An Economic Study of the Determinants of Egypt's Wheat Imports

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ABSTRACT

Wheat is considered one of the most strategic crops in Egyptian agriculture, cultivated across the majority of Egypt's governorates. In 2023, approximately 3.167 million feddans were planted with wheat. It is primarily used in the production of bread, which serves as a staple food for the population regardless of their socioeconomic status, and it is the main source of energy for individuals. Wheat provides approximately 57% of the daily carbohydrate requirements and a significant portion of the protein needs for individuals.

The wheat gap in Egypt has emerged due to the inability of domestic production to meet the growing food consumption needs. The research problem lies in the fact that the self-sufficiency rate of wheat was about 46% in 2023, 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 its flour. Consequently, Egypt has become one of the largest wheat-importing countries in the world, with imports reaching approximately 9.212 million tons in 2024.

The wheat import equation indicates a decline in import volumes by approximately 0.77% and 0.55% for every 1% increase in the import price per ton in $ and production quantity, respectively. This means that the most influential variables affecting wheat import volumes in a given year were the import price per ton in $ and the previous year's production. These variables were statistically significant at the 0.05 level, and the overall model was statistically significant as well. Moreover, approximately 61% of the variation in wheat imports can be explained by changes in the studied independent variables.

Keywords: Wheat crop, Simultaneous Equation Model, demand functions, forecasting.

INTRODUCTION

The importance of major cereal crops namely wheat, rice, and maize is reflected in their classification as strategic commodities that attract considerable attention from economic policymakers. Wheat, in particular, is the primary raw material in bread production, which constitutes a staple food for all segments of the population. Despite this significance, domestic production falls short of meeting the population's needs. Moreover, the rising percentage of post-harvest losses in wheat contributes to an increased reliance on imports to bridge the production-consumption gap, thereby escalating the burden of the import bill.

Wheat is considered one of the most vital strategic crops in Egyptian agriculture, cultivated across most of the country's governorates. In 2023, approximately 3.167 million feddans were allocated to wheat cultivation. The crop is essential for producing bread, the principal food item consumed by the population regardless of socioeconomic status. Wheat serves as a major source of energy, providing around 57% of the daily carbohydrate intake per person, in addition to a significant portion of their protein requirements.

The "wheat gap" in Egypt has emerged due to the inability of domestic production to keep pace with the growing dietary demand, which is in turn driven by rapid population growth. This gap has evolved under the influence of a complex set of technical, economic, and political factors. Fundamentally, it is attributable to the cumulative negative outcomes of generally ineffective economic policies, particularly agricultural policies. As a result of the widening wheat gap, the state has increasingly turned to wheat imports. The value of wheat imports reached approximately 4.443 $ billion in 2024.

RESEARCH PROBLEM

The research problem lies in the fact that the self-sufficiency ratio of wheat in Egypt reached only about 46% in 2023, despite the increase in domestic production. This situation may be attributed to rapid population growth and the inability of production increases to keep pace with rising levels of wheat and wheat flour consumption. As a result, Egypt has become one of the largest wheat-importing countries in the world, importing approximately 9.212 million tons in 2024. This reflects Egypt's growing dependence on foreign markets to bridge the wheat food gap.

However, instability in production within these international markets affects global wheat supply. A decline in global wheat production, coupled with increased global demand and the diversion of wheat in some countries toward biofuel production, has

DOI: 10.21608/esm.2025.445037
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Received June 10, 2025, Accepted, July 30, 2025..

contributed to a reduction in the available supply. This poses a significant risk to securing Egypt's wheat needs.

Accordingly, it becomes imperative to identify the obstacles facing Egypt as a wheat-importing country and to work toward addressing them. This research focuses on analyzing the impact of both domestic and global variables on Egypt's wheat import levels.

RESEARCH OBJECTIVES

The primary objective of this study is to identify the determinants of Egypt's wheat imports in light of changes in both domestic and international markets. This will be achieved through the following:

1. Examining key global economic indicators related to wheat.
2. Analyzing the economic characteristics of wheat production and consumption in Egypt.
3. Identifying the most important international wheat-supplying markets.

Determining the main factors influencing Egypt's wheat imports by deriving the wheat demand function, developing a simultaneous equation model, and forecasting the behavior of the variables under study.

RESEARCH METHOD AND DATA RESOURCES

To achieve the objectives of the study, both descriptive and statistical analytical methods were employed to describe and quantify the relationships among the various variables. The study utilized the general trend equation method, multiple regression analysis, and a simultaneous equations model.

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 online sources such as www.worldbank.com and 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
2023	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
2	Productivity	$\hat{Y}_i = 2.66 + 0.008\ X_i$ (55.2) (1.84)	0.29	3.37	0.17
3	Production	$\hat{Y}_i = 7835.5 + 86.40\ X_i$ (28.19) (3.54)**	0.99	12.56	0.43
4	Consumption	$\hat{Y}_i = 12508.7 + 525.6\ X_i$ (27.8) (13.30)**	2.96	176.8	0.91
5	Per Capita Share	$\hat{Y}_i = 190.3 - 0.50\ X_i$ (19.5) (-0.58)	-0.27	0.34	0.02
6	Gap	$\hat{Y}_i = 4673.2 + 439.2\ X_i$ (9.9) (10.62)**	4.85	112.8	0.87
7	Farm-Gate Price	$\hat{Y}_i = 237.7 + 295.5\ X_i$ (0.54) (7.62)**	9.26	57.99	0.77
8	Costs	$\hat{Y}_i = 453.8 + 742.2\ X_i$ (0.8) (15.33)**	10.65	234.9	0.93
9	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: Quantity, Value, and Price of Wheat Imports and Exports

1) Development of Egypt's Wheat Import Quantities during the Period (2005–2024):

Table (3), illustrates the development of Egypt's wheat import quantities, measured in thousand tons, over the period from 2005 to 2024. It is evident from the table that the lowest import quantity was recorded in 2005 at approximately 5.69 milliontons, while the highest quantity was observed in 2017 at around 12.93 milliontons. The average import quantity for the entire period was approximately 9.13 milliontons.

By analyzing the trend relationship of Egypt's wheat import quantities (in thousand tons) over the period (2005–2024), Table (4), shows that the quantity of wheat imports has been increasing by about 225.6 thousand tons annually during the study period. This annual increase represents approximately 2.5% of the period's average.

Table 3. Development of Quantity, Value, and Price of Wheat Imports and Exports During the Period (2005–2024)

Years	Import Quantity	Import Value	Import Price	Export Quantity	Export Value	Export Price
	Thousand Tons	Million $	$ per Ton	Tons	Thousand $	$ per Ton
2005	5687.8	924.6	162.6	386	60	155.4
2006	5816.9	964.5	165.8	690	110	159.4
2007	5911	1563.9	264.6	7153	2274	317.9
2008	5691.2	2760.2	485	502	138	274.9
2009	6435	1956.1	304	4622	2107	455.9
2010	9926.6	2181.9	219.8	7	3	428.6
2011	9800.1	3199.2	326.4	2665	1219	457.4
2012	8246.9	3196.9	387.6	539	168	311.7
2013	10288.4	721.7	70.1	49	13	265.3
2014	11158.9	3066.2	274.8	2	0.6	300
2015	10661.4	2523	236.6	506	464	917
2016	11138.4	2238.5	201	366	238	650.3
2017	12930.1	2636.5	203.9	1721	1309	760.6
2018	12504.6	2787.7	222.9	2273	1405	618.1
2019	10424.4	2975.5	285.4	2	3	1500
2020	9042.6	3216	355.7	8	13	1625
2021	9232.1	3496.4	378.7	7	11	1571.4
2022	9423.6	4271	453.2	4	2	500
2023	9156.2	3773.5	412.1	14166	5647	399
2024	9212.4	4442.8	482.3	6501	2294	353
Average	9134.4	2644.8	294.6	2108.5	873.9	601
Minimum	5687.8	721.7	70.1	2	0.6	155.4
Maximum	12930.1	4442.8	485	14166	5647	1625

Source: https://www.trademap.org

Table 4. General Time Trend Equations for the Development of Quantity, Value, and Price of Wheat Imports and Exports During the Period (2005–2024)

NO	Dependent Variables	Time Trend Equation	Annual Rate of Change*	F	R^2
1	Import Quantity	Ŷi = 6765.9+ 225.6 Xi (7.99) (3.19) *	2.5	10.19	0.36
2	Import Value	Ŷi = 1191.4+ 138.4 Xi (3.9) (5.4) *	5.2	28.99	0.62
3	Import Price	Ŷi = 203.2+ 8.71 Xi (4.2) (2.14) *	3.0	4.59	0.20
4	Export Quantity	Ŷi = 644.5+ 139.4 Xi (0.4) (1.01)	6.6	1.01	0.05
5	Export Value	Ŷi = 195.3+ 64.6 Xi (0.31) (1.21)	7.4	1.46	0.08
6	Export Price	Ŷi = 166.4+ 41.39 Xi (0.9) (2.7) *	6.9	7.23	0.29

Where:

- **Ŷi** = Estimated value of the dependent variable
- **Xi** = Time variable, where (1, 2, 3, …, 20)
- The value in parentheses indicates the calculated **T** value
- **(R^2)** = Coefficient of determination
- **(F)** = Overall significance of the regression model
- **(*)** Indicates the significance of the regression coefficient at the 0.05 significance level
- **( )** Indicates the non-significance of the regression coefficient

Source**:** Calculated from the data in Table (3) of the study.

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

The statistical significance of this trend, as well as the overall model, has been confirmed. Furthermore, the results indicate that around 36% of the variations in wheat import quantities can be attributed to factors reflected in the time variable.

2) Development of the Value of Egypt's Wheat Imports during the Period (2005–2024):

Table (3), illustrates the development of the value of Egypt's wheat imports, measured in million U.S. dollars, during the period from 2005 to 2024. It is shown that the lowest import value was recorded in 2013, amounting to approximately 721.7 million $, while the highest value was observed in 2022 at around 4.44 billion$. The average import value over the entire period was approximately 2.64 billion$.

An analysis of the trend in the value of Egypt's wheat imports (in million $) over the period (2005–2024), as presented in Table (4), reveals an annual increase of about 138.4 million $. This increase represents approximately 5.2% of the period's average. The trend was found to be statistically significant, as was the overall model.

Moreover, the results indicate that approximately 62% of the variations in the value of wheat imports can be attributed to a set of factors reflected in the time variable.

3) Development of the Import Price of Wheat in Egypt during the Period (2005–2024):

Table (3), illustrates the development of Egypt's wheat import price in $/ton over the period from 2005 to 2024. The table shows that the lowest import price was recorded in 2013, amounting to approximately 70.1 $/ton, while the highest price was observed in 2008 at around 485.0 $/ton. The average price over the entire period was approximately 294.6 $/ton.

An analysis of the trend in Egypt's wheat import price (in $/ton) over the period (2005–2024), as presented in Table (4), reveals an annual increase of about 8.71 $/ton, representing approximately 3.0% of the period's average. The trend was found to be statistically significant, as was the overall model.

Furthermore, the results indicate that approximately 20% of the variations in the wheat import price can be attributed to a set of factors captured by the time variable.

4) Development of Egypt's Wheat Export Quantities during the Period (2005–2024):

Table (3), shows the development of Egypt's wheat export quantities, measured in thousand tons, during the

period from 2005 to 2024. The table indicates that the lowest export quantity was recorded in 2014, at approximately 2.0 tons, while the highest was observed in 2023 at around 14.17 thousand tons. The average export quantity for the entire period was approximately 2.11 thousand tons.

An analysis of the trend in Egypt's wheat export quantities (in thousand tons) over the period (2005–2024), as indicated in Table (4), reveals an annual increase of about 139.4 tons, representing approximately 6.6% of the average. However, this trend was found to be statistically insignificant, as was the overall model. The results suggest that there is no clear pattern in the data and that the values tend to fluctuate around their arithmetic mean.

5) Development of the Value of Egypt's Wheat Exports during the Period (2005–2024):

Table (3), illustrates the development of the value of Egypt's wheat exports, measured in thousand U.S. dollars, over the period from 2005 to 2024. It is shown that the lowest export value was recorded in 2014 at approximately 0.6 thousand $, while the highest was observed in 2023, reaching approximately 5.65 million $. The average export value over the entire period was about 873.9 thousand $.

An analysis of the trend in the value of Egypt's wheat exports (in thousand $) over the period (2005–2024) reveals an annual increase of approximately 64.6 thousand $, representing around 7.4% of the period's average. However, this trend was found to be statistically insignificant, as was the overall model. The findings suggest that there is no consistent trend in the data, and that the values fluctuate around their arithmetic mean without a clear directional pattern.

6) Development of Egypt's Wheat Export Price during the Period (2005–2024):

Table (3), presents the development of Egypt's wheat export price, measured in $/ton, over the period from 2005 to 2024. The data indicate that the lowest export price was recorded in 2005 at approximately 155.4 $/ton, while the highest was observed in 2020 at around 1,625 $/ton. The average price over the entire period was approximately 601.0 $/ton.

An analysis of the trend in Egypt's wheat export price (in $/ton) during the period (2005–2024), as shown in Table (4), indicates an annual increase of about 41.14 $/ton, which accounts for approximately 6.9% of the average price over the period. This trend was found to be statistically significant, as was the overall model. Furthermore, the results show that around 29% of the variation in the wheat export price can be explained by the factors captured through the time variable.

Third: Egypt's Wheat Imports

1. Relative Importance of the Quantity and Value of Egypt's Wheat Imports during the Period (2020–2024):

Relative Importance of the Quantity of Egypt's Wheat Imports during the Period (2020–2024):

A review of the data in Table (5), shows that Russia ranked first in terms of the average quantity of wheat exported to Egypt, estimated at approximately 6.39 million tons, representing a relative importance of about 61.80% during the period (2020–2024). Ukraine, Romania, and France followed in second, third, and fourth places, with average quantities of approximately 1.54& 1.14 and 0.54 million tons, respectively. Their relative import shares during the same period were about 15.32%, 11.02%, and 5.24%, respectively.

Together, these four countries accounted for a total of approximately 93.37% of Egypt's wheat import quantities during the period. Meanwhile, the average quantity imported from all other countries combined was approximately 197.37 thousand tons, representing a relative importance of about 1.91%.

Table 5. Quantity of Egypt's Wheat Imports and Their Relative Importance (in Thousand Tons) During the Period (2020–2024)

Years	2020	2021	2022	2023	2024	Average	%
Russia	6845.3	5654.32	4769.69	6148.8	8525.68	6388.76	61.8
Ukraine	2646.98	2676.92	798.38	1081.39	713.43	1583.42	15.32
Romania	552.89	1608.37	1566.35	1171.6	795.84	1139.01	11.02
France	726.95	259.06	1299.67	298.38	124.56	541.72	5.24
Bulgaria	65.87	0	434.48	138.42	510.37	287.28	2.78
Australia	237.7	406.13	113.27	77.82	151.93	197.37	1.91
USA	84.19	8.33	85.89	140.74	208.98	105.63	1.02
Rest of the World	124.38	108.79	355.89	99.08	75.44	152.72	1.48
World	11284.24	10721.92	9423.61	9156.23	11106.24	10338.45	100

Source: Compiled and calculated from www.trademap.org

Relative Importance of the Value of Egypt's Wheat Imports during the Period (2020–2024):

An examination of the data presented in Table (6), reveals that Russia ranked first in terms of the average value of wheat exports to Egypt, estimated at approximately 2.31 billion $, with a relative importance of about 60.11% during the period (2020–2024). Ukraine, Romania, and France followed in second, third, and fourth positions, with average values of approximately 609.42, 428.12, and 234.80 million $, respectively. Their relative shares during the same period were about 15.87%, 11.15%, and 6.11%, respectively.

Combined, these four countries accounted for approximately 93.25% of the total value of Egypt's wheat imports during the period. In contrast, the average import value from all other countries amounted to approximately 61.17 million $, representing a relative importance of around 1.01%.

Fourth: Determinants of Egypt's Wheat Imports during the Period (2010–2024)

1. Determinants of Egypt's Imports of Russian Wheat:

The following equation models the quantity of Egypt's wheat imports from Russia as the dependent variable, while the following are considered independent variables: Egypt's wheat import price (in $/ton), wheat import prices from Turkey, Azerbaijan, and Nigeria, Egypt's population size, and Egypt's gross national income (in $). These variables are expected to have either a positive or negative effect on the quantity of wheat imported by Egypt during the period (2010–2024). This model aims to estimate the demand for wheat imports into Egypt, and the mathematical form of the demand function is as follows:

The results of the multiple linear regression model indicated that the relationships between each of the independent variables and the dependent variable were statistically insignificant. This was attributed primarily to econometric problems, foremost among them multicollinearity, as confirmed by the simple correlation coefficients and the correlation matrix.

However, the Stepwise Regression model revealed that the most influential factors affecting Egypt's wheat imports from Russia were: Egypt's wheat import price (in $/ton), Azerbaijan's wheat export price, Egypt's gross national income (in $)

The F-statistic indicated that the equation was statistically significant at the 0.05 level of significance. Moreover, the adjusted coefficient of determination (adjusted R^2) showed that approximately 91% of the variation in Egypt's wheat import quantity could be explained by the independent variables included in the model. This suggests that there are other influential factors affecting Egypt's wheat imports that were not captured in the model.

Table 6. Relative Importance of the Value of Egypt's Wheat Imports (in Million $) During the Period (2020–2024)

Years	2020	2021	2022	2023	2024	Average	%
Russia	1950.91	1820.47	2167.44	2545.11	3057.34	2308.25	60.11
Ukraine	754.39	885.04	364.58	447.97	595.13	609.42	15.87
Romania	157.57	531.76	705.26	467.77	278.22	428.12	11.15
France	207.18	85.65	581.89	123.64	175.65	234.8	6.11
Bulgaria	18.77	0	198.41	57.36	176.6	90.23	2.94
Australia	67.74	134.37	51.73	32.25	54.45	68.11	1.77
USA	23.99	2.76	39.22	58.31	74.89	39.83	1.04
Rest of the World	35.47	36.31	162.52	41.05	30.48	61.17	1.01
World	3216.03	3496.35	4271.02	3773.46	4442.76	3839.93	100

Source: Compiled and calculated from www.trademap.org.

$$\ln Y = 4.41 - 1.83 \ln X_1 + 1.42 \ln X_3 + 1.09 \ln X_6$$
$$(0.97) \quad (-5.86)^{**} \quad (3.76)^{*} \quad (4.03)^{**}$$
$$R^{-2} = 0.91 \qquad F = 14.22$$

Where:

- **Y**: Quantity of Egypt's wheat imports from Russia (in thousand tons)
- **X1**: Egypt's import price of Russian wheat ($/ton)
- **X2**: Turkey's import price of Russian wheat ($/ton)
- **X3**: Azerbaijan's import price of Russian wheat ($/ton)
- **X4**: Nigeria's import price of Russian wheat ($/ton)
- **X5**: Population of Egypt (in millions)
- **X6**: Egypt's gross national income (in billion $)
- **(****)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: Data from Table (1) in the Appendices.

2. Determinants of Egypt's Imports of Ukrainian Wheat:

The following equation models the quantity of Egypt's wheat imports from Ukraine as the dependent variable, while the following are considered independent variables: Egypt's wheat import price ($/ton), the import prices of Ukrainian wheat in Indonesia, Algeria, and Spain ($/ton). Egypt's population (in millions), and Egypt's gross national income (in billion $). These variables are expected to have either a positive or negative effect on the quantity of wheat imported by Egypt during the period (2010–2024). This model is used to estimate the demand for wheat imports into Egypt, and the mathematical form of the demand function is as follows:

The results of the multiple linear regression model showed that the relationships between each independent variable and the dependent variable were statistically insignificant. This was primarily due to econometric issues, most notably multicollinearity, as confirmed by the correlation matrix and simple correlation coefficients.

However, the Stepwise Regression model identified the most influential factors affecting Egypt's imports of Ukrainian wheat to be, Egypt's wheat import price ($/ton), Indonesia's import price of Ukrainian wheat, Egypt's gross national income (in $)

The F-statistic indicated that the model was statistically significant at the 0.05 significance level. Additionally, the adjusted R-squared value showed that approximately 88% of the variation in Egypt's wheat import quantities could be explained by the independent variables included in the model. This suggests that other influential factors affecting Egypt's wheat imports were not captured in the analysis.

$$\ln Y = 8.86 - 2.96 \ln X_1 + 1.89 \ln X_2 + 1.66 \ln X_6$$
$$(0.81) \quad (-3.60)^{*} \quad (2.35)^{*} \quad (3.54)^{*}$$
$$R^{-2} = 0.88 \qquad F = 12.15$$

Where:

- **Y**: Quantity of Egypt's wheat imports from Ukraine (in thousand tons)
- **X1**: Egypt's import price of Ukrainian wheat ($/ton)
- **X2**: Indonesia's import price of Ukrainian wheat ($/ton)
- **X3**: Algeria's import price of Ukrainian wheat ($/ton)
- **X4**: Spain's import price of Ukrainian wheat ($/ton)
- **X5**: Egypt's population (in millions)
- **X6**: Egypt's gross national income (in billion $)
- **(****)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: Data from Table (2) in the Appendices.

3. Determinants of Egypt's Imports of Romanian Wheat:

The following equation models the quantity of Egypt's wheat imports from Romania as the dependent variable. The independent variables include: Egypt's wheat import price ($/ton), as well as the import prices of Romanian wheat in Italy, Jordan, and Spain ($/ton), Egypt's population (in millions), and Egypt's gross national income (in billion $). These variables are expected to exert either a positive or negative effect on the quantity of wheat imported by Egypt during the period (2010–2024). This model is used to estimate the demand for wheat imports into Egypt, and the mathematical form of the demand function is as follows:

The results of the multiple linear regression model indicated that none of the independent variables had a statistically significant relationship with the dependent variable. This is primarily due to econometric problems, particularly multicollinearity, as confirmed by the correlation matrix and simple correlation coefficients.

However, the Stepwise Regression model identified the most influential factors affecting Egypt's wheat imports from Romania as: Egypt's wheat import price ($/ton), Italy's import price of Romanian wheat, Egypt's gross national income ($)

The F-statistic indicated that the model was statistically significant at the 0.05 significance level. Furthermore, the adjusted R-squared value indicated that approximately 62% of the variation in Egypt's wheat import quantity from Romania could be explained by the independent variables included in the model. This implies that other factors, not accounted for in the model, also influence Egypt's wheat imports.

$$\ln Y = 13.26 - 4.31 \ln X_1 + 4.56 \ln X_2 + 3.17 \ln X_6$$
$$(1.94) \quad (-2.05)^* \quad (2.00)^* \quad (3.46)^*$$
$$R^{-2} = 0.62 \qquad F = 8.62$$

Where:

- **Y**: Quantity of Egypt's wheat imports from Romania (in thousand tons)
- **X1**: Egypt's import price of Romanian wheat ($/ton)
- **X2**: Italy's import price of Romanian wheat ($/ton)
- **X3**: Jordan's import price of Romanian wheat ($/ton)
- **X4**: Spain's import price of Romanian wheat ($/ton)
- **X5**: Egypt's population (in millions)
- **X6**: Egypt's gross national income (in billion $)
- **(**)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: Data from Table (3) in the Appendices.

Fifth: Estimation of the Parameters of the Simultaneous Equation Model for Wheat:

Demand Function:

The demand side for wheat is represented in the form of a wheat consumption function. These functions can be expressed in the following mathematical form:

1- The following equation represents the consumption function:

$$Y_{2t} = f(Y_{2t-1}, x_7, x_8, x_9, x_{10})$$

y2t : Per capita wheat availability for consumption (kg)
y2t-1: Lagged per capita wheat availability for consumption (kg) (t–1)
x7 : Retail price of wheat (EGP/kg)
x8 :Retail price of maize (EGP/kg)
x9 :Per capita national income (EGP/year)
x10 :Retail price of rice (EGP/kg)

Supply Function:

The supply side in the Egyptian wheat demand model includes two main relationships: the first pertains to the factors affecting wheat production, while the second relates to the factors influencing the volume of wheat imports to Egypt. The persistent and growing deficit in Egyptian wheat demand has led to a continuous increase in imports to bridge the wheat food gap.

1. Production Function: This can be expressed in the following equation:

$$Y_{2t} = f(Y_{2t-1}, x_7, x_8, x_9, x_{10})$$

y1t: Per capita production (kg)
y1t-1: Lagged per capita production (kg) (t–1)
x1: Per capita cultivated area (m²)
x2: Lagged per capita cultivated area (m²) (t–1)
x3: Farm-gate price (EGP/ton)
x4: Lagged farm-gate price (EGP/ton) (t–1)
x5: Net return per feddan (EGP)
x6: Lagged net return per feddan (EGP) (t–1)

2- Import Function Equation:

$$Y_{3t} = f(x_{11}, x_{12}, x_{13})$$

y3t1: Per capita wheat imports (kg)
x11: Per capita wheat stock volume (kg)
x12: Lagged per capita wheat stock volume (kg) (t–1)
x13: Import price of wheat for Egypt ($/ton)

Results of the Statistical Estimation:

It is evident from the previous results that the model is over-identified. Therefore, the Three-Stage Least Squares (3SLS) method was the most appropriate approach for estimating the following econometric model. The statistical analysis yielded the following results:

1- Production Equation:

$$\ln Y_{1t} = 0.97 + .071 \ln X_1 + 0.05 \ln X_5 + 0.05 \ln X_6 + 0.20\, Y_{3-t}$$
$$(1.6) \quad (5.6)^{**} \quad (2.2)^* \quad (2.7)^* \quad (-3.5)^{**}$$
$$F^2 = 10.7 \qquad R^{-2} = 0.70 \qquad D.W = 2.02$$

2- Consumption Equation:

$$\ln Y_{2t} = 7.9 + 0.63 \ln Y_{1-t} - 0.67 \ln X_{10}$$
$$(5.5)^{**} \quad (2.2)^* \quad (-5.1)^{**}$$
$$F^2 = 11.5 \qquad R^{-2} = 0.56 \qquad D.W = 1.86$$

3- Import Equation:

$$\ln Y_{3t} = 2.1 - 0.77 \ln X_{13} - 0.55 \ln Y_{1-T}$$
$$(0.8) \quad (-5.8)^{**} \quad (-3.9)^{**}$$
$$F^2 = 13.8 \qquad R^{-2} = 0.61 \qquad D.W = 1.78$$

It is also evident from the wheat production equation that production increases by approximately 0.71%, 0.05%, and 0.20% for every 1% increase in, respectively: the average per capita share of cultivated area, the net return per ton (in Egyptian pounds), the net return from the previous year (EGP/ton), and the quantity of imports. This indicates that the most influential variables on wheat production in a given year, in order of impact, are: Per capita share of cultivated area, Net return per ton (EGP), Previous year's net return, Quantity of imports.The relationships were found to be statistically significant at the 0.05 level, and the overall model was statistically significant as well. The results further indicate that approximately 70% of the variation in wheat production can be explained by the independent variables included in the model.

Table 7. Forecast of Wheat Supply and Demand (in Thousand Tons) During the Period (2025–2029)

Years	Wheat Crop		
	Import Quantity	Consumption Quantity	Production Quantity
	Model: ARIMA(2,0,1)	Model: Linear trend	Model: Linear trend
2025	8958.9	23218.1	9676.8
2026	9046.2	23720.3	9765.1
2027	9061.7	24222.5	9853.4
2028	9078	24724.7	9941.7
2029	9087.4	25226.8	10030
Average	9046.4	24222.5	9853.4

Source: Forecasts were generated using Statgraphics software.

Based on the wheat consumption equation, it is evident that consumption increases by approximately 0.63% for every 1% increase in the average per capita production from the previous year. In contrast, wheat consumption decreases by approximately 0.17% for every 1% increase in the retail price of wheat (EGP per kilogram). This indicates that the most influential variables affecting wheat consumption in a given year are: Previous year's per capita production, Retail price of wheat (EGP/kg). The relationships were found to be statistically significant at the 0.05 level, and the overall model was statistically significant as well. Moreover, the results show that approximately 56% of the variation in wheat consumption is explained by the independent variables included in the model.

The wheat import equation indicates a decrease in the volume of imports by approximately 0.77% and 0.55% for every 1% increase in the import price ($/ton) and domestic production, respectively. This suggests that the most influential variables affecting wheat import volumes in a given year are: Import price ($/ton), Wheat production in the previous year.

These relationships were found to be statistically significant at the 0.05 level, and the overall model was statistically significant as well. The results further indicate that approximately 61% of the variation in wheat import volumes can be attributed to the changes in the independent variables included in the model.

Sixth: Use of Simultaneous Equation Models to Forecast Future Values of the Study Variables

Future economic forecasts are essential in shaping government policy and strategic direction, enabling policymakers to align their decisions with expected trends. Through such forecasts, the government can gain insight into the future outlook of critical commodities, which in turn informs national policy for those commodities. The proposed econometric model can be employed to estimate the expected values of the endogenous variables it encompasses.

Forecasting Using Simultaneous Equation Models for Projected Wheat Values During the Period (2025–2029):

As shown in Table (7), the average projected values of Egypt's wheat production, consumption, and imports during the period (2025–2029) are approximately 9.85 & 24.22, and 9.05 million tons, respectively.

RECOMMENDATIONS

1- The role of agricultural extension services should be activated to raise farmers' awareness and encourage the adoption of certified seeds, as this can lead to a 10% increase in production.

2- A reconsideration of Egypt's wheat-related agricultural policies is necessary, aiming to incorporate the cultivation of higher-yielding wheat varieties across governorates, alongside the implementation of incentive mechanisms to ensure compliance.

3- The role of the media should be enhanced in raising consumer awareness to promote rational consumption practices.

4- The diversification and multiplicity of wheat import sources is particularly important, given that Egypt is one of the world's largest wheat-importing countries. Therefore, wheat imports may be used as a political tool by exporting countries to exert pressure and achieve political or economic objectives.

5- Collaborating with the relevant state authorities to increase the wheat food security coefficient to 0.05, through horizontal expansion by cultivating wheat in newly reclaimed lands, or vertical expansion by promoting the cultivation of high-yield varieties nationwide. This also includes providing improved seeds free of charge or at subsidized prices, as well as focusing on rationalizing wheat consumption.

REFERENCES

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

Mostafa Mohamed El-Saadany, *An Economic and Social Study of the Factors Influencing Farmers' Choice of New Varieties of Wheat and Rice in Beheira Governorate*, Annals of Agricultural Science, Moshtohor, Faculty of Agricultural Sciences, Moshtohor, Zagazig University, Vol. 28, 1990.

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

Mehran Suleiman Atteya , *An Economic Study of Post-Harvest Losses of Major Cereal Crops During Storage in the Warehouses of the Principal Bank for Development and Agricultural Credit*, Egyptian Journal of Agricultural Economics, Egyptian Association of Agricultural Economics, March 1992.

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

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

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

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

الملخص العربي

دراسة اقتصادية لمحددات واردات مصر من القمح

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يعد محصول القمح أحد أهم المحاصيل الإستراتيجية في الزراعة المصرية حيث يزرع اغلب محافظات مصر، يزرع منه حوالي 3.167 مليون فدان عام 2023 ، 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 57% من الاحتياجات اليومية للفرد من المواد النشوية وجزء كبير من احتياجاته البروتينية. وظهرت الفجوة القمحية فى مصر نتيجة لعدم قدرة الإنتاج المحلى على الوفاء بالإحتياجات الإستهلاكية الغذائية المتزايدة، تتمثل المشكلة البحثية فى ان نسبة الاكتفاء الذاتى من القمح بلغت نحو46% فى عام 2023 ، 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 2024 كما توضح معادلة الواردات للقمح إلى تناقص حجم الواردات بنسبة بلغت حوالي 0.77% ، 0.55% لكل زيادة في سعر الاستيراد بالدولار للطن، كمية الانتاج بنسبة 1%. أي أن أكثر المتغيرات تأثيرا في حجم الواردات للقمح في سنة معينة كان سعر الاستيراد بالدولار للطن ، انتاج العام السابق . وقد ثبتت المعنوية الإحصائية عند مستوى 0.05، كما ثبتت معنوية النموذج ككل كما تبين أن حوالي 61% من التغيرات الحادثة في الواردات من للقمح ترجع إلى التغير في المتغيرات المستقلة محل الدراسة.

الكلمات المفتاحية : محصول القمح، النموذج الاني ، دوال الطلب ، التنبؤ.

APPENDICES

Table 1. Key Factors Influencing Egyptian Demand for Russian Wheat During the Period (2010–2023)

Years	Egypt's Import Quantity (in thousand tons)	Egypt's Import Price ($ /ton)	Turkey's Import Price ($ /ton)	Azerbaijan's Import Price ($ /ton)	Nigeria's Import Price ($ /ton)	Population (in million)	Gross National Income (in billion $)
2010	3264.3	177	165	200	200	89.2	196.3
2011	3777	249	228	232	220	91.1	216.8
2012	4297.9	287	267	316	285	93.2	245.2
2013	4134.5	253	248	255	252	95.3	268
2014	419.3	254	238	231	259	97.5	292.3
2015	3334.4	186	181	191	195	99.6	309.1
2016	4364.9	170	160	167	173	101.6	325.2
2017	6560.5	183	160	165	185	103.7	299.1
2018	7987.8	198	186	172	204	105.7	286
2019	7315.1	208	196	200	202	107.6	284.5
2020	6845.3	285	299	303	281	109.3	323.7
2021	5654.32	322	336	341	310	111	384.9
2022	4769.69	454	372	379	339	112.6	455.1
2023	6148.8	414	409	417	368	114.5	439.3
2024	8525.68	359	445	455	397	116.2	480.8

Source: www.trademap.org, www.worldbank.org

Table 2. Key Factors Influencing Egyptian Demand for Ukrainian Wheat During the Period (2010–2023)

Years	Egypt's Import Quantity (in thousand tons)	Egypt's Import Price ($ /ton)	Indonesia's Import Price ($/ton)	Algeria's Import Price ($/ton)	Spain's Import Price ($/ton)	Population (in million)	Gross National Income (in billion $)
2010	602.4	199	188	141	165	89.2	196.3
2011	390.8	274	260	248	248	91.1	216.8
2012	1944.3	276	283	237	259	93.2	245.2
2013	192.3	240	237	226	196	95.3	268
2014	209.9	229	221	180	188	97.5	292.3
2015	665.3	172	162	158	154	99.6	309.1
2016	2038.9	152	156	138	149	101.6	325.2
2017	2136.7	165	159	141	157	103.7	299.1
2018	2237.7	187	187	155	169	105.7	286
2019	2367.8	188	181	162	165	107.6	284.5
2020	2647	199	200	251	190	109.3	323.7
2021	2676.9	259	239	276	258	111	384.9
2022	798.4	277	229	288	198	112.6	455.1
2023	1081.4	176	176	208	169	114.5	439.3
2024	713.4	188	189	193	173	116.2	480.8

Source: www.trademap.org, www.worldbank.org

Table 3. Key Factors Influencing Egyptian Demand for Romanian Wheat During the Period (2010–2023)

Years	Egypt's Import Quantity (in thousand tons)	Egypt's Import Price ($ /ton)	Italy's Import Price ($/ton)	Jordan's Import Price ($/ton)	Spain's Import Price ($/ton)	Population (in million)	Gross National Income (in billion $)
2010	10.5	224	178	234	171	89.2	196.3
2011	165.6	263	280	264	271	91.1	216.8
2012	272.6	332	276	317	282	93.2	245.2
2013	267.9	260	276	312	252	95.3	268
2014	266.2	266	239	259	230	97.5	292.3
2015	822.2	215	224	212	193	99.6	309.1
2016	1004.6	173	192	194	173	101.6	325.2
2017	918.4	192	212	190	182	103.7	299.1
2018	1024.4	209	202	207	202	105.7	286
2019	675.5	215	201	204	179	107.6	284.5
2020	552.9	224	217	213	199	109.3	323.7
2021	1608.4	270	267	242	246	111	384.9
2022	1566.4	376	342	347	334	112.6	455.1
2023	1171.6	260	287	294	266	114.5	439.3
2024	795.8	248	238	236	236	116.2	480.8

Source: www.trademap.org, www.worldbank.org