Economic and Marketing Efficiency of Wheat Crop in Egypt

Mohamed M. E. S. Shaheen [1], Mohamed H. Salem[2], Abdullah M. Abdel-Maqsoud[2],
Ibrahim A. M. Abdel-Fatah[3]

ABSTRACT

Wheat is considered one of the most important strategic crops in Egyptian agriculture, as it is cultivated across the majority of Egyptian governorates. In 2023, the cultivated area reached about 3.167 million feddans. Wheat is primarily used for bread production, which constitutes the staple food for the population regardless of their living standards. It represents the main source of energy, providing approximately 57% of an individual's daily caloric requirements from starches, in addition to a significant portion of protein needs.

The research problem lies in the fact that the self-sufficiency ratio of wheat in 2023 reached only about 46%, despite the increase in domestic production. This may be attributed to population growth and the inability of production growth to keep pace with the rising consumption of wheat and wheat flour. Consequently, Egypt has become one of the largest wheat-importing countries in the world, with imports amounting to about 9.212 million tons in 2024.

The study shows that an increase of half a million feddans in the cultivated area would result in an additional production of approximately 10.34 million tons, with an absolute change of about 0.83 million tons and a relative change rate of 8.73%. Assuming an average yield of 2.85 tons per feddan, this additional area would reduce the wheat consumption gap by about 8.91 million tons, out of the total gap estimated at 10.34 million tons during the study period. This corresponds to an absolute change of –1.43 million tons and a relative change rate of –13.83%. Moreover, the self-sufficiency ratio would increase to approximately 55.10%, with an absolute change of about 7.18% and a relative change rate of 14.98%.

Keywords: Wheat crop, Marketing efficiency, Demand functions, Forecasting.

INTRODUCTION

The importance of the major cereal crops (wheat, rice, and maize) is reflected in their classification as strategic crops that receive significant attention from economic policymakers. Wheat, in particular, is the primary raw material for bread production, which constitutes the staple food for all social classes. Nevertheless, domestic production does not meet population needs, in addition to the rising proportion of post-harvest losses, which further exacerbates import dependency and consequently increases the burden of the import bill.

Wheat is considered one of the most important strategic crops in Egyptian agriculture, cultivated across most governorates. In 2023, the cultivated area amounted to about 3.167 million feddans. Wheat is mainly used for bread production, which is the essential food for the population regardless of their living standards. It is the primary source of energy, supplying about 57% of the daily starch requirements and a significant share of protein intake.

The wheat gap in Egypt has emerged due to the inability of domestic production to meet the rapidly growing consumption demand, driven primarily by continuous population growth. This gap has been further shaped by a combination of technical, economic, and political factors. Fundamentally, it stems from the accumulation of negative outcomes arising from shortcomings in economic policies in general and agricultural policies in particular. As a result of the widening wheat gap, the state has increasingly resorted to wheat imports, with wheat import expenditures reaching about USD 4.443 billion in 2024.

RESEARCH PROBLEM

The research problem lies in the fact that Egypt's self-sufficiency ratio in wheat was only about 46% in 2023, despite the increase in local production. This situation is primarily attributed to population growth and the inability of production growth to match the surge in wheat and flour consumption. Consequently, Egypt has become one of the world's largest wheat importers, importing about 9.212 million tons in 2024. This indicates Egypt's heavy reliance on international markets to bridge the wheat food gap. Given the instability of production in these markets—resulting from global wheat production declines, increasing international demand, and the diversion of wheat to biofuel production in some countries—the available global supply has contracted. This poses a serious risk to Egypt's food security. Accordingly, it is essential to

DOI: 10.21608/esm.2025.452240
[1]Postgraduate student registered for a PhD
[2] Professor of Agricultural Economics, Faculty of Agriculture, Ain Shams University
[3] Assistant Professor of Agricultural Economics, Faculty of Agriculture, Ain Shams University
Received August 10, 2025, Accepted, September 11, 2025.

identify the challenges Egypt faces as a wheat-importing country and to explore possible solutions. This research focuses on assessing the impact of domestic and global variables on Egypt's wheat imports.

RESEARCH OBJECTIVES

The study aims to determine the economic and marketing efficiency indicators of the wheat crop through:

- Identifying selected economic and consumption indicators of wheat.
- Analyzing the marketing indicators of wheat.
- Examining the main factors influencing Egypt's wheat imports by deriving the demand function for wheat.
- Forecasting the variables under study.

METHODOLOGY AND DATA SOURCES

To achieve the research objectives, both descriptive and statistical analytical methods were applied to describe and measure the relationships among the different variables. The study employed trend equations and multiple regression analysis, in addition to analyzing marketing efficiency indicators under different scenarios. The research relied on secondary data, both published and unpublished, obtained from the Ministry of Agriculture and Land Reclamation, the Economic Affairs Sector, Agricultural Economics Bulletins, as well as international sources including http://www.worldbank.org & http://www.trademap.org.

Research Findings:

First: Wheat Production and Consumption Indicators in Egypt

1- Development of Wheat Cultivated Area in Egypt:

Data presented in Table (1), illustrate the development of the wheat cultivated area in Egypt over the study period (2005–2023). It is evident that the average cultivated area during this period reached approximately 3.17 million feddans annually. The minimum recorded area was about 2.72 million feddans in 2007, while the maximum reached around 3.47 million feddans in 2015.

An analysis of the general time trend equation for wheat cultivated area, as shown in Table (2), reveals that the area exhibited a statistically significant increasing trend at an annual rate of approximately 22.59 thousand feddans. This increase represents about 0.71% of the overall average cultivated area during the study period.

Furthermore, the coefficient of determination (R^2) was estimated at 0.36, indicating that 36% of the variation in wheat cultivated area can be attributed to time-related factors. The model was statistically significant overall, as confirmed by the calculated value of the F-statistic.

2. **Development of Wheat Yield per Feddan in Egypt:**

An analysis of wheat yield per feddan during the study period reveals that the average yield was approximately 2.74 tons/feddan per year. The minimum yield recorded was around 2.39 tons/feddan in 2010, while the maximum reached about 2.88 tons/feddan in 2015.

Based on the general time trend equation for wheat yield presented in Table (2), the yield demonstrated a statistically insignificant upward trend at an annual rate of approximately 0.008 tons/feddan, representing about 0.29% of the average yield. Although the model was generally statistically significant based on the computed F-value, there was no mathematically appropriate functional form that effectively captured the nature of the data, as the values fluctuated closely around their arithmetic mean.

3. **Development of Total Wheat Production in Egypt:**

As shown in Table (1), the average total wheat production in Egypt during the study period was approximately 8.70 million tons annually. The lowest recorded production was about 7.17 million tons in 2010, while the highest was around 9.84 million tons in 2021.

Analysis of the general time trend equation for total wheat production Table (2), indicates that production followed a statistically significant upward trend at an annual rate of approximately 86.40 thousand tons, which represents about 0.99% of the average production. The coefficient of determination (R^2) was about 0.43, suggesting that 43% of the variation in wheat production can be attributed to time-related factors. The overall model was statistically significant, as confirmed by the calculated F-value.

Table 1. Development of Wheat Cultivation Area, Productivity, Production, Consumption, Deficit, Self-Sufficiency Ratio, Per Capita Share, Costs, and Net Return in Egypt During the Period (2005–2023)

Years	Area (1000 Feddans)	Productivity (Ton/Feddan)	Production (1000 Tons)	Consumption (1000 Tons)	Per Capita Share (Kg/Person)	Gap (1000 Tons)	Farm-Gate Price (EGP/Ton)	Costs (EGP/Feddan)	Net Return (EGP/Feddan)
2005	2985.3	2.73	8149.9	13353	176.8	5203.1	1120	1981	1956
2006	3063.7	2.7	8272	14257	185.5	5985	1126.7	2143	1863
2007	2715.5	2.72	7386.2	13773	176.1	6386.8	1153.3	2444	1769
2008	2920.4	2.73	7972.7	14546	182.7	6573.3	2553.3	3145	5159
2009	3147	2.71	8528.4	14592	179.8	6063.6	1613.3	3459	2190
2010	3001.4	2.39	7173.3	14978	181	7804.7	1813.3	3680	1975
2011	3048.6	2.75	8383.7	16878	199.7	8494.3	2346.7	4069	3884
2012	3160.7	2.78	8786.6	15657	181.2	6870.4	2520	4425	4358
2013	3377.9	2.8	9458.1	17210	194.7	7751.9	2580	4808	4274
2014	3393	2.73	9262.9	17025	188.3	7762.1	2740	5271	4047
2015	3468.9	2.77	9608.8	18411	199.2	8802.2	2753.3	5627	3941
2016	3350	2.79	9346.5	19410	205.5	10063.5	2773.3	7054	2573
2017	2921.7	2.88	8421	20019	207.6	11598	3760	8991	3824
2018	3156.8	2.64	8349	19714	200.3	11365	3760	10631	2142
2019	3134.9	2.73	8559	20847	207.7	12288	4406.7	11326	3586
2020	3394.2	2.68	9102	21482	209.9	12380	4420	11643	3246
2021	3419.4	2.88	9841.1	22449	150.4	12607.9	5005	12833	5536
2022	3417	2.82	9622.9	23194.7	137.4	13571.7	5208.9	13441	6072.7
٢٠٢٣	3166.5	2.86	9065.4	19728	157.1	10662.6	9000	15422	6422
Average	3170.7	2.74	8699.5	17764.4	185.3	9065	3192.3	6968.1	3622
Minimum	2715.5	2.39	7173.3	13353	137.4	5203.1	1120	1981	1769
Maximum	3468.9	2.88	9841.1	23194.7	209.9	13571.7	9000	15422	6422

Source**:** Ministry of Agriculture and Land Reclamation, Sector of Economic Affairs, Agricultural Economics Bulletins, Various Issues.

Table 2. Time Trends of the Development of Area, Productivity, Production, Consumption, Gap, Self-Sufficiency, Per Capita Average, Costs, and Net Return of Wheat Crop in Egypt during the Period (2005–2023)

NO	Dependent Variables	Time Trend Equation	Annual Rate of Change*	F	R^2
1	Cultivated Area	$\hat{Y}_i = 2944.8 + 22.59\ X_i$ (35.31) (3.09)**	0.71	9.54	0.36
٢	Productivity	$\hat{Y}_i = 2.66 + 0.008\ X_i$ (55.2) (1.84)	0.29	3.37	0.17
٣	Production	$\hat{Y}_i = 7835.5 + 86.40\ X_i$ (28.19) (3.54)**	0.99	12.56	0.43
٤	Consumption	$\hat{Y}_i = 12508.7 + 525.6\ X_i$ (27.8) (13.30)**	2.96	176.8	0.91
٥	Per Capita Share	$\hat{Y}_i = 190.3 - 0.50\ X_i$ (19.5) (-0.58)	-0.27	0.34	0.02
٦	Gap	$\hat{Y}_i = 4673.2 + 439.2\ X_i$ (9.9) (10.62)**	4.85	112.8	0.87
٧	Farm-Gate Price	$\hat{Y}_i = 237.7 + 295.5\ X_i$ (0.54) (7.62)**	9.26	57.99	0.77
٨	Costs	$\hat{Y}_i = 453.8 + 742.2\ X_i$ (0.8) (15.33)**	10.65	234.9	0.93
٩	Net Return	$\hat{Y}_i = 2002.2 + 161.9\ X_i$ (3.55) (3.27)**	4.47	10.69	0.39

Where:

- **Ŷi** = Estimated value of the dependent variable
- **Xi** = Time variable, where *i* = (1, 2, 3, ..., 19)
- The value in parentheses refers to the computed *T* value
- **(R^2)** = Coefficient of determination
- **(F)** = Significance of the regression model
- **(****)**Indicates that the regression coefficient is significant at the 0.01 level
- **(*)** Indicates that the regression coefficient is significant at the 0.05 level
- **( )** Indicates that the regression coefficient is not statistically significant

Source: Compiled and calculated from the data in Table (2)

*Annual Rate of Change = $B/\bar{X}$*100

4- Development of Wheat Consumption in Egypt:

As shown in Table (1), the average wheat consumption in Egypt during the study period was approximately 17.76 million tons annually. The minimum consumption was around 13.35.0 million tons in 2005, while the maximum reached about 23.19 million tons in 2022.

An analysis of the general time trend equation for wheat consumption, presented in Table (2), indicates a statistically significant upward trend at an annual rate of approximately 525.6 thousand tons, representing about 2.96% of the average annual consumption. The coefficient of determination (R^2) was about 0.91, implying that 91% of the variation in wheat consumption can be attributed to time-related factors. The model was statistically significant overall, as confirmed by the calculated F-value.

5- Development of Per Capita Wheat Consumption in Egypt:

Table (1), also shows that the average per capita wheat consumption in Egypt during the study period was approximately 185.3 kg per person per year. The minimum was about 137.4 kg per person in 2022, while the maximum reached approximately 209.9 kg per person in 2020.

According to the general time trend equation for per capita wheat consumption, as shown in Table (2), the trend was generally decreasing at an annual rate of approximately 0.50 kg per person, which is statistically insignificant and represents a decline of about -0.27% of the average. The model did not prove statistically significant overall, and no appropriate mathematical form was found to accurately represent the nature of the data, which appeared to fluctuate around the arithmetic mean.

6. Development of the Wheat Gap in Egypt:

As shown in Table (1), the average wheat gap in Egypt during the study period was approximately 9.07 million tons annually. The minimum gap was around 5.20 million tons in 2005, while the maximum reached about 13.57 million tons in 2022.

An analysis of the general time trend equation for the wheat gap, as presented in Table (2), reveals a statistically significant upward trend at an annual rate of approximately 439.2 thousand tons, representing about 4.85% of the average gap. The coefficient of determination (R^2) was estimated at 0.87, indicating that 87% of the variation in the wheat gap can be explained by time-related factors. The model was statistically significant overall, as confirmed by the calculated F-value.

7.Development of the Farm-Gate Price of Wheat in Egypt:

According to Table (1), the average farm-gate price of wheat in Egypt during the study period was approximately EGP 3,192.3 per ton. The minimum price recorded was around EGP 1,120.0 per ton in 2005, while the maximum reached approximately EGP 9,000.0 per ton in 2023.

The general time trend equation for the development of the farm-gate price of wheat, as shown in Table (2), indicates a statistically significant increasing trend at an annual rate of approximately EGP 295.5 per ton, representing about 9.62% of the average price. The coefficient of determination (R^2) was estimated at 0.77, suggesting that 77% of the variation in the farm-gate price can be attributed to time-related factors. The model was statistically significant overall, as validated by the calculated F-value.

8- Development of Total Production Costs of Wheat in Egypt:

As shown in Table (1), the average total production cost of wheat in Egypt during the study period was approximately EGP 6,968.1 per feddan per year. The minimum cost was around EGP 1,981.0 per feddan in 2005, while the maximum reached about EGP 15,422.0 per feddan in 2023.

According to the general time trend equation for the development of total production costs, as presented in Table (2), the costs showed a statistically significant upward trend at an annual rate of approximately EGP 742.2 per feddan, representing about 10.65% of the average. The coefficient of determination (R^2) was around 0.93, indicating that 93% of the variation in total production costs can be attributed to time-related factors. The model proved to be statistically significant overall, as confirmed by the calculated F-value.

9- Development of Net Return from Wheat in Egypt:

Table (1), also shows that the average net return from wheat production in Egypt during the study period was approximately EGP 3,622.0 per feddan per year. The lowest net return was about EGP 1,769.0 per feddan in 2007, while the highest reached approximately EGP 6,422.0 per feddan in 2023.

Analysis of the general time trend equation for the development of net return, as shown in Table (2), reveals a statistically significant upward trend at an annual rate of approximately EGP 161.9 per feddan, representing about 4.47% of the average. The coefficient of determination (R^2) was estimated at 0.39, suggesting that 39% of the variation in net return is explained by time-related factors. The model was found to be statistically significant overall, as indicated by the calculated F-value.

Second: Indicators of Marketing Efficiency for the Wheat Crop

1-The Indicator of Reducing Import Quantities or Increasing Export Quantities

Table (3), shows that the average cultivated area of wheat during the period (2021–2023) amounted to about 3.33 million feddans, while the average yield was approximately 2.85 tons per feddan. The average total production during the study

period reached about 9.51 million tons. Moreover, the average quantities of wheat import and consumption were about 10.38 million tons and 19.85 million tons, respectively. The self-sufficiency ratio was estimated at about 47.92%, while the wheat food gap amounted to approximately 10.34 million tons.

Proposed Scenarios for Increasing Wheat Acreage

a. In the case of expanding wheat cultivation by half a million feddans.

Table (4), indicates that increasing the cultivated area of wheat by half a million feddans would lead to a rise in production to about 10.34 million tons, representing an absolute change of approximately 0.83 million tons and a relative change rate of 8.73%, based on an average yield of 2.85 tons per feddan.

This additional area would also contribute to reducing the wheat consumption gap to about 8.91 million tons, compared to the total gap of **10.34 million tons during the same study period, with an absolute change of–1.43 million tons** and a relative change rate of–13.83%.

Furthermore, the self-sufficiency ratio would increase to approximately 55.10%, with an absolute change of about 7.18% and a relative change rate of 14.98%.

Additionally, expanding the cultivated area by half a million feddans would decrease the average quantity of wheat imports from about 10.38 million tons to 8.96 million tons, with an absolute change of–1.42 million tons and a relative change rate of–13.68% during the period (2021–2023).

Table 3. Cultivated area, production, yield, import quantities, consumption, self-sufficiency ratio, and wheat gap during the period (2021–2023)

Year	Area million feddans	Yield (tons/feddan)	Production (million tons)	Imports (million tons)	Consumption (million tons)	| Self-sufficiency (%)	Wheat Gap (million tons
2021	3.42	2.88	9.84	11.12	21.12	46.60	11.28
2022	3.42	2.82	9.62	9.18	18.69	51.48	9.07
2023	3.17	2.86	9.07	10.86	19.73	45.95	10.66
Average	3.33	2.85	9.51	10.38	19.85	47.92	10.34

Source: Food Balance Bulletin, Economic Affairs Sector, Ministry of Agriculture, Various Issues.

Table 4. Results of Increasing Wheat Acreage by Half a Million Feddans and Its Impact on Production, the Consumption Gap, Self-Sufficiency Ratio, and Import Quantities during the Period (2021–2023)

Indicator	Average Production (million tons)	Average Gap (million tons)	Self-Sufficiency (%)	Average Imports (million tons)
Before Expansion	9.51	10.34	47.92	10.38
After Expansion	10.34	8.91	55.1	8.96
Absolute Change	0.83	-1.43	7.18	-1.42
Relative Change (%)	8.73	-13.83	14.98	-13.68

Source:Table (1) in the study.

Table 4. Results of Increasing Wheat Acreage by Half a Million Feddans and Its Impact on Production, the Consumption Gap, Self-Sufficiency Ratio, and Import Quantities during the Period (2021–2023)

Indicator	Average Production (million tons)	Average Gap (million tons)	Self-Sufficiency (%)	Average Imports (million tons)
Before Expansion	9.51	10.34	47.92	10.38
After Expansion	10.34	8.91	55.1	8.96
Absolute Change	0.83	-1.43	7.18	-1.42
Relative Change (%)	8.73	-13.83	14.98	-13.68

Source:Table (1) in the study.

Table 5. Results of Increasing Wheat Acreage by One Million Feddans and Its Impact on Production, the Consumption Gap, Self-Sufficiency Ratio, and Import Quantities during the Period (2021–2023)

Indicator	Average Production (million tons)	Average Gap (million tons)	Self-Sufficiency (%)	Average Imports (million tons)
Before Expansion	9.51	10.34	47.92	10.38
After Expansion	12.36	7.48	62.29	7.53
Absolute Change	2.85	-2.86	14.37	-2.85
Relative Change (%)	29.97	-27.66	29.99	-27.46

Source:Table (3) in the study.

b. In the Case of Expanding Wheat Cultivation by One Million Feddans :

Table (5), illustrates that, in the event of increasing the cultivated area of wheat by one million feddans, production would rise to about 12.36 million tons, representing an absolute change of 2.85 million tons and a relative change rate of 29.97%, based on an average yield of 2.85 tons per feddan. This additional acreage would contribute to reducing the wheat consumption gap to about 7.48 million tons, compared with the total gap of 10.34 million tons during the same study period, with an absolute change of–2.86 million tons** and a relative change rate of–27.66%.

Furthermore, the self-sufficiency ratio would increase to approximately 62.29%, with an absolute change of 14.37% and a relative change rate of 29.99%.

In addition, expanding the cultivated area by one million feddans would decrease the average quantity of wheat imports from about 10.38 million tons to 7.53 million tons, with an absolute change of–2.85 million tons and a relative change rate of–27.46% during the period (2021–2023).

c. In the Case of Expanding Wheat Cultivation by One and a Half Million Feddans:

Table (6), shows that increasing the cultivated area of wheat by one and a half million feddans would raise production to about 13.79 million tons, with an absolute change of 4.28 million tons and a relative change rate of 45.01%, based on an average yield of 2.85 tons per feddan. This additional acreage would reduce the wheat consumption gap to approximately 6.06 million tons, compared with the total gap of 10.34 million tons during the same study period, with an absolute change of–4.28 million tons** and a relative change rate of–41.39%.

Moreover, the self-sufficiency ratio would increase to around 69.48%, with an absolute change of 21.56% and a relative change rate of 44.99%.

In addition, expanding the cultivated area by one and a half million feddans would decrease the average quantity of wheat imports from about 10.38 million tons to 6.10 million tons, with an absolute change of **–4.28 million tons and a relative change rate of–41.23% during the period (2021–2023).

2- Contribution Index of Egyptian Agricultural Output and Its Impact on Agricultural Growth:

Table (7), shows that the average value of crop production during the period (2021–2023) amounted to approximately 692.25 billion EGP, while the average value of production from the primary and secondary wheat crop reached about 82.27 billion EGP, representing around 11.95% of the total value of crop production.

Table 6. Results of Increasing Wheat Acreage by One and a Half Million Feddans and Its Impact on Production, the Consumption Gap, Self-Sufficiency Ratio, and Import Quantities during the Period (2021–2023)

Indicator	Average Production (million tons)	Average Gap (million tons)	Self-Sufficiency (%)	Average Imports (million tons)
Before Expansion	9.51	10.34	47.92	10.38
After Expansion	13.79	6.06	69.48	6.1
Absolute Change	4.28	-4.28	21.56	-4.28
Relative Change (%)	45.01	-41.39	44.99	-41.23

Source:Table (3) in the study.

Table 7. illustrates the wheat cultivation area, the value of wheat production, and the value of crop production during the period (2021–2023)

Year	Cultivated Area (million feddans)	Value of Crop Production (billion EGP)	Value of Primary and Secondary Wheat Production (billion EGP)
2021	3.42	408.45	62.21
2022	3.42	603.76	75.66
2023	3.17	1065.24	110.37
Average	3.33	692.49	82.74
Share of Wheat Production Value in Total Crop Production (%)			11.95
Value of Primary and Secondary Wheat Production (EGP per feddan)			24.82

Source:Agricultural Income Bulletin, Economic Affairs Sector, Ministry of Agriculture, various issues.

Table 8. illustrates the results of increasing the wheat cultivation area by half a million feddans and its impact on the value of crop production as well as on the value of primary and secondary wheat production during the period (2021–2023)

Indicator	Value of Crop Production (billion EGP)	Value of Primary and Secondary Wheat Production (billion EGP)
Before Expansion	692.49	82.74
After Expansion	704.9	172.67
Absolute Change	12.41	89.93
Relative Change (%)	1.79	108.69

Source:Table (7) in the study.

Table 9. presents the results of increasing the wheat cultivation area by one million feddans and its impact on the value of crop production as well as on the value of primary and secondary wheat production during the period (2021–2023)

Indicator	Value of Crop Production (billion EGP)	Value of Primary and Secondary Wheat Production (billion EGP)
Before Expansion	692.49	82.74
After Expansion	717.31	185.08
Absolute Change	24.82	102.34
Relative Change (%)	3.58	123.69

Source:Table (7) in the study.

a- In the Case of Expanding Wheat Cultivation Area by Approximately Half a Million Feddans :

It is shown in Table (8), that the average production value of primary and secondary wheat reached about 24.82 thousand EGP per feddan. In the case of adding approximately half a million feddans of wheat, this would contribute around 12.41 billion EGP. Consequently, the total value of crop production would amount to 704.9 billion EGP, with a relative change rate of 1.79%. Meanwhile, the value of wheat production during the study period is about 89.93 billion EGP, with a cumulative total of approximately 172.67 billion EGP, and a relative change rate of 108.69%

b- In the Case of Expanding Wheat Cultivation Area by Approximately One Million Feddans :

Table (9), indicates that adding approximately one million feddans of wheat would contribute about 24.82 billion EGP in additional average crop production value, bringing the total to around 717.31 billion EGP, with a relative change rate of 3.58%. Meanwhile, the value of wheat production during the study period amounts to about 102.34 billion EGP, with a cumulative total of approximately 185.08 billion EGP, and a relative change rate of 123.69%.

c- In the Case of Expanding Wheat Cultivation Area by Approximately One and a Half Million Feddans:

Table (10), shows that adding approximately one and a half million feddans of wheat would contribute about 37.22 billion EGP in additional crop production value, bringing the total to around 729.71 billion EGP, with a relative change rate of 5.37%. Meanwhile, the value of wheat production during the study period amounts to about 114.74 billion EGP, with a cumulative total of approximately 197.48 billion EGP, and a relative change rate of 138.68%.

Table 10. illustrates the results of increasing the wheat cultivation area by one and a half million feddans and its impact on the value of crop production as well as on the value of primary and secondary wheat production during the period (2021–2023)

Indicator	Value of Crop Production (billion EGP)	Value of Primary and Secondary Wheat Production (billion EGP)
Before Expansion	692.49	82.74
After Expansion	729.71	197.48
Absolute Change	37.22	114.74
Relative Change (%)	5.37	138.68

Source:Table (7) in the study.

Table 11. illustrates labor costs and the number of workers required for wheat cultivation during the period (2021–2023)

Year	Total Labor Wage (EGP per feddan)	Proposed Area (million feddans)	Additional Agricultural Workers (million workers)
2021	3024	0.5	1
2022	3517	1	2
2023	4811	1.5	3
Average	3784	1	2

Source: Agricultural Costs Bulletin, Economic Affairs Sector, Ministry of Agriculture, various issues.

3- Employment Opportunities Index for Agricultural Workers:

Table (11), shows that the average labor cost for wheat cultivation during the period (2021–2023) amounted to approximately 3,784 EGP per feddan. Each feddan requires about two permanent workers for cultivation, agricultural operations, harvesting, and collection. In the case of adding half a million feddans for wheat cultivation, this would result in the creation of one million additional job opportunities in the agricultural sector. Similarly, expanding wheat cultivation by one million feddans would generate two million permanent jobs, while an expansion of one and a half million feddans would generate three million permanent jobs. This contributes to providing employment opportunities, reducing unemployment in the agricultural sector, increasing agricultural income, and improving living standards.

Third: Determinants of Egypt's Wheat Imports during the Period (2005–2023)

1- Determinants of Egypt's Imports of Russian Wheat**

The following equation represents Egypt's imports of Russian wheat, where the dependent variable is the volume of imported Russian wheat, and the independent variables include Egypt's import price, the import prices of Turkey, Azerbaijan, and Nigeria, Egypt's population, and Egypt's national income. These variables are expected to exert either a positive or negative influence on Egypt's wheat imports during the period (2005–2023). Through these variables, the demand for Egypt's wheat imports can be estimated, and the mathematical form of the demand function is expressed as follows:

The results of the multiple linear regression model indicated that the relationships between the independent variables and the dependent variable were statistically insignificant due to econometric problems, foremost among them multicollinearity, which was confirmed by the correlation matrix. However, the stepwise regression model revealed that the most influential factors affecting Egypt's imports of Russian wheat are: Egypt's import price per ton in USD, Azerbaijan's import price, and Egypt's national income in USD.

The F-statistic showed that the model is statistically significant at the 0.05 level. The adjusted coefficient of determination further indicated that approximately 90% of the variations in Egypt's wheat imports can be attributed to the independent variables included in the model, which also implies that other factors influencing imports were not captured in the analysis.

$$\ln Y = 4.12 - 1.45 \ln X_1 + 1.11 \ln X_3 + 1.34 \ln X_5$$

(0.21) (-5.45) (3.23) (4.56)

$$R^{-2} = 0.90 \qquad F = 14.11$$

Where:

Y: Egypt's imports of Russian wheat (in thousand tons).
X1: Egypt's import price of Russian wheat (USD/ton).
X2: Turkey's import price of Russian wheat (USD/ton).
X3: Azerbaijan's import price of Russian wheat (USD/ton).
X4: Nigeria's import price of Russian wheat (USD/ton).
X5: Egypt's population (million persons).
X6: Egypt's national income (billion USD).
Source: Compiled and calculated from (http://www.worldbank.com) and (http://www.teradmap.org)

Table 12. Forecast of Wheat Supply and Demand (thousand tons) during the period (2025–2029)

years	Consumption quantity Model: ARIMA(2,0,1)	Production quantity Model: Linear trend
2025	23218.1	9676.8
2026	23720.3	9765.1
2027	24222.5	9853.4
2028	24724.7	9941.7
2029	25226.8	10030.0
Average	24222.5	9853.4

Source: Forecasted using Statgraphics

1- Determinants of Egypt's Imports of Ukrainian Wheat

The following equation represents Egypt's imports of Ukrainian wheat, where the dependent variable is the quantity of Ukrainian wheat imported by Egypt. The independent variables include Egypt's import price, the import prices of Indonesia, Algeria, and Spain, Egypt's population, and Egypt's national income. These factors are expected to exert either positive or negative effects on Egypt's wheat imports during the period (2005–2023). The demand for wheat imports is thus estimated through the following functional form of the demand equation:

The results of the multiple linear regression model indicated that the relationships between the independent variables and the dependent variable were statistically insignificant due to econometric problems, particularly multicollinearity, which was confirmed by the correlation matrix of simple correlation coefficients. However, the stepwise regression model revealed that the most influential factors affecting Egypt's imports of Ukrainian wheat are: Egypt's import price per ton in USD, Indonesia's import price, and Egypt's national income in USD.

The F-statistic confirmed that the equation is statistically significant at the 0.05 level. Moreover, the adjusted coefficient of determination indicated that about 88% of the variations in Egypt's wheat imports can be explained by the independent variables included in the model. This also implies the existence of additional influencing factors not accounted for in the analysis.

$$\mathbf{lnY = 8.86 - 2.96\ lnX_1 + 1.89\ lnX_2 + 1.66\ lnX_6}$$

(0.81) (-3.60) (2.35) (3.54)

$$\mathbf{R^{-2} = 0.88 \qquad F = 12.15}$$

Where:
Y: Egypt's imports of Ukrainian wheat (in thousand tons)
X1: Egypt's import price of Ukrainian wheat (USD/ton)
X2: Indonesia's import price of Ukrainian wheat (USD/ton)
X3: Algeria's import price of Ukrainian wheat (USD/ton)
X4: Spain's import price of Ukrainian wheat (USD/ton)
X5: Egypt's population (million persons)
X6: Egypt's national income (billion USD)
Source: Compiled and calculated from (http://www.worldbank.com) and (http://www.teradmap.org)

4.Application of Simultaneous Models in Forecasting the Future Expected Values of the Study Variables

The use of simultaneous econometric models in forecasting provides a vital tool for anticipating the expected future values of key economic variables. Such forecasts are of great importance in guiding the state's economic policies and strategic directions, enabling policymakers to align national plans with anticipated trends. By employing these models, it becomes possible to project the future behavior of both supply and demand sides for essential commodities, such as wheat, and to assess their potential implications for self-sufficiency, import requirements, and food security.

Forecasting Using Simultaneous Models for Wheat during the Period (2025–2029)

Table (12) reveals that the average production and consumption of wheat in Egypt during the period (2024–2028) are projected to reach approximately 9.85 million tons and 24.22 million tons, respectively.

RECOMMENDATIONS

1. The state should prioritize horizontal expansion in wheat cultivation to increase production, which in turn would reduce Egypt's wheat import volumes and consequently decrease the national wheat import bill.
2. Strengthening the role of agricultural extension services in raising farmers' awareness regarding the adoption of certified seeds in cultivation, as this practice contributes to an approximate 10% increase in productivity.
3. Revisiting Egyptian wheat-related agricultural policies with the aim of encouraging the cultivation of higher-yielding varieties across different governorates, accompanied by the introduction of appropriate incentive mechanisms.
4. Enhancing the role of media institutions in raising consumer awareness with the objective of promoting rational consumption.

REFERENCES

Damodar N. Gujarati, Basic Econometrics, 4th ed, McGraw-Hill Companies , 2004.

Jeffrey M. Wooldridge, Introductory Econometrics - A Modern Approach - 2nd ed, 2003.

Mehran Suleiman Atiya (Ph.D.), *An Economic Study of Post-Harvest Losses of Major Cereal Crops during Storage in Warehouses and Silos of the Principal Bank for Development and Agricultural Credit*, Egyptian Journal of Agricultural Economics, Egyptian Association of Agricultural Economics, March 1992.

Michael D. Intriligator ,Econometric Models, Techniques, and Applications, Prentice-Hall ,Inc. Englewood Cliffs,N.J.1978.

Mohamed Fawzi Shahin et al., *Economic Analysis of the Present and Future of Wheat Self-Sufficiency in Egypt*, Egyptian Journal of Agricultural Economics, Egyptian Association of Agricultural Economics, Vol. 21, No. 3, September 2011.

Mona Kamal Riyad Abdel-Karim, *The Impact of Economic Reform Policies on the Wheat Sector in Egypt*, Master's Thesis, Department of Agricultural Economics, Faculty of Agriculture, Ain Shams University, 2007.

Mostafa Mohamed El-Saadany (Ph.D.), *An Economic and Social Study of the Factors Affecting Farmers' Adoption of New Varieties of Wheat and Rice in El-Beheira Governorate*, Annals of Agricultural Sciences, Moshtohor, Faculty of Agricultural Sciences, Moshtohor, Zagazig University, Vol. 28, 1990.

Nagi Abdel-Latif Mohamed Imam, *Economic Evaluation of Grain Improvement Projects in the Arab Republic of Egypt*, Ph.D. Dissertation, Department of Agricultural Economics, Faculty of Agriculture, Menoufia University, 1990.

OECD: Trade Policy Ussues, Assessing the Effects of the Uruguay Round, Paris, 1993.

الملخص العربي

الكفاءة الاقتصادية والتسويقة لمحصول القمح في مصر

محمد محمد السيد سليم شاهين ، محمد حمدي سالم، عبد الله محمود عبد المقصود ، ابراهيم علي محمد عبد الفتاح

يعد محصول القمح أحد أهم المحاصيل الإستراتيجية في الزراعة المصرية حيث يزرع اغلب محافظات مصر، يزرع منه حوالي ٣.١٦٧ مليون فدان عام ٢٠٢٣ ، حيث يستخدم فى انتاج الخبز الذى يعتبر لغذاء الاساسى للسكان على اختلاف مستوياتهم المعيشية، وهو المصدر الرئيسي للطاقة التي يحصلون عليها، وأنه يمد الجسم يوميا بنحو ٥٧٪ من الاحتياجات اليومية للفرد من المواد النشوية وجزء كبير من احتياجاته البروتينية ، تتمثل المشكلة البحثية فى ان نسبة الاكتفاء الذاتى من القمح بلغت نحو٤٦٪ فى عام ٢٠٢٣ ، وعلى الرغم من تزايد الانتاج المحلى منه . وقد يرجع ذلك الى السكانية وعدم قدرة الزيادة في الانتاج على مواجهة زيادة في الاستهلاك من القمح ودقيقه . وقد ادى ذلك إلى ان اصبحت مصر من اكبر دول العالم استيراداً للقمح حيث استوردت حوالى 9.212 مليون طن في عام ٢٠٢٤ ، أنه في حالة زيادة المساحة المزروعة بنصف مليون فدان يترتب علي ذلك زيادة الانتاج بنحو ١٠.٣٤ مليون طن وبمقدار تغير بلغ نحو ٠.٨٣ مليون طن في حين بلغ معدل التغير النسبي ٨.٧٣٪ ، وذلك بالإعتماد علي ان انتاجية القمح بلغت نحو ٢.٨٥ طن للفدان وتساهم المساحة الجديدة في تخفيض الفجوة الاستهلاكية من القمح بنحو ٨.٩١ مليون طن من الفجوة خلال نفس الفترة الدراسة والبالغ نحو ١٠.٣٤ مليون طن وبمقدار تغير بلغ نحو -١.٤٣ مليون طن في حين بلغ معدل التغير النسبي -١٣.٨٣٪، بالاضافة الي زيادة نسبة الاكتفاء الذاتي نتيجة زيادة المساحة الي حوالي ٥٥.١٠٪ وبمقدار تغير بلغ نحو ٧.١٨٪ في حين بلغ معدل التغير النسبي ١٤.٩٨٪ .

الكلمات المفتاحية : محصول القمح، الكفاءة التسويقية ، دوال الطلب ، التنبؤ .