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THE IMPACT OF EXCHANGE RATE LIBERALIZATION ON THE ECONOMIC IMPORTANCE OF SOME FODDER CROPS (YELLOW CORN, SOYBEANS) IN EGYPT

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Abstract:

This research investigates the economic importance of yellow corn and soybeans as key inputs in Egypt's poultry industry. Utilizing index number analysis, the study empirically examines the factors driving the economic value of these crops over the period 2011-2022.

The findings reveal a substantial increase in the economic importance of both crops, primarily driven by expanded cultivated areas. However, the study also highlights the contrasting performance of the two commodities. While yellow corn exhibited consistent growth across all components, soybeans experienced a decline in average yield, partially offset by increases in cultivated area and farm-gate prices.

The research underscores the intricate relationship between cultivated area, yield, and farm-gate price in determining the overall economic value of these crops. It emphasizes the need for policies aimed at increasing cultivated areas while simultaneously improving average yields and stabilizing farm-gate prices. By adopting a holistic approach that considers the interplay of these factors, policymakers can optimize the economic benefits derived from yellow corn and soybeans for Egypt's agricultural sector and broader economy.

The study contributes to the existing literature by providing empirical evidence on the economic dynamics of these crucial crops and offering insights for policy formulation to enhance agricultural productivity and food security.

Keywords: Yellow corn, Soybeans, Economic Importance, Index Numbers Analysis, Productive Policies.
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Introduction:

The poultry industry serves as a cornerstone of Egypt's food security. However, it grapples with significant challenges stemming from its heavy reliance on imported yellow corn and soybean to meet its feed requirements. This dependency exposes the industry to global price fluctuations, adversely impacting production costs and exerting pressure on Egypt's balance of trade.

Reforming Egypt's agricultural sector requires fundamental overhauls to its policy framework. This includes restructuring pricing, marketing, and support mechanisms for agriculture, as well as adjusting foreign trade, fiscal, and monetary policies that directly impact the sector (Manal Mashhour Elsayed, 2020).

Yellow corn, in particular, is a linchpin in the growth of the poultry, red meat, dairy, and egg industries. It constitutes approximately 40% of the concentrated feed for red meat and dairy animals, and between 60-70% for poultry and fish feed. Between 2011 and 2022, the average cultivated area of yellow corn was around 583.9 thousand feddans, yielding a total production of approximately 1872.6 thousand tons per feddan, the nation seeks to foster sustainable growth in the cultivation of strategic crops, including yellow corn, to mitigate food shortages and stimulate agricultural economic development (Amal Kamel Eid Ramadan, 2021).

Soybeans and their byproducts, particularly soybean meal, are essential components of feed for cattle, sheep, poultry, and other livestock. When mixed with yellow corn, they form a key ingredient in animal feed. The average cultivated area of soybeans during the period from 2011 to 2022 was about 35.3 thousand feddans, with a total production of approximately 46.15 thousand tons.

Research Problem:

The domestic production of yellow corn and soybeans, two economically vital crops, has consistently fallen below target levels in recent years despite concerted policy efforts to increase supply. This shortfall has resulted in marked fluctuations in self-sufficiency rates for both commodities. Between 2010 and 2019, the self-sufficiency rate for yellow corn decreased from 58.3% to 40.7% (Hammam and Ghada A. Al Damrawi, 2021). Similarly, the soybean self-sufficiency rate experienced a more pronounced decline, dropping from 3.2% in 2010 to 1.5% in 2021 (Mona A. T. Hussein, 2024). These fluctuations can be attributed to several economic factors, ultimately resulting in varying monetary contributions of these crops to agricultural income from year to year. These variations are dependent on factors such as cultivated area, average yield per feddan, and farm-gate prices, which are determined by supply and demand dynamics and the diverse end-uses of these crops.

Research Aims:

This research aims to identify the factors hindering increased domestic production of yellow corn and soybeans in Egypt, crucial commodities for the poultry industry. By examining the economic importance of these crops from 2011 to 2022, the study seeks to decompose their value into constituent elements, isolate influential factors, and measure their interrelationships. Ultimately, the research will provide insights to guide policymakers in optimizing agricultural resource allocation and prioritizing development initiatives to enhance food security and industry sustainability.

Research Methodology:

This research employed index numbers as an analytical tool for quantitatively measuring the components of economic significance and their interrelationships. Index numbers were utilized to assess the extent to which changes in the components of a phenomenon influence overall changes over time.

It's worth noting that the use of index numbers to measure the impact of elements or factors constituting a phenomenon is contingent upon two primary conditions. Firstly, all elements or factors under investigation must be quantifiable. Secondly, the value of the phenomenon must be the product of its constituent elements or factors (Bert M. Balk, 2008).

Essentially, the application of index numbers to measure the influence of specific factors on a phenomenon involves decomposing the overall index into partial indices corresponding to the constituent elements or factors. This allows for the analysis of both the

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independent (isolated) and interdependent (sequential) effects of these elements on the economic phenomenon under study.

The second method distinguishes itself from the first in that the value of the partial index number calculated for each individual element is not only linked to the degree of change of the element under study but is also associated with the changes in other elements. In other words, calculating partial index numbers in this manner considers the influence of all factors, which contrasts with the first method where each element's partial index number is calculated independently of the influence of other factors or elements.

This does not imply a contradiction between the two methods; rather, the second method complements the first. It decomposes the total effect on the phenomenon into components based on its constituent elements and measures the interconnected effects of these elements. Consequently, it enables the isolation and measurement of the impact of each individual element on the phenomenon's value in the comparison period (R_1) relative to the base period (R_0), using one of the following analytical methods: (Emad Younis Wahdan, 2003).

AND $R_0 = A_0 . Q_0 .P_0,$ $R_1 = A_1 . Q_1 .P_1$

Where:

- **A_0, A_1:** Represent the cultivated area of the crop in base period and comparison period, respectively, measured in feddans.
- **Q_0, Q_1:** Represent the average yield per feddan of the crop in base period and comparison period, respectively.
- **P_0, P_1:** Represent the farm-gate price per unit of output in base period and comparison period, respectively.

The isolated or independent impact of each constituent element on the change in the magnitude of the phenomenon between the comparison period and the base period can be determined using the following relationships:

1-Partial index of the effect of factor (A) on phenomenon (R)

$$I_A = \frac{A_1 Q_0 P_0}{A_0 Q_0 P_0} \times 100$$

2-Partial index of the effect of factor (Q) on phenomenon (R)

$$I_Q = \frac{A_0 Q_1 P_0}{A_0 Q_0 P_0} \times 100$$

3-Partial index of the effect of factor (P) on phenomenon (R)

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$$I_P = \frac{A_0\,Q_0\,P_1}{A_0\,Q_0\,P_0} \times 100$$

4-The overall index of change in the phenomenon (R)

$$I_R = \frac{A_1\,Q_1\,P_1}{A_0\,Q_0\,P_0} = \frac{R_1}{R_0} = I_A \,.\, I_Q \,.\, I_P$$

$$= \frac{A_1\,Q_0\,P_0}{A_0\,Q_0\,P_0} \times \frac{A_0\,Q_1\,P_0}{A_0\,Q_0\,P_0} \times \frac{A_0\,Q_0\,P_1}{A_0\,Q_0\,P_0} \times 100$$

And because the absolute algebraic sum of the partial effects of the components of the phenomenon, when considered separately or independently, does not equal the absolute value of the actual change in the size of the phenomenon between the base and comparison periods, as shown in the following relationship:

$$R_1 - R_0 \neq (A_1\,Q_0\,P_0 - A_0\,Q_0\,P_0) + (A_0\,Q_1\,P_0 - A_0\,Q_0\,P_0) + (A_0\,Q_0\,P_1 - A_0\,Q_0\,P_0)$$

In other words,

$$A_1\,Q_1\,P_1 - A_0\,Q_0\,P_0 \neq (A_1\,Q_0\,P_0 + A_0\,Q_1\,P_0 + A_0\,Q_0\,P_1) - 3(A_0\,Q_0\,P_0)$$

However, there remains a difference between them, known as the unexplained residual, which represents or expresses the result of the combined effect of the elements or factors on the phenomenon. This combined effect is not considered when calculating the partial indices for each element individually. Therefore, the importance of using the sequential or interconnected change analysis of the constituent elements of the phenomenon becomes apparent, utilizing the following relationships:

1-Partial index of the effect of factor (A) on phenomenon (R)

$$I_A = \frac{A_1\,Q_1\,P_1}{A_0\,Q_1\,P_1} \times 100$$

2-Partial index of the effect of factor (Q) on phenomenon (R)

$$I_Q = \frac{A_0\,Q_1\,P_1}{A_0\,Q_0\,P_1} \times 100$$

3-Partial index of the effect of factor (P) on phenomenon (R)

$$I_P = \frac{A_0\,Q_0\,P_1}{A_0\,Q_0\,P_0} \times 100$$

4-The overall index of change in the phenomenon (R)

$$I_R = \frac{A_1\,Q_1\,P_1}{A_0\,Q_0\,P_0} = \frac{R_1}{R_0} = I_A \,.\, I_Q \,.\, I_P$$

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$$= \frac{A_1\, Q_1\, P_1}{A_0\, Q_1\, P_1} \times \frac{A_0 Q_1\, P_1}{A_0\, Q_0\, P_1} \times \frac{A_0\, Q_0\, P_1}{A_0\, Q_0\, P_0} \times 100$$

Here, it is observed that the absolute algebraic sum of the partial effects of the components of the phenomenon, considering the impact of changes in other factors, equals the absolute actual change in the size of the phenomenon.

To isolate and quantify the interactive effects of the components constituting the phenomenon on the magnitude of the studied phenomenon, the following approach was adopted:

1-Isolating the joint effect of elements A and Q: In order to isolate the combined impact of element A and element Q on the overall change in the phenomenon from the effect of element A interacting with all other elements, the following relationship was employed:

$(A_1Q_1P_1 - A_0Q_1P_1) - (A_1Q_0P_1 - A_0Q_0P_1)$

2-To isolate the combined effect of factor (A) with factor (P) from the total change in the phenomenon resulting from the impact of factor (A) with all factors, while neglecting the influence of factor (Q), the following relationship was used:

$(A_1Q_0P_1 - A_0Q_0P_1) - (A_1Q_0P_0 - A_0Q_0P_0)$

3-And in the same way, the impact of the relationship between (Q) and (P) can be measured by applying the following equation:

$(A_0Q_1P_1 - A_0Q_0P_1) - (A_0Q_1P_0 - A_0Q_0P_0)$

To determine the percentage change in the phenomenon under study as a result of the change in each of its constituent elements, or in other words, to determine the relative weight of the change in each of the constituent elements of the phenomenon on the change in the phenomenon itself in the comparison period relative to the base period, the following relationships were used:

- The relative weight of the change in element (A) on the change in the phenomenon (R)

$$A_W = \frac{A_1Q_1\, P_1 - A_0\, Q_1\, P_1}{R_1 - R_0} \times 100$$

2-The relative weight of the change in factor (Q) on the change in phenomenon (R)

$$Q_W = \frac{A_0Q_1\, P_1 - A_0Q_0\, P_1}{R_1 - R_0} \times 100$$

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3-The relative weight of the change in factor (P) on the change in phenomenon (R)

$$P_W = \frac{A_0 Q_0 P_1 - A_0 Q_0 P_0}{R_1 - R_0} \times 100$$

The preceding analysis of index numbers demonstrates their general utility in examining economic phenomena and their constituent elements or influencing factors. Additionally, they enable the study of the relationships between these variables or elements and the quantification of the relative weight of each element's change on the overall change in the phenomenon

Furthermore, the index number model was employed to measure the impact of changes in individual cost components, identifying those components that most significantly contributed to cost increases. This was achieved through a sequential elimination of the effects of different components (Gehan Abdel Moez, 2014).

Where Ic represents the index number for the cost of production for one feddan

$$I_c = \frac{L_1+M_1+R_1+F_1+O_1+S_1+A_1+P_1}{L_0+M_0+R_0+F_0+O_0+S_0+A_0+P_0}$$

Where L represents the value of human labor, M represents the value of machinery and animal labor, R represents the value of land rent, F represents the value of chemical fertilizers, O represents miscellaneous expenses, S represents the value of seeds, A represents the value of organic manure, and P represents the value of pesticides during both the base period (2011-2016) and the comparison period (2017-2022).

To measure the impact of economic policies on net farm income per feddan and its components during the period 2011-2022, a quantitative analysis was employed. This involved assessing the relationship between net farm income per feddan and changes in its constituent elements using an index number model.

$\pi = [(Q.P) - C]$

Given that:

Q = Yield per feddan, P = Farm-gate price per unit of production, C = Cost per feddan, π = Net farm income per feddan

Data Sources:

Data pertaining to the study crops, yellow corn and soybeans, spanning the period from 2011 to 2022, was collected from agricultural economics bulletins published by the Economic Affairs Sector of the Ministry of Agriculture. Additionally, various studies, research papers, and relevant references were consulted to support the research.

Research Findings and Discussion:

First: Economic Significance of the Study Crops:

1.Yellow Corn:

The economic significance of yellow corn, as a primary component of poultry feed, is fundamentally tied to the monetary value of its output. Since the monetary value is the product of cultivated area, average yield per feddan, and farm-gate price, an increase in economic significance can be attributed to an increase in cultivated area, even if yield or price decreases. Conversely, a decrease in economic significance could be due to a decline in any of these components. Therefore, to accurately assess the impact of each component on the economic significance of yellow corn over a specific period, it is essential to measure the relative changes in each element during that same period.

Table 1 reveals a significant upward trend in the monetary economic importance of yellow corn during the period 2011-2022. The crop's monetary value surged from approximately 3111.8 million Egyptian pounds in the base period (2011-2016) to around 11717.01 million Egyptian pounds in the comparison period (2017-2022), marking a substantial increase of 8605.2 million pounds or 276.5%. A detailed analysis of the changes in the components contributing to the crop's economic importance between the two periods indicates that the partial indices for cultivated area, average yield per feddan, and farm-gate price experienced increases of approximately 172.9%, 103.6%, and 210.1%, respectively.

These findings indicate an approximate 72.9% increase in cultivated area, a 3.6% increase in average yield per feddan, and a 110.1% increase in farm-gate price per ton, respectively.

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Table 1: Relative Changes in the Economic Importance Components of Yellow Corn in Egypt during the period (2011-2022)

Monetary Economic Importance Components of the Crop — Item	Symbol	Base Period Average (2011-2016)	Comparison Period Average (2017-2022)	Index Number (%)
Cultivated area of the crop in feddans	A	444816	769095.3	172.9
Average production per feddan in tons	Q	3.1	3.3	103.6
Farm-gate price per ton in Egyptian pounds	P	2227.8	4680.95	210.1
Total monetary value in millions of Egyptian pounds	R	3111.8	11717.01	376.5

Source: Compiled and calculated from Table 1 in the appendix.

To quantify the impact of changes in each component of the crop's economic value on its overall change between 2017-2022 compared to 2011-2016, and to measure the relationship between these components, index numbers were utilized. By employing both the separate and joint methods of change analysis, the impact of individual factors could be isolated.

Table 2 presents the findings. For instance, when analyzing the isolated impact of an increase in cultivated area on the total monetary value, while holding other factors constant, the value increased by 2268.56 million Egyptian pounds. However, when considering the combined effect of this factor with other related elements, the increase in monetary value was significantly higher at 4940.33 million Egyptian pounds.

The additional increase of 2671.8 million Egyptian pounds can be attributed to the interactive effects of various factors. Approximately 2498 million pounds of this increase was due to the combined impact of cultivated area and the farm-gate price per ton of the crop. Moreover, the joint effect of cultivated area and average yield per feddan had a positive impact, contributing an additional 173.7 million Egyptian pounds to the increased monetary value.

It was observed that when analyzing the isolated impact of an increase in average yield per feddan on the total monetary value of the crop, independent of other factors, it resulted in a 113.42 million

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Egyptian pound increase. However, when measuring the impact of this factor in conjunction with its relationship to other elements, it contributed to a 238.30 million Egyptian pound increase in monetary value. This additional increase of 124.89 million Egyptian pounds is attributed to the relationship between average yield per feddan and the farm-gate price per ton of the product. The analysis revealed that the increase in the farm-gate price per ton of the crop, assuming constant cultivated area and average yield per feddan, had a significant impact, amounting to approximately 3426.58 million Egyptian pounds.

Table 2: Analysis of the Total Change in the Monetary Economic Importance of Yellow Corn in Egypt (2011-2022)

Components of Economic Importance		Separate Measurement	Joint Effect of Elements		Sequential Measurement	Specific Weight of the Effect of Elements
Item	Symbol		Q	P		
Cultivated area of the crop in feddans	A	2268.56	173.7	2498.0	4940.33	57.41
Average production per feddan in tons	Q	113.42	-	124.89	238.30	2.77
Farm-gate price per ton in Egyptian pounds	P	3426.58	-	-	3426.58	39.82
Total monetary value in millions of Egyptian pounds	R	5808.56	173.7	2622.93	8605.21	100

Source: Calculated from data in Table 1

To determine the percentage change in the economic value of the crop resulting from a change in each of its constituent elements, and to determine the specific weight of the change in each of the components of the economic value of the crop on the change in the value of this importance by approximately 8605.21 million Egyptian pounds in the comparison period (2017-2022) compared to the base period (2011-2016), it was found that the specific weight of the increase in the cultivated area by 72.9% led to an increase in the economic value of the crop by about 57.41% of that increase, and that the increase in the farm-gate price per unit of output by 110.1% contributed 39.82% of the value of the change, or the increase in the economic value of the crop. The increase in the average yield per feddan of the crop from its level in the base period by 3.6% was

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responsible for an increase in the economic value of the crop by 2.77%. It is clear from this that the area factor plays the main role in increasing the economic value of the yellow corn crop, especially since its increase is likely to encourage farmers to increase the average yield per feddan.

2. Soybean

The economic significance of soybeans as a primary component of poultry feed is primarily determined by the monetary value of its output. As previously mentioned, the magnitude of this economic significance is influenced by several factors, most notably the cultivated area, yield per feddan, and farm-gate price. Therefore, it is crucial to analyze the trends in each of these elements.

Table 3 reveals a significant increase in the total monetary value of soybean production in Egypt during the period 2011-2022. The average annual value rose from approximately 148.6 million Egyptian pounds during 2017-2022 to around 586.03 million pounds during 2011-2016, representing an increase of 437.4 million pounds or 294.2%.

Table 3: Relative Changes in the Monetary Economic Importance Components of Soybean Crop in the Arab Republic of Egypt during the period (2011-2022)

Monetary Economic Importance Components of the Crop		Base Period Average (2011-2016)	Comparison Period Average (2017-2022)	Index Number (%)
Item	Symbol			
Cultivated area of the crop in feddans	A	26112.8	44241.5	169.4
Average production per feddan in tons	Q	1.4	1.3	88.6
Farm-gate price per ton in Egyptian pounds	P	4032.1	10586	262.5
Total monetary value in millions of Egyptian pounds	R	148.6	586.03	394.2

Source: Calculated and collected from Table 2 in the appendix.

Furthermore, the data in Table 3 indicates that the index numbers for changes in the components of the soybean's economic significance between the two periods show increases of 169.4%, and 262.5% for cultivated area, and farm-gate price, respectively. This implies that both the cultivated area and the farm-gate price increased by 69.4% and 162.5%, respectively, during the comparison period (2017-2022), while the average yield decreased by 11.4% compared to the base period.

To measure the impact of changes in each component of the crop's monetary economic significance and to assess the influence of the relationship between these components on the value of this significance during the period (2017-2022) relative to (2011-2016), index numbers were utilized to isolate this effect using both the separate (independent) and connected (sequential) change methods.

The results, tabulated in Table 4, reveal that when analyzing the isolated impact of an increase in the cultivated area on the total monetary value, independent of other factors, it led to a rise of 103.20 million Egyptian pounds. However, when examining the connected impact of this factor along with its relationship to other elements, it contributed to an increase of 240.13 million Egyptian pounds in the crop's monetary value. The analysis indicates that the impact of the relationship between the cultivated area and average yield per feddan on the total monetary value of the crop was approximately 136.93 million Egyptian pounds. Similarly, the impact of the relationship between the cultivated area and the farm-gate price per unit of the crop on the change in the total monetary value was around 167.7 million Egyptian pounds. Likewise, when studying the isolated impact of an increase in the average yield per feddan on the total monetary value, independent of other factors, it resulted in a decrease of 30.81 million Egyptian pounds.

It was observed that when analyzing the isolated impact of a decrease in the average yield per feddan on the total monetary value of the crop, independent of other factors, the value decreased by 16.90 million Egyptian pounds. However, when measuring the impact of this factor in conjunction with its relationship to other elements, the value decreased by 44.38 million Egyptian pounds. This larger decrease is attributed to the interaction between average yield per feddan and the farm-gate price per ton of the product, which was estimated to contribute an additional 27.48 million Egyptian pounds to the overall reduction. Finally, the results indicate that an increase in the farm-gate price per ton of the crop, assuming constant cultivated area and average yield per feddan, led to an increase of approximately 241.62 million Egyptian pounds in the total value To determine the percentage

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change in the monetary economic importance of the crop due to changes in each of its constituent elements, and consequently to determine the specific weight of each of these elements in the change in the monetary economic importance of the crop by approximately 437.38 million Egyptian pounds in the comparison period (2017-2022) compared to the base period (2011-2016), it was found that the specific weight of the 69.4% increase in the cultivated area led to an increase in the monetary economic importance of the crop by about 54.90% of that increase, and that the 162.5% increase in the farm-gate price per unit of output contributed 55.24% of the value of the change, or the increase in the monetary economic importance of the crop. The decrease in the average yield per feddan by 11.4% compared to the base period was responsible for a decrease in the monetary economic importance of the crop by 10.15%. It is clear from this that the area factor plays a major role in increasing the monetary economic importance of the soybean crop, especially since its increase can mitigate the decrease in average yield per feddan.

Table 4: Analysis of the Total Change in the Monetary Economic Importance of Soybean Production in Egypt (2011-2022)

Components of Economic Importance		Separate Measurement	Joint Effect of Elements		Sequential Measurement	Specific Weight of the Effect of Elements
Item	Symbol		Q	P		
Cultivated area of the crop in feddans	A	103.20	(30.81)	167.7	240.13	54.90
Average production per feddan in tons	Q	(16.90)	-	(27.48)	(44.38)	(10.15)
Farm-gate price per ton in Egyptian pounds	P	241.62	-	-	241.62	55.24
Total monetary value in millions of Egyptian pounds	R	327.92	(30.81)	140.27	437.38	100

( ) The figures in parentheses are negative.
Source: Calculated from the data in Table 3.

Second: Analysis of Cost Components for the Study Crops:

1. Yellow Corn:

An index number model was employed to measure the impact of changes in individual cost components, thereby identifying the most influential factors contributing to increased costs. Through a sequential elimination process of the various components, the results shown in Table 5 were obtained, detailing the evolution of production costs per feddan of yellow corn in response to changes in its components.

Table 5: Changes in Production Cost Components per feddan of Yellow Corn, 2011-2022

Item		Comparison Period (2017-2022)
I. Production Cost per feddan by Component		
$L_0+M_0+R_0+F_0+O_0+S_0+A_0+P_0$		4733.20
$L_1+M_0+R_0+F_0+O_0+S_0+A_0+P_0$		6901.23
$L_1+M_1+R_0+F_0+O_0+S_0+A_0+P_0$		7936.07
$L_1+M_1+R_1+F_0+O_0+S_0+A_0+P_0$		9336.57
$L_1+M_1+R_1+F_1+O_0+S_0+A_0+P_0$		9959.57
$L_1+M_1+R_1+F_1+O_1+S_0+A_0+P_0$		10365.41
$L_1+M_1+R_1+F_1+O_1+S_1+A_0+P_0$		10691.17
$L_1+M_1+R_1+F_1+O_1+S_1+A_1+P_0$		10877.17
$L_1+M_1+R_1+F_1+O_1+S_1+A_1+P_1$		11079.51
II. Index Numbers for Production Costs when Changing:		
Labor Costs (L)	(2÷1) × 100	145.80
Machinery and Animal Labor Costs (M)	(3÷2) × 100	114.99
Rent (R)	(4÷3) × 100	117.65
Chemical fertilizers (F)	(5÷4) × 100	106.67
Miscellaneous Expenses (O)	(6÷5) × 100	104.07
Seeds (S)	(7÷6) × 100	103.14
Organic fertilizer (A)	(8÷7) × 100	101.74
Pesticides (P)	(9÷8) × 100	101.86
All Cost Components (C)	(9÷1) × 100	234
III. Absolute Change in Production Costs per feddan:		
Labor Costs (L)	(2-1)	2168.03
Machinery and Animal Labor Costs (M)	(3-2)	1034.84
Rent (R)	(4-3)	1400.50
Chemical fertilizers (F)	(5-4)	623.00
Miscellaneous Expenses (O)	(6-5)	405.84
Seeds (S)	(7-6)	325.76
Organic fertilizer (A)	(8-7)	186.00
Pesticides (P)	(9-8)	202.33
All Cost Components (C)	(9-1)	6346.3

Source: Compiled and calculated from Table 3 in the Appendix.

The baseline production cost per feddan was estimated at EGP 4733.20. Subsequent changes in cost components led to an increase in production costs during the comparison period. Labor costs emerged as the primary driver of this increase, rising by EGP 2168.03 to reach EGP 6901.23 per feddan, representing a 45.80% increase compared to the baseline period.

Meanwhile, changes in rental costs ranked second in terms of their contribution to the overall increase. Costs associated with rent reached EGP 9336.57, signifying an absolute increase of EGP 1400.5 compared to the baseline year. The index number for the change in rental costs revealed a 17.65% increase during the comparison period relative to the baseline.

When calculating the change in all items of production costs per feddan, it was found that production costs increased by EGP 6346.3 per feddan during the comparison period (2017-2022) compared to the base period (2011-2016), which amounted to approximately EGP 4733.20 per feddan, representing an increase of 134% over the base period, as shown in Table (5).

2. Soybean:

A study of the evolution of production costs per feddan of soybeans, as various cost components changed, revealed the results shown in Table 6. It is evident that the production cost per feddan during the base period was approximately EGP 3731.17 Changes in the various components led to an increase in costs per feddan during the comparison period. Labor costs emerged as the primary driver of this increase, rising by EGP 2051.60 to reach EGP 5782.76 per feddan, representing an absolute increase of 54.99% compared to the base period.

The change in the value of machinery and animal labor came in second place, contributing to the overall increase. These costs amounted to approximately 7015.98 Egyptian pounds per feddan, representing an absolute increase of 1233.2 Egyptian pounds per feddan compared to the base year. When calculating the index number for the change in the value of machinery and animal labor, it was found that this factor was responsible for a 21.33% increase during the comparison period relative to the base year.

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Table 6: Changes in Production Cost Components per feddan of Soybean, 2011-2022

Item		Comparison Period (2017-2022)
I. Production Cost per feddan by Component		
$L_0+M_0+R_0+F_0+O_0+S_0+A_0+P_0$		3731.17
$L_1+M_0+R_0+F_0+O_0+S_0+A_0+P_0$		5782.76
$L_1+M_1+R_0+F_0+O_0+S_0+A_0+P_0$		7015.98
$L_1+M_1+R_1+F_0+O_0+S_0+A_0+P_0$		8446.98
$L_1+M_1+R_1+F_1+O_0+S_0+A_0+P_0$		9031.41
$L_1+M_1+R_1+F_1+O_1+S_0+A_0+P_0$		9433.74
$L_1+M_1+R_1+F_1+O_1+S_1+A_0+P_0$		9853.32
$L_1+M_1+R_1+F_1+O_1+S_1+A_1+P_0$		10010.22
$L_1+M_1+R_1+F_1+O_1+S_1+A_1+P_1$		10176.09
II. Index Numbers for Production Costs when Changing:		
Labor Costs (L)	(2÷1) × 100	154.99
Machinery and Animal Labor Costs (M)	(3÷2) × 100	121.33
Rent (R)	(4÷3) × 100	120.40
Chemical fertilizers (F)	(5÷4) × 100	106.92
Miscellaneous Expenses (O)	(6÷5) × 100	104.45
Seeds (S)	(7÷6) × 100	104.45
Organic fertilizer (A)	(8÷7) × 100	101.59
Pesticides (P)	(9÷8) × 100	101.66
All Cost Components (C)	(9÷1) × 100	273
III. Absolute Change in Production Costs per feddan:		
Labor Costs (L)	(2-1)	2051.60
Machinery and Animal Labor Costs (M)	(3-2)	1233.21
Rent (R)	(4-3)	1431.00
Chemical fertilizers (F)	(5-4)	584.43
Miscellaneous Expenses (O)	(6-5)	402.33
Seeds (S)	(7-6)	419.58
Organic fertilizer (A)	(8-7)	156.91
Pesticides (P)	(9-8)	165.87
All Cost Components (C)	(9-1)	6444.9

Source: Compiled and calculated from Table 4 in the Appendix.

When calculating the change in all production cost items per feddan, it was found that the production cost increased by EGP 6444.9 per feddan during the comparison period, compared to EGP 3731.17 per feddan in the base period, representing a 173% increase over the base period, as detailed in Table 6.

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Third: Net Returns per Feddan and Its Components for the Studied Crops

1) Yellow Corn:

To assess the impact of economic policies during the period (2011-2022) on the net returns per feddan and its components, a quantitative analysis of the relationship between net returns per feddan and changes in its components was conducted. Table 7 presents the results, illustrating the changes in net returns per feddan for both yellow corn and soybeans, starting from the base period where net returns were estimated at approximately EGP 2175.18/feddan and EGP 1923.7/feddan, respectively. The analysis examined changes in net returns per feddan when farm-gate prices and yield per feddan varied independently and jointly, as well as in relation to changes in production costs per feddan.

Table 7: Index Numbers and Absolute Values of the Factors Determining Net Returns of Yellow Corn and Soybean Crops and Changes in Their Components during the Period (2011-2022)

Item / Variable		Yellow Corn	Soybean
I. Net Return per Feddan in Egyptian Pounds:			
1 $\{(Q_0.P_0)-C_0\}$		2175.18	1923.7
2 $\{(Q_1.P_1)-C_1\}$		4725	3698.3
3 $\{(Q_1.P_0)-C_0\}$		2620.7	1520.5
4 $\{(Q_1.P_1)-C_0\}$		10716.1	10040.6
II. Index Numbers of Net Return per Feddan Due to Changes in:			
1 All factors	% (2÷1)	217.2	192.2
2 Productivity per feddan	% (3÷1)	120.5	79
3 Farm-gate price	% (4÷3)	408.9	660.3
4 Production costs	% (2÷4)	44.1	36.8
III. Absolute Change in Production Costs per Feddan:			
1 All factors	(2-1)	2549.8	1774.6
2 Productivity per feddan	(3-1)	445.6	(403.2)
3 Farm-gate price	(4-3)	8095.4	8520.1
4 Production costs	(2-4)	(5991.2)	(6342.3)

Source: Compiled and calculated from data in tables (1, 2, 3, 4) in the appendix.

- Change in yield per feddan:

With a constant farm-gate price and production cost per feddan, the net return per feddan for yellow corn and soybeans experienced a change of EGP 2620.7 and EGP 1520.5, respectively. Yellow corn saw an absolute increase of approximately EGP 445.6 per feddan, while soybean experienced a decrease in net return of EGP 403.2 per feddan. When calculated as an index, the increase in net return for yellow corn was approximately 120.5%, whereas the loss in net return for soybeans was estimated at 21% compared to the base year.

- **Changes in Farm-Gate Prices:** A change in farm-gate prices, while holding costs constant, led to an increase in net returns per feddan for both yellow corn and soybeans. Specifically, net returns increased by approximately EGP 10716.1 and EGP 10040.6 per feddan for yellow corn and soybeans, respectively. This represents an absolute increase of EGP 8095.4 and EGP 8520.1 per feddan. When calculated as an index, the increase in net returns for the studied crops was approximately 408.9% and 660.3%, respectively.
- **Changes in per feddan production costs:** This resulted in a decrease in net returns for yellow corn and soybeans by EGP 5991.2 and EGP 6342.3 per feddan, respectively. Calculating the index of loss in net returns revealed a decrease of approximately 44.1% for yellow corn and 36.8% for soybeans.

Collectively, changes in all components of net return per feddan for both yellow corn and soybeans resulted in a significant increase over the comparison period. The net return per feddan rose by approximately EGP 4725 and EGP 3698.3 for yellow corn and soybeans, respectively, representing absolute increases of EGP 2549.8 and EGP 1774.6 per feddan. The index numbers for these increases were estimated at 217.2% and 192.2% for yellow corn and soybeans, respectively.

Conclusion:

The analysis reveals that both yellow corn and soybeans have experienced significant growth in economic importance during the study period. While the cultivated area emerged as the primary driver of this growth for both crops, the contributions of average yield per feddan and farm-gate prices were also notable. The interactive effects among these components further amplified the overall increase in economic value.

However, the study also highlights the contrasting performance of the two crops. Yellow corn exhibited consistent growth across all components, leading to a substantial increase in net returns. In contrast, soybeans experienced a decline in average yield, partially offset by increases in cultivated area and farm-gate price.

These findings underscore the importance of policies aimed at increasing cultivated areas for both crops while simultaneously improving average yields. Additionally, strategies to stabilize and increase farm-gate prices are crucial for enhancing the profitability of these commodities. A comprehensive approach considering the interrelationships between these factors is essential for maximizing the economic benefits of yellow corn and soybeans for the agricultural sector and the broader economy.

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Appendix:

Table 1: Cultivated Area, Average Yield per Feddan, Total Production, and Farm-Gate Price of Summer Yellow Corn in Egypt (2011-2022)

Year	Cultivated Area (Feddan)	Yield per Feddans (Ton)	Total Production (Ton)	Farm-Gate Price (EGP/Ton)*
2011	276349	3.11	858317	1923.7
2012	317870	3.11	988414	2115.7
2013	415246	3.17	1314269	2256.1
2014	467138	3.29	1534580.96	2285.7
2015	518951	2.98	1548481	2314.3
2016	673342	3.19	2149430	2471.4
Mean	444816.0	3.1	1398915.3	2227.8
2017	842164	3.35	2822671	3000.0
2018	846803	3.17	2683537	3185.7
2019	782701	3.25	2543194	3321.4
2020	746118	3.29	2452666	3785.7
2021	816166	3.31	2702774	4707.1
2022	580620	3.16	1834243	10085.7
Mean	769095.3	3.3	2506514.2	4681.0

* The farm-gate price, expressed in Egyptian Pounds per ardeb, has been converted. Note that one ardeb is equivalent to 0.140 metric tons.

Source:

- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Agricultural Statistics Bulletin, Part Two: Summer and Nile Crops**, various issues.
- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Agricultural Prices Bulletin, Part Two: Summer and Nile Crops**, various issues.

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Table 2: Cultivated Area, Average Yield per Feddan, Total Production, and Farm-Gate Price of Soybean in Egypt during the Period (2011-2022)

Year	Cultivated Area (Feddan)	Yield per Feddans (Ton)	Total Production (Ton)	Farm-Gate Price (EGP/Ton)
2011	22719	1.310	29765	2868
2012	17106	1.516	25939	4119
2013	22423	1.460	32747	4213
2014	28485	1.399	39858	4262
2015	33896	1.377	46671	4342
2016	32048	1.408	45136	4388
Mean	26112.83333	1.411826404	36686	4032.05
2017	30557	1.254	38310	5357
2018	38190	1.225	46777	6034
2019	29451	1.228	36161	6041
2020	29946	1.203	36027	6062
2021	49052	1.276	62582	18068
2022	88253	1.322	116681	21954
Mean	44241.5	1.251281873	56089.665	10586

Source:

- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Agricultural Statistics Bulletin, Part Two: Summer and Nile Crops**, various issues.
- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Agricultural Prices Bulletin, Part Two: Summer and Nile Crops**, various issues.

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Table 3: Evolution of Cost Items per Feddan of Summer Yellow Corn Production during the Period (2011-2022)

Year	Labor Wages	Costs of animal labor	Cost of machinery or equipment	Cost of seeds	Cost of organic fertilizer	Cost of chemical fertilizer	Cost of pesticides	overhead costs	Total costs
2011	1216	8	417	209	173	496	47	231	2797
2012	1205	11	504	249	200	491	46	244	2950
2013	802	11	442	140	116	295	20	183	2009
2014	1512	16	559	281	222	493	84	285	3452
2015	1694	-	636	272	224	538	86	310	3760
2016	1900	20	673	286	211	590	93	340	4113
Mean	1388.2	13.2	538.5	239.5	191.0	483.8	62.7	265.5	3180.17
2017	2388	-	956	399	299	775	162	448	5427
2018	2932	-	1203	482	326	866	189	540	6538
2019	3369	-	1418	545	306	925	186	607	7356
2020	3771	-	1637	589	281	964	193	671	8126
2021	4128	-	1952	665	534	1496	403	826	7840
2022	4749	-	2353	712	516	1615	457	936	11338
Mean	3556.2	-	1586.5	565.3	377.0	1106.8	265.0	671.3	7770.8

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Bulletin of Cost Statistics and Net Returns**, Various Issues.

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Table 4: Evolution of Cost Items per Feddan of Soybean Production during the Period (2011-2022)

Year	Labor Wages	Costs of animal labor	Cost of machinery or equipment	Cost of seeds	Cost of organic fertilizer	Cost of chemical fertilizer	Cost of pesticides	overhead costs	Total costs
2011	789	-	489	84	12	388	63	183	2008
2012	892	-	331	86	-	430	113	167	2019
2013	847	-	580	88	-	440	99	185	2239
2014	798	-	689	95	-	439	121	193	2335
2015	894	-	731	98	-	436	142	207	2508
2016	1057	-	831	130	-	514	142	241	2915
Mean	879.5	-	608.5	96.8	12.0	441.2	113.3	196.0	2337.3
2017	2039	-	908	324	154	594	125	373	4517
2018	2549	-	1124	398	184	756	157	465	5633
2019	2589	-	1833	416	-	905	288	543	6574
2020	2827	-	2038	457	-	996	320	597	7235
2021	3558	-	2296	705	-	1247	343	733	8882
2022	4025	-	2851	798	-	1656	442	879	10651
Mean	2931.2	-	1841.7	516.3	169	1025.7	279.2	598.3	7248.7

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **Bulletin of Cost Statistics and Net Returns**, Various Issues.

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أثر تحرير سعر الصرف على الأهمية الاقتصادية لبعض محاصيل الأعلاف (الذرة الصفراء، فول الصويا) في مصر

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المستخلص:

يهدف هذا البحث إلى دراسة الأهمية الاقتصادية للذرة الصفراء وفول الصويا كمدخلات أساسية في صناعة الدواجن في مصر .باستخدام تحليل الأرقام القياسية، قامت الدراسة بتحليل العوامل المؤثرة على القيمة الاقتصادية لهذه المحاصيل خلال الفترة من 2011 إلى 2022.

أظهرت النتائج زيادة كبيرة في الأهمية الاقتصادية لكلا المحصولين، مدفوعة بشكل أساسي بزيادة المساحات المزروعة .ومع ذلك، سلطت الدراسة الضوء على أداء متباين للمحصولين .بينما شهدت الذرة الصفراء نموًا ثابتًا في جميع المكونات، بينما عانى فول الصويا من انخفاض في متوسط الإنتاجية، والذي تم تعويضه جزئيًا بزيادة في المساحة المزروعة وسعر البيع في المزرعة.

تؤكد الدراسة على العلاقة بين المساحة المزروعة والإنتاجية وسعر البيع في المزرعة في تحديد القيمة الاقتصادية الإجمالية لهذه المحاصيل .وتشدد على الحاجة إلى سياسات تهدف إلى زيادة المساحات المزروعة مع تحسين متوسط الإنتاجية في نفس الوقت وتثبيت أسعار البيع في المزرعة لتعزيز ربحية هذه السلع .من خلال اتباع نهج شامل يأخذ في الاعتبار التفاعل بين هذه العوامل، حتى يمكن لصناع السياسات تحقيق أقصى استفادة اقتصادية من الذرة الصفراء وفول الصويا لقطاع الزراعة والاقتصاد المصري ككل.

تساهم هذه الدراسة في الأدبيات القائمة من خلال تقديم أدلة تجريبية على الديناميكيات الاقتصادية لهذه المحاصيل الحيوية وتقديم رؤى لصياغة السياسات لتعزيز الإنتاجية الزراعية والأمن الغذائي.

الكلمات المفتاحية :الذرة الصفراء، فول الصويا، الأهمية الاقتصادية، تحليل الأرقام القياسية، السياسات الانتاجية.