

An economic study on forecasting the sugar market in Egypt in 2035

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ABSTRACT

The sugar production in Egypt is estimated at 1952 thousand tons and the sugar cane and sugarcane production is 52.2%, 47.8% respectively, and the sugar gap is estimated at 877 thousand tons for the middle period (2000-2022). The problem of the study is the increase in the food gap in sugar in Egypt, As a result of the lack of local production, the needs of the consumer are met, and the study aims to provide a future statement of the amount produced and consumed and imported through the three stages of growth and forecasting the amount produced and finished from sugar in the year 2035. . The study concluded that the quantity imported and the number of the population directly affect the consumption of sugar, while the consumer price has an inverse effect, while the quantity produced is affected by the quantity imported and the quantity produced from sugar beets in the previous year. to increase the amount imported from sugar, , and the amount of sugar produced in the year 2035 is 3447.2 thousand tons, while the amount of consumed sugar is 4747.9 thousand tons, and the amount of the sugar gap is 1279.3 million tons, and the amount of imports is 1771.2 million tons. The study is based on contract farming for the production of beets and sugar, and attention to the use of modern technology to increase sugar production and the possibility of closing the gap. Tight control over the markets is due to the presence of monopolies from greedy middlemen in the Egyptian sugar market, which affects the consumer due to his inability to obtain the commodity.

I. INTRODUCTION

Sugar is considered one of the most important strategic food commodities that receives great attention from the Egyptian state due to the economic importance of sugar crops. The sugar industry in Egypt depends mainly on the two crops

(cane and sugar beets), which represent one of the sources of agricultural and national income. Which is considered an entry point for the manufacture and extraction of its raw material from sugar, as it is an essential factor in the manufacture of many other food industries. The sugar industry represents one of the most important food processing industries due to the establishment of some other industries based on it, and in light of the global changes and their economic effects on the state's balance of payments to cover the increasing consumer needs of Sugar, The state seeks to achieve an appropriate rate of food security as one of the goals of economic policy by developing the agricultural sector as it is responsible for providing crops and food products, as the average production quantity and consumption volume reached about 1962 and 2802.5 thousand tons, respectively, and the average self-sufficiency was estimated at about 68.8%, in Egypt. During the period (2000-2022).

Research problem

The problem of the study lies in the growing nutritional gap in sugar in Egypt. As a result of the lack of local production to meet consumer needs, which leads to fluctuation in production, and the continuous increase in quantities consumed, which leads to exacerbation of the instability of local prices and an increase in the amount of sugar imports, this is reflected in an increase in the burden on the Egyptian balance of payments, especially in light of this increase in sugar. Sugar imports due to the sharp rise in global prices over the past few years

The Aim of the Study:

The research aims to reach the most important factors that affect the produced ,consumed and imported quantities of Egypt's sugar through the use of Simultaneous Equations System for a three-stage econometric model.

Data Sources:

The study depends on official data sources like the Central Agency for Public Mobilization and Statistics and bulletins issued by the Central Administration of Agricultural Economy at the Ministry of Agriculture and Land Reclamation

In a study by Allam and Salem(3) in 2012, the results showed that by measuring the standards of the nominal protection factor and the effective protection factor, the value of the two factors is less than the correct one in the case of sugar beets, while it is more than the correct one in wheat, which means that there is protection and incentives for wheat production despite the forms of support. The direct and indirect benefits that sugar beet farmers receive from both companies and the Sugar Crops Council include seed support, control, mechanized agriculture, extension service, training, and other forms of support. The study recommends continuing to provide both direct and indirect support to sugar beet farmers, which is consistent with what is permitted within the framework of international trade agreements, given that the sugar beet crop is a lesser source of water consumption for the sugar industry compared to the sugar cane crop. In addition to contributing to bridging the sugar food gap by increasing the supply of domestic product, and reducing the degree of dependence on global markets to meet part of the local needs for sugar and under the conditions imposed by those markets, thus reducing the deficit in the balance of payments as well as reducing the severity of the risks associated with those markets, The possibility of confronting the fierce competition resulting from flooding the local market with white sugar imported from the European Union and importing parties without customs or controls governing imports. The strategy of the Arab Republic of Egypt aims to address the shortcomings arising from the distortion of international sugar prices. This is done by protecting the local industry through customs tariffs and protectionism Working with the import quota system and determining import quantities, whether of raw sugar or white sugar, in light of policy indicators related to the development of sugar crops and the sugar industry, and in light of local and global changes and challenges.

In a study by Muslim (1)in 2014, it aimed to study and analyze some of the economic variables associated with the production and consumption of sugar in Egypt. The results of the study indicated that the production capacity of sugar beets in Egypt ranged between a minimum of about 65 thousand tons in 2004 and a maximum of

about 1,382 thousand tons in 2010, with an average of about 470 thousand tons. The agricultural price of sugar in Egypt ranged between a minimum of about 91 pounds per ton in 1998 and a maximum of about 355 pounds/ton in 2011, with an average of about 174 pounds/ton. The study recommended maximizing the use of by-products of the sugar industry, such as cane and beets, in order to achieve financial liquidity that enables companies to.. implementing the investments that you plan, the need to work to provide additional quantities of sugar cane and sugar beets to avoid the presence of some idle capacities in sugar factories, especially for companies that produce sugar from beets. Make more efforts to increase the efficiency of sugar extraction in sugar factories from both cane and beets. Using price incentives to encourage farmers to grow the two crops and supply them to factories. The need to set appropriate farm prices for crop producers.

Doaa Muhammad (6)in 2020, study indicated that sugar production in Egypt is produced from sugarcane and sugar beets, with sugar beets contributing about 58.9% of the total production, greater than sugarcane, which represents about 41.1%.The study showed, in light of both the strategic stock and the average local consumption of sugar of about 2.9 million tons, that the food security factor for sugar in Egypt is estimated at about 0.11 during the study period, and therefore it is necessary to increase the strategic stock of sugar for local consumption for a period of no less than 6 months until it reaches The value of the food security factor is set to 0.5 according to food security considerations By estimating the Gini coefficient for the geographical distribution of both the quantity and value of Egyptian exports of cane sugar, it amounted to about 32% and 36% for each of them, respectively, during the study period, while the quantity and value of Egyptian imports of cane sugar amounted to about 88%, 83% for each of them, respectively. During the study period, while the quantity and value of Egyptian exports of beet sugar amounted to about 36% and 39% for each, respectively, during the study period, while the quantity and value of Egyptian imports of beet sugar amounted to about 81%, 50% for each, respectively, during the study period. . The study then reached the optimal distribution of Egyptian sugar exports and imports using programming by objectives

Shaima Samir(11) in 2023, study in which the results of the policy analysis matrix indicated an improvement in the relative advantage of the sugarcane crop, while that advantage declined in the case of sugar beets. With regard to

sugar production, the results of applying the partial equilibrium model indicated the positive impact of the applied policies, which is represented in producers receiving implicit support, Consumers bear an implicit tax. By analyzing the value chain of the sugar beet crop as a case study, it was found that the highest value added was attributed to the farmer (33.38%), followed by the factory (12.11%), the packing companies (7.46%) and the retailer (5.3%). Then the wholesaler (5%). Accordingly, the study recommends encouraging cooperation between stakeholders in the value chain, with increased attention to recycling by-products and waste from the sugar industry. To raise the efficiency of the value chain and make it more sustainable.

Dalia M. Nasr El Batran, and Yehia M. M. Khalil(5) in 2023, The study aimed to identify the impact of using an integrated package of modern technology on the production of the sugar beet crop, which was reflected on the productive and economic indicators of the crop, through a sample of sugar beet. Through some productive and economic indicators, the study showed the relative superiority of farmers who use the technology package over their who do not use the technology package. So The study recommends the importance of expanding for the contract farming of the sugar beet crop, as well as the need to apply the technological packages to improve and increase production and then increase the net yield, which will lead to a decrease in the Egyptian sugar gap as well as the fodder gap.

The development of production, consumption, the gap and the imporats of sugar in Egypt for the period (2000-2022)

II. RESULTS AND DISSECTIONS:

As shown in table no.(1) that the produced quantity of sugar cane in Egypt increases annually at a statistically significant rate of about 67.7 thousand tons, representing about 7.2% of the average production of about 1024 thousand tons during the period (2000-2022), the produced quantity of total sugar in Egypt increases annually at a statistically significant rate of about 63.1 thousand tons, representing about 3.3% of the average production of about 1932.9 thousand lion tons during the period, while the annual increase rate of total sugar consumption is about 78.4 thousand tons, representing about 2.8% of the average consumption of about 2822.5 thousand tons, which means that there is a large gap between the produced and the consumed quantity of sugart , that shortage in the sugart quantities is filled by imports, whose annual increase rate is about 39.5 thousand tons, representing about 4.8% of the average sugar imports amounting to about 822 thousand tons for the average study period (2000-2022). It was found that the amount of the sugar gap increases annually at a rate of about 17.1 thousand tons, representing about 2.01% of the average sugar gap for the study period, which amounted to about 888.7 thousand tons, while the stock sugar to decrease, reaching 12.6 thousand tons , representing about 3.4% of the average stock sugar the study period,.

Table1. Time series analysis equations of production, consumption and imports quantities of sugar Egypt during the period (2000-2022)

Indicators	Equation	R ²	Average	change rate%
production of sugar beet quantity (thousand tons)	$\hat{Y}_i = 1095 - 5.8 x_i$ (-1.9)	0.14	1024	-0.54
Production of sugar cane quantity (thousand tons)	$\hat{Y}_i = 124.4 + 67.7 x_i$ (18.4)**	0.94	938	7.2
Production of sugar quantity (thousand tons)	$\hat{Y}_i = 1175.7 + 63.1 x_i$ (15.8)**	0.92	1932.9	3.3
consumption quantity (thousand tons)	$\hat{Y}_i = 1861.8 + 78.4 x_i$ (16.1)**	0.92	2822.5	2.8
sugar gap (thousand tons)	$\hat{Y}_i = 666 + 17.1 x_i$ (3.6)**	0.38	888.7	2.01
Stock of sugar quantity (thousand tons)	$\hat{Y}_i = 511.8 - 12.6 x_i$ (-3.1)**	0.31	362	-3.4
Imports of sugar quantity (thousand tons)	$\hat{Y}_i = 347.4 + 139.5 x_i$ (3.8)**	0.40	822	4.8

**Significant at 0.01

sugar \hat{Y}_i is the value of the Dependent variable.

X_i is the value of the time independent variable during the period (2000- 2022). Where, $i = (1, 2, 3 \dots 23)$.

Source:

^{1/} The Central Agency for Public Mobilization and Statistics, the annual research of the movement of production and foreign trade, and the availability of consumption of agricultural commodities, in different numbers.

^{2/} Ministry of Agriculture and Land Reclamation, Central Administration of Agricultural Economy, Food Balance Bulletin, various issues.

^{3/} Central Agency for Public Mobilization and Statistics, website: WWW.Capmas.gov.eg

Model description

The model consists of three structural equations in addition to the definitions

1- The local sugar consumption equation: It was assumed that the most important factors affecting the amount of sugar consumed are the amount of sugar imports, the consumer price of sugar, and the population.

2- The local sugar production equation: It was assumed that the most important factors affecting the quantity of sugar produced are the quantity of sugar imported, and the price of the sugar produced. The quantity of beets produced in the previous year

3- Sugar import equation: It was assumed that the most important factors affecting the quantity of sugar imports are the quantity of sugar stocks, the import price of sugar, and the population. The price of the sugar product

4- Definition equation: The amount of sugar consumed = the amount produced locally + the amount of imports + inventory.

Below is the mathematical description of the behavioral and definitional equations in the model

Equation of factors affecting local consumption of sugar

Consumption Equation

$$QCOt = \alpha + \beta1QMOt + \beta2RLCt + \beta3Pt$$

Equating the factors affecting local sugar production

Production Equation

$$QPOt = \alpha + \beta1QMOt - \beta2RLPt + \beta3Pbt-1$$

Equating the factors affecting Egyptian imports of sugar

Import Equation

$QIOt = \alpha + \beta1 QSOt + \beta2IPWt + \beta3Pt + \beta4RLPt$
As for the mathematical description of the induction equation, it is as follows:

Definitional Equation

$$QCOt = QPOt + QIOt$$

QCOt = The amount of sugar consumed is in thousand tons per year

QPOt = The amount of sugar produced is in thousand tons per year

QSOt = The stock quantity of sugar is one thousand tons per year

QIOt = Quantity of sugar imports in thousand tons per year

IP t = Import price of sugar in dollars per ton per year

RPOt = The produced price of sugar is in pounds per ton per year

Pt = Population in million people per year

Pbt-1 = The quantity of sugar beets produced in the previous year

RLCt = Consumer price of sugar per year

Description and rating of the model:

Estimating the multi-equation econometric model is relatively more difficult compared to those single-equation models, because it requires many stages and main steps, starting from the description of economic relations (according to economic logic) and then determining the most important variables that will be used according to the matrix of simple correlation coefficients, and then determining The best mathematical images that will be used in statistical analysis and after completing the preparation of the model parameter. The degree of definition of the model is determined, then the most appropriate methods of estimation are determined. In this regard, the study used the total form sometimes and the average form at other times, in addition to the logarithmic images for each of them. All these permutations and reconciliations between the variables of the model used under certain criteria were economic logic, statistical significance, and distance as possible from the problems of econometric measurement in order to ensure the accuracy of the obtained estimates as much as possible and so that they can be relied upon in forecasting later.

Consumed Quantity Equation

It was revealed from the equation of the quantity of sugar consumed that there is a statistically significant, direct relationship between

the amount of sugar imported and the amount consumed, as by increasing the amount of sugar imported by one unit, the consumption of sugar in Egyptian society increases by about 0.924 thousand tons. It also became clear that there is a direct relationship between the amount of sugar consumed and the number of Population in Egypt: By increasing the population by one unit, which is one million people, the quantity consumed increased by about 46.1 thousand tons. While it was found that there is an inverse relationship between the consumer price and the quantity consumed, which means that increasing the consumer price by one unit led to a decrease in the quantity consumed by about 0.086 thousand tons, and the coefficient of determination is estimated at about 0.54, meaning that 54% of the changes in the quantity of sugar consumed are due to the quantity imported. And the number of population and consumer prices. It is the duty of the executive authorities in the state to carefully study the consumer prices that are controlled by monopolistic intermediaries. The calculated (F) value was about 123.8, which means the significance of the model, which confirms the superiority of the simultaneous model over the three stages

Produced Quantity Equation

It became clear from the relationship between the quantity of sugar produced and the influencing factors that there is a statistically significant, direct relationship between the quantity of imports and the quantity produced, as by increasing the quantity of imports by one unit, producers tended to compete by increasing their production by about 0.841 thousand tons. It was found that there was a direct relationship between the production of sugar beets in the previous year by one unit. One that encouraged producers and increased their production by about 0.063 thousand tons. his explains the significant increase of sugar beets in the production of beet sugar during the school period. On the other hand, the statistical

significance of the product price was not confirmed, which is the only way to encourage producers to increase their production and reduce the sugar content, which affects the improvement of the self-sufficiency rate. The coefficient of determination was about 0.64, which means that 64% Of the changes in the quantity produced, it is due to the imported quantity and sugar production from the sugar beet crop in the previous year. The calculated value of (F) was about 102.7, which is greater than the tabular (F), which confirms the significance of the simultaneous model for the three stages

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Table No. (2) Functions of the Egyptian sugar market during the period (2000-2022)

Statement	Equation	R ²	F
Consumption	$QCOt = 1437.3 + 0.924QMOt - 0.086 RLCt + 46.1 Pt$ <p style="text-align: center;">(1.23) (2.9) ** (3.9)**</p> <p style="text-align: center;">(2.663)**</p>	0.54	124
Production	$QPOT = 815.2 + 0.841QMOt - 0.044RLPt + 0.063 Pbt-1$ <p style="text-align: center;">(5.9)**)** (-1.3) (2.8)**</p> <p style="text-align: center;">(3.4</p>	0.64	

Import	QIOt =1719 +0.009QSot + 0.03PWt+ 39.4pt + 0.00004RIPt	0.66	49
	(0.12) (0.03) (005) (2.7)**		
	(0.001)		

Source: Results of the sugar market model in Egypt in the appendix

Forecasting the quantity produced and consumed, the sugar gap and imports

It is clear from Tables (3), (4), (5), (6) and the graphs that the amount of sugar produced in 2035 will reach about 3447.2 thousand tons, while the amount consumed will reach about 2802.5 thousand tons, and the sugar gap will reach about

1279.3 thousand tons, and the gap will be closed. Through the imported quantity, which amounts to about 1771.2 thousand tons, it is clear that the quantity consumed exceeds the quantity produced, and thus the imported amount of sugar will increase, negatively affecting the Egyptian agricultural trade balance.

Table No. (3) Forecasting the quantity produced (2023-2035)

	production	Lower 95.0%	Upper 95.0%
Period	Forecast	Limit	Limit
2023	2690.07	2402.06	2978.08
2024	2753.17	2462.17	3044.16
2025	2816.26	2522.08	3110.45
2026	2879.36	2581.79	3176.93
2027	2942.46	2641.31	3243.61
2028	3005.55	2700.64	3310.47
2029	3068.65	2759.79	3377.51
2030	3131.75	2818.78	3444.72
2031	3194.85	2877.6	3512.09
2032	3257.94	2936.26	3579.62
2033	3321.04	2994.77	3647.31
2034	3384.14	3053.13	3715.14
2035	3447.23	3111.36	3783.11

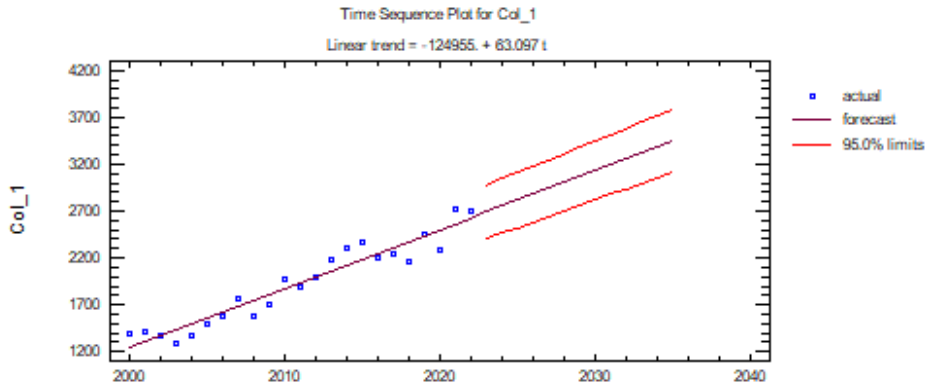


Table No. (4) Forecasting the quantity consumed (2023-2035)

	consumption	Lower 95.0%	Upper 95.0%
Period	Forecast	Limit	Limit
2023	3961.22	3718.08	4204.35
2024	3850.35	3550.82	4149.88
2025	3931.94	3627.16	4236.73
2026	4013.53	3703.59	4323.48
2027	4095.13	3780.1	4410.16
2028	4176.72	3856.69	4496.75
2029	4258.31	3933.36	4583.26
2030	4339.9	4010.1	4669.7
2031	4421.49	4086.91	4756.07
2032	4503.08	4163.79	4842.37
2033	4584.67	4240.73	4928.61
2034	4666.26	4317.74	5014.79
2035	4747.85	4394.8	5100.9

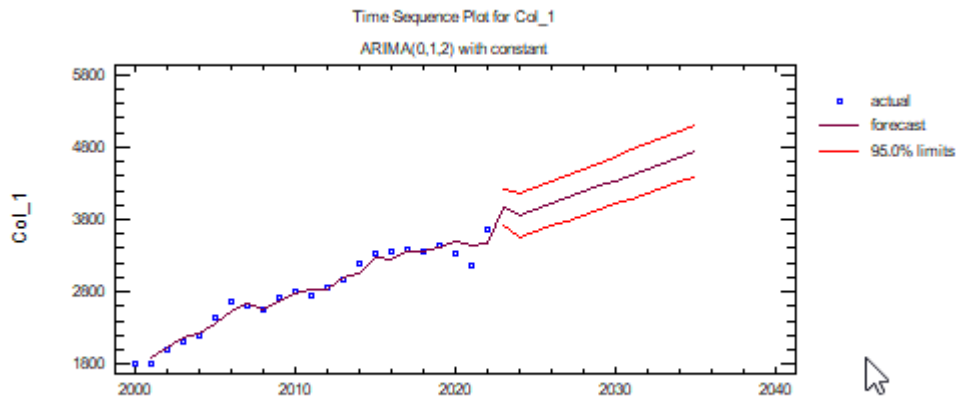


Table No. (5) Prediction of the amount of the sugar gap (2023-2035)

	Gap sugar	Lower 95.0%	Upper 95.0%
Period	Forecast	Limit	Limit
2023	979.945	692.085	1267.81
2024	1004.89	597.795	1411.99
2025	1029.84	531.247	1528.43
2026	1054.78	479.061	1630.5
2027	1079.73	436.052	1723.4
2028	1104.67	399.561	1809.78
2029	1129.62	368.011	1891.23
2030	1154.56	340.371	1968.76
2031	1179.51	315.928	2043.09
2032	1204.45	294.16	2114.75
2033	1229.4	274.675	2184.13
2034	1254.35	257.167	2251.52
2035	1279.29	241.395	2317.19

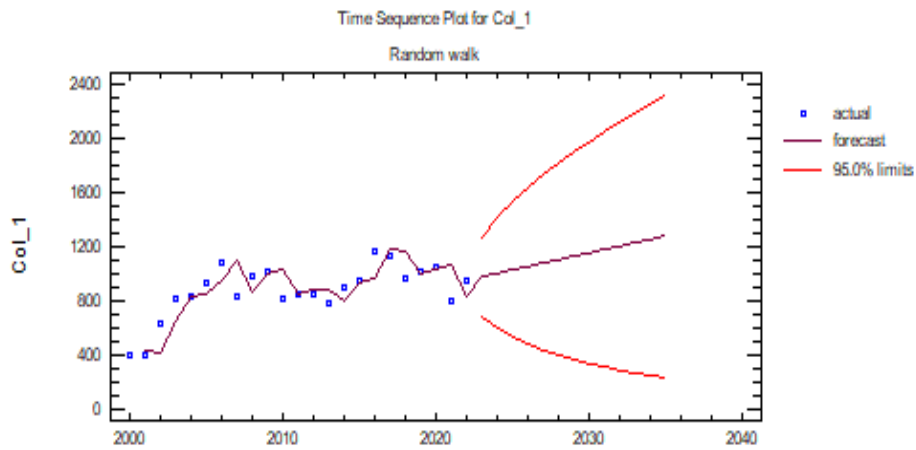
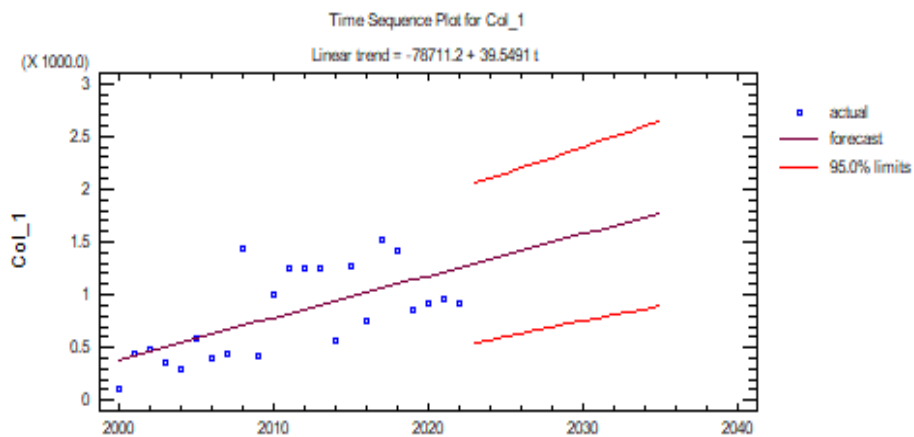


Table No. (6) Forecasting the imported quantity (2023-2035)

	important	Lower 95.0%	Upper 95.0%
Period	Forecast	Limit	Limit
2023	1296.61	541.167	2052.06
2024	1336.16	572.887	2099.43
2025	1375.71	604.071	2147.35
2026	1415.26	634.734	2195.78
2027	1454.81	664.895	2244.72
2028	1494.36	694.572	2294.14
2029	1533.91	723.782	2344.03
2030	1573.45	752.542	2394.37
2031	1613.0	780.871	2445.14
2032	1652.55	808.786	2496.32
2033	1692.1	836.302	2547.9
2034	1731.65	863.438	2599.86
2035	1771.2	890.208	2652.19



Research recommendations

The general time trend equations confirmed a statistically significant increase in the amount of beet sugar produced. The increase is affected by the use of modern technological packages. Sugarcane and sugar beet producers must apply modern technologies to bridge the sugar gap.

The simultaneous model shows the importance of prices for producers and consumers, and it shows the control of monopolistic brokers in the sugar market. It is the duty of the authorities to control prices, break monopolies in the Egyptian market, and tighten punishment for market manipulators.

Field studies have shown the importance of contract farming, and attention must be given to its implementation in sugar crops in Egypt.

It is clear that there is idle capacity in sugar factories in Egypt, and the state's executive authorities must strive to reduce and reduce idle capacity.

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Appendix

Tabel (1) Results of the sugar market model in Egypt

Equation	Obs	Parms	RMSE	"R-sq"	chi2	
Qct	20	3	311.6681	0.5399	123.84	0.0000
Qpt	20	3	253.3669	0.6351	102.70	0.0000
Qmt	20	4	291.45	0.6603	49.25	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Qct						
- Qmt	.9237916	.3187522	2.90	0.004	.2990488 1.548535	1.30
- RLCt	-.0856874	.0218854	-3.92	0.000	-.128582 -.042792	-.04
- Pt	46.14492	17.36534	2.66	0.008	12.10949 80.18035	80.1
_cons	-1437.291	1165.609	-1.23	0.218	-3721.842 847.260	847.26
Qpt						
- Qmt	.8410769	.2452707	3.43	0.001	.3603552 1.321800	1.32
RLPt	-.0435654	.0334938	-1.30	0.193	-.1092121 .0220813	.02
- Pbt1	.063452	.0225222	2.82	0.005	.0193094 .1075946	.107
_cons	815.1702	137.8446	5.91	0.000	544.9998 1085.340	1085.34
Qmt						
QSt	.0090626	.3478686	0.03	0.979	-.6727473 .6900221	.690
IPWt	.0329262	.6237865	0.05	0.958	-1.189673 1.123821	1.12
- Pt	39.43382	14.52458	2.71	0.007	10.96616 67.90149	67.90
RLPt	.0000388	.0510778	0.00	0.999	-.1000719 .1000719	.100
_cons	-1719.222	13894.53	-0.12	0.902	-28951.99 25559.55	25559.55

Exogenous variables: Qct Qpt Qmt
 Exogenous variables: RLCt Pt RLPt Pbt1 QSt IPWt
 more--