2961	13110	6052	874	4110	1898	274
2022	-----	3599	----------					
Average	**152.43	**2675**	**6454**	**6678**	**703**	**3755**	**4877**	**464**

*Base year 2010 (World Bank). ** Geometric mean.
Source: Ministry of Agriculture and Land Reclamation, Central Administration of Agricultural Economics, Agricultural Economics Bulletin, various issues.

proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 85% of the changes occurring in production costs per

Feddan at current prices for the local mint crop (green) are due to independent variables whose effect reflects the time element.

B- The development of the net return per Feddan at current prices:

It is clear from Table (1) that the net return per Feddan at current prices for the local mint crop (green) reached a minimum of 2578 pounds/Feddan in 2007, and a maximum of 10,298 pounds/Feddan in 2011, with an average of about 6678 pounds/Feddan during the study period (2007-2021). . By studying the general time trend equation in Table (2), it was found that the cubic form is the best form from a statistical standpoint, as it was shown that the net return per Feddan at current prices for the local mint crop (green) increases at the beginning of the period until the highest net return per Feddan was reached in 2011, with an estimated value of about 10,298. pounds/Feddan, then it began to decrease until it reached the lowest net return per Feddan in 2018, estimated at about 4068 pounds/Feddan. Then the net return per Feddan began to increase by a statistically significant amount, amounting to about 151.2 pounds/Feddan annually, representing 8.2% of the average period (2019-2021).) amounting to about 7439.3 pounds/Feddan. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 60% of the changes occurring in the net return per Feddan at current prices for the local mint crop (green) are due to the independent variables whose effect reflects the time element.

C- Development of agricultural prices at current prices:

It is clear from Table (1) that farm-gate price at current prices for the local mint crop (green) reached a minimum of about 284 pounds/ton in 2007, and a maximum of about 874 pounds/ton in 2021, with an average of about 703 pounds/ton during the study period (2007-2021). By studying the general time trend equation in Table (2), it was found that the Linear Form is the best Form from a statistical standpoint, as it was shown that farm-gate price at current prices for the local mint crop (green)

increases by a statistically significant amount of about 33.9 pounds/ton, which represents about 4.8% of the average period. the study. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 78% of the changes occurring in farm-gate price at current prices of the local mint crop (green) are due to independent variables whose effect reflects the time element.

Table (2): General trend equations for the development of production costs, net return per Feddan, and farm price in pounds for the local mint crop (green) at current and real prices in Egypt during the period (2007-2021).

variable	The equation	R^2	F	% annual change
Cultivated area	$\hat{Y}_i = 1404.05 + 149.5\ X_i$ (2.7)** (2.78)**	0.36	7.7	5.6
Current prices				
Production costs	$\hat{Y}_i = 644.4 + 729.2\ X_i$ (0.85) (8.7)**	0.85	75.3	11.3
net return	$\hat{Y}_i = -929.9 + 4523.9\ X_i$ (-0.43) (4.1)** $- 638.2\ X_i^2 + 25.2\ X_i^3$ (-3.98)** (3.8)**	0.60	5.5	—
Farm price	$\hat{Y}_i = 431.8 + 33.9\ X_i$ (9.5)** (6.8)**	0.78	45.97	4.8
Real prices				
Production costs	$\hat{Y}_i = 4965 - 389.7\ X_i + 23.1\ X_i^2$ (24.8)** (-6.8)** (6.6)**	0.76	22.9	—
net return	$\hat{Y}_i = 8608.4 - 466.4\ X_i$ (8.2) (-4.02)**	0.55	16.2	-9.6
Farm price	$\hat{Y}_i = 6478 - 22.97\ X_i$ (12.8)** (-4.14)**	0.57	17.2	-4.9

Where: $\hat{Y}i$: the estimated value of the variable.
Xi: time variable for the time period (2007-2022), where i = (1,2,3,...,15).
The value in parentheses indicates the calculated (T) value, (R2) the coefficient of determination, (F) the significance of the model, (**) indicates the significance of the regression coefficients at a significance level (0.01). **Source:** Calculated from Table (1) of the study.

D- Statistical characterization of the linear model of the response of the supply of local mint (green) at current prices:

$$Yi1T = \beta 0 + \beta 1\ Yi1\ T\text{-}1 + \beta 2\ Pi1\ T\text{-}1 + \beta 3\ Ci1\ T\text{-}1 + \beta 4\ Ri1\ T\text{-}1 + \beta 5\ Yi2\ T\text{-}1$$

+ β6 Pi2 T-1 + β7 Ci2 T-1 + β8 Ri2 T-1

Y_{i1T}: Mint crop area (green) in Feddans in year T.

$Y_{i1\ T-1}$: Mint crop area (green) in Feddans in year T-1.

$P_{i1\ T-1}$: The price of a ton of local mint (green) in pounds per year T-1.

$C_{i1\ T-1}$: Production costs of an Feddan of local mint (green) in pounds per year T-1.

$R_{i1\ T-1}$: Net return on Feddans of local mint (green) in pounds in year T-1.

$P_{i2\ T-1}$: Price per ton of cumin (competing crop) in pounds in year T-1.

$C_{i2\ T-1}$: Production costs of an Feddan of cumin (the competing crop) in pounds in year T-1.

$R_{i2\ T-1}$: The net return of an Feddan of cumin (the competing crop) in pounds per year T-1.

Through the use of both the Stepwise Regression method and the correlation matrix between the independent variables under study to avoid the problem of multicollinearity, many attempts were made to determine the most important statistical models specific to the response function of the supply of local mint crop (green) at current prices, and the estimation results were as follows:

$\hat{Y}_{i1T}$ = .32656 + 3.26	$P_{i1\ T-1}$ – 0.28	$Y_{i2\ T-1}$ – 0.32	$P_{i2\ T-1}$ + 0.90	$C_{i2\ T-1}$
(3.2)**	(2.4)*	(-2.7)**	(-4.7)**	(4.5)**
R^2 = 0.80	$\bar{R}^2$ = 0.72		F = 9.8	

The results of the statistical analysis of the supply response function of the local mint crop (green) at current prices during the study period (2008-2022) show that the Linear Form is the best Form from a statistical standpoint, as farm-gate price of the local mint crop (green) increased in the previous year Pi1 T-1 By one pound per ton, this leads to a significant increase in the area of the local mint crop (green) in the current year, Yi1T, by 3.26 Feddans, while increasing the cultivated area of the cumin crop in the previous year, Yi2 T-1, by an Feddan, this leads to a significant decrease in the area of the local mint crop. (green) in the current year, Yi1T, by 0.28

Feddans, while increasing farm-gate price of the cumin crop at current prices in the previous year, Pi1 T-1, by one pound per Feddan, leads to a significant decrease in the area of the local mint crop (green) in the current year, Yi1T, by 0.32 Feddans, while Increasing tthe costs of production an Feddan of cumin crop at current prices in the previous year, Ci2 T-1, by one pound per Feddan, leads to a significant increase in the area of the local mint crop (green) in the current year, Yi1T, by 0.90 Feddans. The adjusted coefficient of determination was 0.72, meaning that 72% of the changes occurring in the area of the local mint crop (green) in the current year are due to the aforementioned independent variables. The significance of the model as a whole was proven at the 1% level, which means that the model used fits the nature of the data.

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3-1- Development of production costs, net return per Feddan, and agricultural price of the local mint crop (green) at fixed (real) prices:

A- The development of production costs per Feddan at fixed (real) prices:

It is clear from Table (1) that the production costs per Feddan at fixed (real) prices for the local mint crop (green) reached a minimum of 2875 pounds/Feddan in 2014, and a maximum of 4752 pounds/Feddan in 2007, with an average of about 3755 pounds/Feddan during the study period (2007). -2021). By studying the general time trend equation in Table (2), it was found that the quadratic image is the best form from a statistical standpoint, as it was shown that tthe costs of production an Feddan at fixed (real) prices for the local mint crop (green) began to decrease at the beginning of the period until the lowest cost reached in 2014 by an estimated About 4752 pounds/Feddan, then it increased by a statistically significant amount, amounting to about 26.2 pounds/Feddan annually, representing 0.70% of the average for the period (2015-2021), which amounted to about 3761 pounds/Feddan. The significance was proven at the level of 0.01, as was the significance of the model as

a whole. The results also showed that about 76% of the changes occurring in production costs per Feddan at fixed (real) prices for the local mint crop (green) are due to independent variables whose effect reflects the time element.

B- The development of the net return per Feddan at constant (real) prices:

It is clear from Table (1) that the net return per Feddan at fixed (real) prices for the local mint crop (green) reached a minimum of 1539 pounds/Feddan in 2018, and a maximum of 9357 pounds/Feddan in 2011, with an average of about 4877 pounds/Feddan during the study period (2007). -2021). By studying the general time trend equation in Table (2), it was found that the linear form is the best form from a statistical standpoint, as it was shown that the net return per Feddan at constant (real) prices for the local mint crop (green) decreases by a statistically significant amount of about 466.4 pounds/Feddan annually, representing 9.6 pounds. % of the average study period. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 55% of the changes occurring in the net return per Feddan at constant (real) prices for the local mint crop (green) are due to the independent variables whose effect reflects the time element.

C- The development of farm-gate price in fixed (real) prices:

It is clear from Table (1) that the farm price at fixed (real) prices for the local mint crop (green) reached a minimum of about 274 pounds/ton in 2021, and a maximum of about 649 pounds/ton in 2011, with an average of about 464 pounds/ton during the study period (2007-2021). By studying the general time trend equation in Table (2), it was found that the Linear Form is the best Form from a statistical standpoint, as it was shown that farm-gate price at constant (real) prices for the local mint crop (green) decreases by a statistically significant amount of about 22.97 pounds/ton, which represents about 4.9%. Of the average study period. The significance was proven at the level of 0.01, as was the significance of the model as

a whole. The results also showed that about 57% of the changes occurring in farm-gate price at constant (real) prices of the local mint crop (green) are due to independent variables whose effect reflects the time element.

D- Statistical characterization of the linear model of the response of the supply of local mint (green) at constant (real) prices:

$$Yi1T = \beta0 + \beta1\ Yi1\ T\text{-}1 + \beta2\ Pi1\ T\text{-}1 + \beta3\ Ci1\ T\text{-}1 + \beta4\ Ri1\ T\text{-}1 + \beta5\ Yi2\ T\text{-}1 + \beta6\ Pi2\ T\text{-}1 + \beta7\ Ci2\ T\text{-}1 + \beta8\ Ri2\ T\text{-}1$$

Y_{i1T}: Mint crop area (green) in Feddans in year T.

$Y_{i1\ T-1}$: Mint crop area (green) in Feddans in year T-1.

$P_{i1\ T-1}$: The price of a ton of local mint (green) in pounds per year T-1.

$C_{i1\ T-1}$: Production costs of an Feddan of local mint (green) in pounds per year T-1.

$R_{i1\ T-1}$: Net return on Feddans of local mint (green) in pounds in year T-1.

$P_{i2\ T-1}$: Price per ton of cumin (competing crop) in pounds in year T-1.

$C_{i2\ T-1}$: Production costs of an Feddan of cumin (the competing crop) in pounds in year T-1.

$R_{i2\ T-1}$: The net return on Feddans of cumin (the competing crop) in pounds in year T-1.

Through the use of both the stepwise regression method and the correlation matrix between the independent variables under study to avoid the problem of multicollinearity, many attempts were made to determine the most important statistical models specific to the response function of the supply of the local mint crop (green) at constant (real) prices, and the estimation results were as follows: follows:

$\hat{Y}_{i1T} = 1608.5 + 5.1\ P_{i1\ T-1} - 0.22\ Y_{i2\ T-1} - 0.46\ P_{i2\ T-1} + 1.8\ C_{i2\ T-1}$				
(0.36)	(1.2)	(-2.2)*	(-5.1)**	(1.8)*
$R^2 = 0.78$		$\bar{R}^2 = 0.69$		F = 8.9

The results of the statistical analysis of the supply response function of the local mint crop (green) at constant (real) prices during the study period (2008-2022) show that the Linear Form is the best Form from a statistical standpoint, as farm-gate price of the local mint crop (green) increased in the previous year Pi1 T-1 by one pound per ton. This leads to a non-significant increase in the area of the mint crop (green) in the current year, Yi1T, by 5.1 Feddans, while increasing the cultivated area of the cumin crop in the previous year, Yi2 T-1, by an Feddan, this leads to a significant decrease in The area of the mint crop (green) in the current year is Yi1T by 0.22 Feddans, while increasing the farm price of the cumin crop at fixed (real) prices in the previous year Pi1 T-1 by one pound per Feddan leads to a significant decrease in the area of the mint crop (green) in the current year. Yi1T by 0.46 Feddans, while increasing tthe costs of production an Feddan of cumin crop at constant (real) prices in the previous year, Ci2 T-1, by one pound per Feddan leads to a significant increase in the area of the local mint crop (green) in the current year, Yi1T, by 1.8 Feddans. The adjusted coefficient of determination was 0.69, meaning that 69% of the changes occurring in the area of the local mint crop (green) in the current year are due to the aforementioned independent variables. The significance of the model as a whole was proven at the 1% level, which means that the model used fits the nature of the data.

2- Marjoram crop:

1-2- Development of the cultivated area of the marjoram crop:

It is clear from Table (3) that the cultivated area of the marjoram crop reached a minimum of 1,935 Feddans in 2017, and a maximum of 5,403 Feddans in 2018, with an average of about 3,400 Feddans during the study period (2007-2022).

Table (3): Development of production costs, net return per Feddan, and agricultural price in pounds for the marjoram crop at current and real prices in Egypt during the period (2007-2021).

Year	Price index*	Area in Feddans	Current prices			Real prices		
			Costs	Net Return	Price arm	Costs	Net Return	Price arm
2007	67.97	4056	2495	1779	3042	3671	2617	4476
2008	80.42	5403	2757	1804	3466	3428	2243	4310
2009	89.88	4691	2793	2885	3531	3107	3210	3929
2010	100.00	4128	2993	1534	6229	2993	1534	6229
2011	110.06	4113	3594	6921	3660	3265	6288	3325
2012	117.89	3474	3259	2412	3731	2764	2046	3165
2013	129.06	2520	3432	3037	3783	2659	2353	2931
2014	142.05	2681	3608	1010	3810	2540	711	2682
2015	156.78	3361	3801	959	3826	2424	612	2440
2016	178.44	3594	6298	-658	3834	3529	369-	2149
2017	231.09	1935	9199	3959	9661	3981	1713	4181
2018	264.38	2049	10702	2155	9674	4048	815	3659
2019	288.57	3788	12156	5185	9715	4212	1797	3367
2020	303.13	2889	11478	5022	9729	3786	1657	3210
2021	318.94	2973	13260	2310	9731	4158	724	3051
2022	-----	2740	----------					
المتوسط	**152.43**	**3400**	**6122**	**2688**	**5828**	**3371**	**1863**	**3540**

*Base year 2010 (World Bank). ** Geometric mean.

Source: Ministry of Agriculture and Land Reclamation, Central Administration of Agricultural Economics, Agricultural Economics Bulletin, various issues.

By studying the general time trend equation in Table (4), it was found that the Linear Form is the best Form from a statistical standpoint, as it was shown that the cultivated area of the marjoram crop decreased by a statistically significant amount,

amounting to about 136 Feddans annually, which represents 4.0% of the average period of the study. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 47% of the changes occurring in the cultivated area of the marjoram crop are due to independent variables whose effect reflects the element of time.

2-2- The development of production costs, the net return per Feddan, and farm-gate price of the marjoram crop at current prices:

A- Development of production costs per Feddan at current prices:

It is clear from Table (3) that tthe costs of production an Feddan at current prices for the marjoram crop reached a minimum of 2,495 pounds/Feddan in 2007, and a maximum of 13,260 pounds/Feddan in 2021, with an average of about 6,122 pounds/Feddan during the study period (2007-2021). By studying the general time trend equation in Table (4), it was found that the linear form is the best form from a statistical standpoint, as it was shown that tthe costs of production an Feddan at current prices for the marjoram crop increase by a statistically significant amount, amounting to about 816.4 pounds/Feddan annually, which represents 13.3% of the average period of the study. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 83% of the changes occurring in the costs of production per Feddan at current prices for the marjoram crop are due to independent variables whose effect reflects the time element.

B- The development of the net return per Feddan at current prices:

It is clear from Table (3) that the net return per Feddan at current prices for the marjoram crop reached a minimum of -658 pounds/Feddan in 2016, and a maximum of 6921 pounds/Feddan in 2011, with an average of about 2688 pounds/Feddan during the study period (2007-2021). By examining the general time trend equation in Table (4), none of the commonly accepted statistical forms were found to be

significant, as there is fluctuation in the data, which means that the net yield per Feddan data at current prices for the marjoram crop revolves around its arithmetic average of about 2688 pounds/Feddan.

Table (4): General trend equations for the development of production costs, net return per Feddan, and farm-gate price in pounds for the marjoram crop at current and real prices in Egypt during the period (2007-2021).

variable	The equation	R^2	F	% annual change
Cultivated area	$\hat{Y}_i = 4555.4 - 136.0\ X_i$ (12.1)** (-3.5)**	0.47	12.2	-4.0
	Current prices			
Production costs	$\hat{Y}_i = -409.6 + 816.4\ X_i$ (-0.44) (7.9)**	0.83	62.6	13.3
net return	None of the common statistical forms were significant			
Farm price	$\hat{Y}_i = 1618.05 + 526.3\ X_i$ (1.7) (4.9)**	0.65	24.2	9.0
	Real prices			
Production costs	$\hat{Y}_i = 3830.4 - 284.2\ X_i + 21.9\ X_i^2$ (1.8)** (-2.8)** (3.6)**	0.63	10.3	—
net return	$\hat{Y}_i = 3206.5 - 167.9\ X_i$ (4.3)** (-2.03)*	0.24	4.1	-9.0
Farm price	$\hat{Y}_i = 4386.6 - 105.8\ X_i$ (8.8)** (-1.93)*	0.22	3.7	-3.0

Where: $\hat{Y}i$: the estimated value of the variable.
Xi: time variable for the time period (2007-2022), where i = (1,2,3,...,15).
The value in parentheses indicates the calculated (T) value, (R2) the coefficient of determination, (F) the significance of the model, (**) indicates the significance of the regression coefficients at a significance level (0.01).
Source: Calculated from Table (3) of the study.

C- Development of agricultural prices at current prices:

It is clear from Table (3) that farm-gate price at current prices for the marjoram crop reached a minimum of about 3042 pounds/ton in 2007, and a maximum of about 9731 pounds/ton in 2021, with an average of about 5828 pounds/ton during the study period (2007-2021). By studying the general time trend equation in Table (4), it was found that the linear form is the best form from a statistical standpoint, as it was found that farm-gate price at current prices of the marjoram crop increases by a

statistically significant amount of about 526.3 pounds/ton, which represents about 9% of the average period of the study. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 65% of the changes occurring in farm-gate price at current prices of the marjoram crop are due to independent variables whose effect reflects the time element.

D- Statistical characterization of the linear model of the marjoram supply response at current prices:

$Yi1T = \beta0 + \beta1\ Yi1\ T\text{-}1 + \beta2\ Pi1\ T\text{-}1 + \beta3\ Ci1\ T\text{-}1 + \beta4\ Ri1\ T\text{-}1 + \beta5\ Yi2\ T\text{-}1 + \beta6\ Pi2\ T\text{-}1 + \beta7\ Ci2\ T\text{-}1 + \beta8\ Ri2\ T\text{-}1$

Yi1T: marjoram crop area in Feddans in year T.

Yi1 T-1: Marjoram crop area in Feddans in year T-1.

Pi1 T-1: The price of a ton of marjoram in pounds in year T-1.

Ci1 T-1: Tthe costs of production an Feddan of marjoram in pounds in year T-1.

Ri1 T-1: Net return on marjoram Feddans in pounds in year T-1.

Pi2 T-1: Price per ton of cumin (competing crop) in pounds in year T-1.

Ci2 T-1: Production costs of an Feddan of cumin (the competing crop) in pounds in year T-1.

Ri2 T-1: The net return of an Feddan of cumin (the competing crop) in pounds per year. T-1

Through the use of both the stepwise regression method and the correlation matrix between the independent variables under study to avoid the problem of multicollinearity, many attempts were made to determine the most important statistical models specific to the marjoram crop supply response function at current prices, and the estimation results were as follows:

$$\hat{Y}_{i1T} = 4196.02 + 0.36\ P_{i1\ T-1} + 0.42\ Y_{i1\ T-1} - 0.42\ Y_{i2\ T-1} + 0.26\ C_{i2\ T-1}$$
$$(4.1)^{**} \quad (2.8)^{**} \quad (2.3)^{*} \quad (-3.1)^{**} \quad (2.9)^{**}$$
$$- 0.25\ RT_{i2\ T-1}$$
$$(-4.0)^{**}$$

$$R^2 = 0.83 \qquad \bar{R}^2 = 0.74 \qquad F = 8.9$$

The results of the statistical analysis of the marjoram crop supply response function at current prices during the study period (2008-2022) show that the Linear Form is the best form from a statistical standpoint, as increasing farm-gate price of the marjoram crop in the previous year Pi1 T-1 by one pound per ton leads to a significant increase. The area of the marjoram crop in the current year (Yi1T) increased by 0.36 Feddans, while increasing the cultivated area of the marjoram crop in the previous year (Yi1 T-1) by an Feddan. This leads to a significant decrease in the area of the marjoram crop in the current year (Yi1T) by 0.42 Feddans, while increasing the cultivated area of the marjoram crop in the current year (Yi1T) by 0.42 Feddans. The green mint crop in the previous year, Yi1 T-1, by an Feddan. This leads to a significant decrease in the area of the marjoram crop in the current year, Yi2 T-1, by 0.42 Feddans. It also increases the cost of producing a green mint crop per Feddan at current prices in the previous year, Ci2 T-1, by an amount One pound per Feddan leads to a significant increase in the area of the marjoram crop in the current year, Yi1T, by 0.26 Feddans, while increasing the net yield per Feddan from the green mint crop in the previous year, RTi2 T-1, by an Feddan, leads to a significant decrease in the area of the marjoram crop in the current year, Yi1, by 0.25. Feddan. The adjusted coefficient of determination was 0.74, meaning that 74% of the changes occurring in the area of the marjoram crop in the current year are due to the aforementioned independent variables. The significance of the model as a

whole was proven at the 1% level, which means that the model used fits the nature of the data.

3-2- The development of production costs, the net return per Feddan, and farm-gate price of the marjoram crop at fixed (real) prices:

A- The development of production costs per Feddan at fixed (real) prices:

It is clear from Table (3) that tthe costs of production an Feddan at fixed (real) prices for the marjoram crop reached a minimum of 2424 pounds/Feddan in 2015, and a maximum of 4158 pounds/Feddan in 2021, with an average of about 3371 pounds/Feddan during the study period (2007-2021). By studying the general time trend equation in Table (4), it was found that the quadratic Form is the best Form from a statistical standpoint, as it was shown that tthe costs of production an Feddan at constant (real) prices for the marjoram crop began to decrease at the beginning of the period until the lowest cost reached in 2015, estimated at about 2424 pounds/ Feddans and then increased by a statistically significant amount amounting to about 43.8 pounds/Feddan annually, representing 0.65% of the average period (2016-2021), which amounted to about 6712 pounds/Feddan. The significance was proven at the level of 0.01, as was the significance of the model as a whole. The results also showed that about 63% of the changes occurring in the costs of production per Feddan at constant (real) prices for the marjoram crop are due to independent variables whose effect reflects the time element.

B- The development of the net return per Feddan at constant (real) prices:

It is clear from Table (3) that the net return per Feddan at fixed (real) prices for the marjoram crop reached a minimum of -369 pounds/Feddan in 2016, and a maximum of 6288 pounds/Feddan in 2011, with an average of about 1863 pounds/Feddan during the study period (2007-2021). . By studying the general time trend equation in Table (4), it was found that the linear form is the best form from a statistical standpoint, as it was shown that the net return per Feddan at constant (real)

prices for the marjoram crop decreases by a statistically significant amount of about 167.9 pounds/Feddan annually, which represents 9% of the average period. the study. The significance was proven at the level of 0.05, as was the significance of the model as a whole. The results also showed that about 24% of the changes occurring in the net return per Feddan at constant (real) prices for the marjoram crop are due to the independent variables whose effect reflects the time element.

C- The development of farm-gate price in fixed (real) prices:

It is clear from Table (3) that the farm price at fixed (real) prices for the marjoram crop reached a minimum of about 2149 pounds/ton in 2016, and a maximum of about 6229 pounds/ton in 2010, with an average of about 3540 pounds/ton during the study period (2007-2021). . By studying the general time trend equation in Table (4), it was found that the linear form is the best form from a statistical standpoint, as it was shown that farm-gate price at fixed (real) prices for the marjoram crop decreases by a statistically significant amount of about 105.8 pounds/ton, which represents about 3% of the average period of the study. . The significance was proven at the level of 0.05, as was the significance of the model as a whole. The results also showed that about 22% of the changes occurring in farm-gate price at constant (real) prices of the marjoram crop are due to independent variables whose effect reflects the time element.

D- Statistical characterization of the linear model of the marjoram supply response at constant (real) prices:

$$Yi1T = \beta0 + \beta1\ Yi1\ T\text{-}1 + \beta2\ Pi1\ T\text{-}1 + \beta3\ Ci1\ T\text{-}1 + \beta4\ Ri1\ T\text{-}1 + \beta5\ Yi2\ T\text{-}1 + \beta6\ Pi2\ T\text{-}1 + \beta7\ Ci2\ T\text{-}1 + \beta8\ Ri2\ T\text{-}1$$

Y_{i1T}: marjoram crop area in Feddans in year T.

$Y_{i1\ T-1}$: Marjoram crop area in Feddans in year T-1.

$P_{i1\ T-1}$: The price of a ton of marjoram in pounds in year T-1.

$C_{i1\ T-1}$: Tthe costs of production an Feddan of marjoram in pounds in year T-1.

$R_{i1\ T-1}$: Net return on marjoram Feddans in pounds in year T-1.

$P_{i2\ T-1}$: Price per ton of cumin (competing crop) in pounds in year T-1.

$C_{i2\ T-1}$: Production costs of an Feddan of cumin (the competing crop) in pounds in year T-1.

$R_{i2\ T-1}$: The net return on Feddans of cumin (the competing crop) in pounds in year T-1.

Through the use of both the stepwise regression method and the correlation matrix between the independent variables under study to avoid the problem of multicollinearity, many attempts were made to identify the most important statistical models specific to the marjoram crop supply response function at constant (real) prices, and the estimation results were as follows:

$$\hat{Y}_{i1T} = 6527.9 + \underset{(6.7)^{**}}{0.76}\ P_{i1\ T-1} + \underset{(6.9)^{**}}{0.67}\ Y_{i1\ T-1} - \underset{(5.2)^{**}}{0.46}\ Y_{i2\ T-1} + \underset{(-4.8)^{**}}{1.45}\ C_{i1\ T-1} + \underset{(5.8)^{**}}{0.42}\ RT_{i1\ T-1} - \underset{(4.5)^{**}}{0.59}\ RT_{i2\ T-1}$$
$$\underset{(-6.8)^{**}}{}$$

$R^2 = 0.94$ $\bar{R}^2 = 0.89$ $F = 19.4$

The results of the statistical analysis of the marjoram crop supply response function at constant (real) prices during the study period (2008-2022) show that the Linear Form is the best Form from a statistical standpoint, as increasing farm-gate price of the marjoram crop in the previous year Pi1 T-1 by one pound per ton leads to this. This leads to a significant increase in the area of the marjoram crop in the current year (Yi1T) by 0.76 Feddans, while increasing the cultivated area of the marjoram crop in the previous year (Yi1 T-1) by an Feddan. This leads to a significant increase in the area of the marjoram crop in the current year (Yi1T) by 0.67 Feddans, with an increase in net returns. This leads to a significant increase in the area of the marjoram crop in the current year (Yi1T) by 0.42 Feddans, while increasing the cultivated area of the green mint crop in the previous year (Yi1 T-1) by an Feddan leads to A significant decrease in the area of the marjoram crop in the

current year, Yi2 T-1, by 0.46 Feddans. Also, increasing the cost of producing green mint crop per Feddan at fixed (real) prices in the previous year, Ci2 T-1, by one pound per Feddan, leads to a significant increase in the area of the marjoram crop in the year. The current Yi1T is 1.45 Feddans, while increasing the net yield per Feddan from the green mint crop in the previous year RTi2 T-1 by an Feddan leads to a significant decrease in the area of the marjoram crop in the current year, Yi1, by 0.59 Feddans. The adjusted coefficient of determination was 0.89, meaning that 89% of the changes occurring in the area of the marjoram crop in the current year are due to the aforementioned independent variables. The significance of the model as a whole was proven at the 1% level, which means that the model used fits the nature of the data.

Recommendations:

1- Working through the competent authorities, such as the Ministry of Agriculture and Land Reclamation and the Horticultural Research Institute, to increase the cultivated area and acreage productivity of mint and marjoram crops, and to provide assistance in solving production problems.

2- Working through the competent authorities, such as the Ministry of Agriculture and Land Reclamation and the Horticulture Research Institute, to increase the agricultural price and reduce the cost of production, which leads to an increase in the cultivated area of mint and marjoram crops.

3- Conducting workshops and seminars through the Agricultural Extension Institute to encourage the importance of cultivating medicinal and aromatic plants, which improve the general health of the agricultural worker and thus work to increase his productivity.4- Providing government support and aid to farmers to work on increasing the cultivated areas of medicinal and aromatic plants, because of their health and economic benefits and increasing export opportunities for these crops.

the reviewer:

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3- https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=EG&start=2010.

4- Mohamed Ahmed Ahmed and Rania Ahmed Mohamed Ahmed (Doctors) (2015): Maximizing the export return of the most important Egyptian medicinal plants in global markets, Sinai Journal of Applied Sciences.

5- Najeh Abdel Khalil Ahmed Omar, Fahmy Hussein Muhammad Ali (Doctors) (2007): An analytical study of Egyptian exports of medicinal and aromatic plants, Egyptian Journal of Agricultural Economics, Volume (17), Issue (1).

6- Ministry of Agriculture and Land Reclamation, Central Administration for Agricultural Economics, Agricultural Economics Bulletin, various issues.