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ECONOMIC ANALYSIS OF SUGARCANE AND SUGAR BEET IN EGYPT

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ABSTRACT: Sugarcane and sugar beet are the sources of sugar in Egypt. Upper Egypt's economy is heavily dependent on sugarcane production. Disruptions to the area planted with sugarcane would impact the livelihood of many families that live directly on it's farming, plus a plethora of ancillary business built around sugar production. The study aims to analyze the production, area and yield of sugarcane and sugar beet in Egypt. The study used the regression as a statistical technique that shows the relationship between the independent variable and the dependent variable. The mean of sugarcane production for the time period 1994-2016 was 15532.49 thousand ton while for the sugar beet production was 4987.03 thousand ton. The mean of sugarcane area is 133.54 thousand hectare and for sugar beet area is 99.60 thousand hectare. The results indicated that the area of sugarcane in Egypt is significant at the level of 1%, the regression coefficient of this variable equal 0.944 this result indicates that 1 percent increase in the area of sugarcane resulted in an increase in the sugarcane production by 0.922. The area of sugar beet in Egypt is significant at the level of 1%, the regression coefficient of this variable equal 1.073 this result indicates that 1 percent increase in the area of sugar beet resulted in an increase in the sugar beet production by 1.073. The study recommends improving the technology and procedures of work to produce sugar beet seeds in Egypt; increase the research with the purpose of taking advantage of genetic improvements, which should enable the introduction of new varieties with higher productivity and quality; government policy should encourage and incentive the farmers in different governorates to produce the most efficient crop in their governorates.

Key words: Sugarcan, sugar beet, Egypt, regression.

INTRODUCTION

Sugarcane production requires a wide-range of inputs levels at different growth stages, such as specific temperature, irrigation water, and soil type (**Dlamini *et al.*, 2010**). Sugarcane is widely cultivated in tropical and temperate regions like Upper Egypt. It is planted in the spring and autumn seasons. Spring planting occurs in February and March, while autumn planting extends from September through October. Sugar beet is planted in August and September and harvested in March. Co-products from the refining process of sugar beets are used to produce animal feed. Beet sugar concentration is 13-18 percent, compared to only 11 percent for cane. The government's policy of encouraging farmers to grow beets over sugar cane as a water saving measure has been ineffective, because of an attractive supply price offered by the government, making it the cash crop of choice in Upper Egypt. Upper Egypt's economy is heavily dependent on sugarcane production. Disruptions to the area planted with sugar cane would impact the livelihood of many families that live directly on it's farming, plus a plethora of ancillary business built around sugar production. These ancillary businesses include input providers, irrigation providers, logistics, metallurgy, as well as all non-commercial activity such as schools and hospitals. The government has tried implementing policies to reduce sugarcane area, due to the crop's high water consumption; however, these have been unsuccessful. Policies designed to move production away from sugarcane find themselves squeezed between the

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hammer of water scarcity and the anvil of sugar processors' demand for raw material (**Hamza, 2017**).

Problem and Objective of the Study

Despite that sugarcane and sugar beet are the sources of sugar in Egypt; there is a fluctuation in the production of the two crops during the time period 1994-2016. This study aims to analyze the production, area and yield of sugarcane and sugar beet in Egypt during the time period 1994-2016.

Methodology

The idea behind regression in the social sciences is that the researcher would like to find the relationship between two or more variables. Regression is a statistical technique that allows the scientist to examine the existence and extent of this relationship. Regression shows that given a population, if the researcher can either examine the entire population or perform a random sample of sufficient size, it is possible to mathematically recover the parameters that describe the relationships between variables. Once the researcher has established such a relationship, he can then use these parameters to predict values of a new dependent variable given a new independent variable. Regression does not make any specifications about the way that the independent variables are distributed or measured, but in order for regression to be the appropriate technique, the Gauss-Markov assumptions must be fulfilled. In its simplest form, $Y_i = \beta_0 + \beta_1 X_i + u_i$ regression shows the relationship between one independent variable (X_i, which represents the area) and a dependent variable (Y_i, which represents the production). The magnitude and direction of that relation are given by a parameter (β_1), and an intercept term (β_0) captures the status of the dependent variable when the independent variable is absent. A final error term (u_i) captures the amount of variation that is not predicted by the slope and intercept terms (**Pepinsky and Tobin, 2003**). The applied model for this study as follow $Y = b_0 X_1^{b1} e^u$, the Cobb-Douglas production function can be reduced to the following form ln Y = ln bo + b1 ln X1 + u, where Y is the production, X1 is the area, bo is constant, b1 is the regression coefficient and u is the error.

RESULTS AND DISCUSSION

Tables 1 and 2 show the production, area and yield of sugarcane and sugar beet in Egypt during the time period 1994-2016. The minimum value of sugarcane production was 13725.53 thousand ton in 1997 while sugar beet production was 824.51 thousand ton in 1994, while the maximum value of sugarcane production was 17014.27 thousand ton in 2007 while the maximum sugar beet production was 11982.946 thousand ton in 2015. The mean of sugarcane production for the time period 1994-2016 was 15532.50 thousand ton while that mean for sugar beet production was 4987.03 thousand ton. The minimum area of sugarcane was 122.28 thousand hectare in 1997 and for sugar beet area was 17.74 thousand hectare in 1994, while the maximum value of sugarcane area was 140.78 thousand hectare in 2007 and for sugar beet area was 235.187 thousand hectare in 2016. The mean of sugarcane area for the time period 1994-2016 was 133.54 thousand hectare and for sugar beet area was 99.60 thousand hectare. The minimum value of sugarcane yield was 109.34 ton/hectare in 1994 and for sugar beet yield was 39.40 ton/hectare in 1996, while the maximum value of sugarcane yield was 121.35 ton/hectare in 2006 and for sugar beet yield was 58.28 ton/ hectare in 2010. The mean of sugarcane yield for the time period 1994-2016 was 116.25 ton/ hectare and for sugar beet yield was 48.57 ton/ hectare.

Tables 3 and 4 show the production, area and yield of sugarcane and sugar beet in the main governorates in Egypt during the time period 1994-2016. The mean of sugarcane production in 1994 was 219.33 thousand ton and 213.87 thousand ton in 2016, while the mean of sugar beet production was 119.52 thousand ton in 1994 and 817.10 thousand ton in 2016. The mean of sugarcane area in 1994 was 4.81 thousand fad., and 4.71 thousand fad., in 2016 while; the mean of sugar beet area in 1994 was 5.79 thousand fad., and 40.58 thousand fad., in 2016. The mean of sugarcane yield in 1994 was 37.06 ton/fad., and 36.09 ton/fad., in 2016, while; the mean of sugar beet yield in 1994 was 23.18 ton/fad., and 22.22 ton/fad., in 2016. For the sugarcane production in Egypt, Menia Governorate has the highest production and area and for the sugar beet production Kafr Elshikh Governorate has the highest production and area in 1994 and 2016.

Table 1. Production, area and yield of sugarcane in Egypt (1994-2016)

Year	Production (Thousand ton)	Area (Thousand hectare)	Yield (Ton/Hectare)
1994	13822.04	126.41	109.34
1995	14104.77	128.77	109.53
1996	13958.41	126.05	110.74
1997	13725.53	122.28	112.25
1998	14352.78	122.46	117.20
1999	15253.62	129.08	118.17
2000	15705.80	133.99	117.22
2001	15571.50	131.06	118.81
2002	16016.76	135.89	117.87
2003	16245.46	137.49	118.16
2004	16230.44	135.31	119.95
2005	16317.32	134.98	120.89
2006	16656.33	137.26	121.35
2007	17014.27	140.78	120.85
2008	16470.22	135.91	121.19
2009	15482.17	133.02	116.39
2010	15708.88	134.54	116.76
2011	15765.21	136.71	115.32
2012	15550.00	136.92	113.57
2013	15780.01	138.24	114.15
2014	16055.01	139.45	115.13
2015	15903.34	137.86	115.36
2016	15557.51	136.94	113.61
Mean	15532.49	133.54	116.25

Sources: FAOSTAT and own elaboration

Table 2. Production, area and yield of sugar beet in Egypt (1994-2016)

Year	Production (Thousand ton)	Area (Thousand hectare)	Yield (Ton/Hectare)
1994	824.51	17.74	46.49
1995	919.93	21.03	43.74
1996	841.54	21.36	39.40
1997	1143.02	26.85	42.57
1998	1951.24	43.60	44.75
1999	2559.65	53.95	47.44
2000	2890.36	56.98	50.72
2001	2857.73	59.93	47.68
2002	3168.31	64.62	49.03
2003	2691.52	55.18	48.78
2004	2860.55	59.24	48.29
2005	3429.54	70.31	48.78
2006	3904.97	78.32	49.86
2007	5458.21	104.33	52.32
2008	5132.59	108.22	47.43
2009	5333.51	111.13	47.99
2010	7840.30	134.54	58.28
2011	7486.10	152.00	49.25
2012	9126.06	177.98	51.28
2013	10044.27	193.41	51.93
2014	11045.64	211.81	52.15
2015	11982.95	233.17	51.39
2016	11209.16	235.19	47.66
Mean	4987.03	99.60	48.57

Sources: FAOSTAT and own elaboration

Table 3. Production, area and yield of sugarcane in the main Governorates in Egypt (1994-2016)

Governorate	Production (Thousand ton)		Area (Thousand fad.)		Yield (Ton/fad.)	
	1994	2016	1994	2016	1994	2016
Behairah	6.10	2.46	0.24	0.09	25.97	28.00
Gharbia	42.50	0.44	1.00	0.01	42.41	40.27
Kafr Elshikh	12.23	4.39	0.36	0.11	34.07	40.65
Dakahlia	30.11	11.97	0.91	0.32	33.13	38.00
Sharkia	5.37	0.75	0.13	0.02	42.60	31.13
Menoufia	8.39	-	0.24	-	34.51	-
Qalyoubia	35.78	13.94	0.89	0.42	40.15	33.04
Giza	91.978	65.09	2.60	1.67	35.35	39.00
Beni Suef	23.95	21.38	0.91	0.67	26.38	32.00
Fayoum	13.48	13.25	0.43	0.50	31.56	26.50
Menia	1782.95	1745.02	38.21	37.61	46.66	46.39
Assuit	66.77	33.848	1.66	1.07	40.32	31.52
Suhag	731.74	653.88	15.02	14.03	48.71	46.61
Mean	219.33	213.87	4.81	4.71	37.06	36.09

Sources: MALR in Egypt and own elaboration

Table 4. Production, area and yield of sugar beet in the main Governorates in Egypt (1994-2016)

Governorate	Production (Thousand ton)		Area (Thousand fad.)		Yield (Ton/fad.)	
	1994	2016	1994	2016	1994	2016
Behairah	-	680.68	-	47.6	-	14.30
Gharbia	26.72	443.83	1.03	17.41	25.92	25.50
Kafr Elshikh	672.91	2669.96	32.87	148.25	20.47	18.01
Dakahlia	11.13	2102.47	0.53	98.67	20.88	21.31
Sharkia	-	1616.39	-	78.18	-	20.67
Menoufia	-	35.85	-	1.74	-	20.56
Qalyoubia	-	20.21	-	0.87	-	23.31
Giza	-	30.59	-	1.49	-	20.50
Beni Suef	-	740.49	-	31.76	-	23.318
Fayoum	5.18	726.09	0.25	35.81	20.72	20.28
Menia	0.51	533.77	0.02	18.29	25.70	29.19
Assuit	-	204.89	-	6.89	-	29.73
Suhag	0.69	-	0.03	-	25.37	-
Mean	119.52	817.10	5.79	40.58	23.18	22.22

Sources: MALR in Egypt and own elaboration

The primary results showed the problem of autocorrelation as the value of Durbin-Watson was 0.414; to solve this problem the study applied the difference transformation method. The coefficient of determination R^2 equal 0.642 (Table 5), this indicates that about 64.2% of the variance in the sugarcane production in Egypt is explained by the area. The value of Durbin-Watson at the level of significance 1% equal 1.604 this value higher than the upper limit (1.187), conclude that there is no autocorrelation. The value of F-Statistic equal 38.639 this value more than the value of F-tab, since F-Statistic higher than F-tab, conclude that the regression model fits the data at 1% level of significance, and the area of sugarcane in Egypt affect the sugarcane production in Egypt. The area of sugarcane in Egypt is significant at the level of 1%. The regression coefficient of this variable equal 0.944 this result indicates that 1 percent increase in the area of sugarcane resulted in an increase in the sugarcane production in Egypt by 0.922.

The coefficient of determination R^2 equal 0.996 (Table 6), this indicates that about 99.6% of the variance in the sugar beet production in Egypt is explained by the area. The value of Durbin-Watson at the level of significance 1% equal 1.690 this value higher than the upper limit (1.187), conclude that there is no autocorrelation between the independent variables. The value of F-Statistic equal 4893.487 this value more than the value of F-tab, since F-Statistic higher than F-tab, conclude that the regression model fits the data at 1% level of significance, and the area of sugar beet in Egypt affect the sugar beet production in Egypt. The area of sugar beet in Egypt is significant at the level of 1%. The regression coefficient of this variable equal 1.073 this result indicates that 1 percent increase in the area of sugar beet resulted in an increase in the sugar beet production in Egypt by 1.090.

Table 5. Results of analysis for sugarcane in Egypt (1994-2016)

Variable	Coefficient	Std. Error	t-Statistic
Constant	0.002	0.003	0.561
Area	0.944	0.152	6.216
R Square	0.642		
Durbin-Watson	1.604		
F-Statistic	38.639		

Source: Own elaboration.

Table 6. Results of analysis for sugar beet in Egypt 1994-2016

Variable	Coefficient	Std. Error	t-Statistic
Constant	3.563	0.068	52.738
Area	1.073	0.015	69.953
R Square	0.996		
Durbin-Watson	1.690		
F-Statistic	4893.487		

Source: Own elaboration.

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تحليل اقتصادي لقصب السكر وبنجر السكر في مصر

يحيى حامد الأسرج

قسم الاقتصاد الزراعي – كلية الزراعة – جامعة القاهرة – مصر

قصب السكر وبنجر السكر هي مصادر السكر في مصر، هدف الدراسة تحليل إنتاج ومساحة و إنتاجية قصب السكر وبنجر السكر في مصر خلال الفترة الزمنية 1994-2016، في هذه الفترة الزمنية بلغ متوسط إنتاج قصب السكر 15532.49 ألف طن، ومتوسط إنتاج بنجر السكر 4987.03 ألف طن، يبلغ متوسط مساحة قصب السكر 133.539 ألف هكتار، ومتوسط مساحة بنجر السكر 99.60 ألف هكتار، تشير النتائج إلى أن مساحة قصب السكر في مصر معنوية عند مستوى معنوية 1%، ومعامل الانحدار لهذا المتغير يساوي 0.944 تشير هذه النتيجة إلى أن زيادة 1% في مساحة قصب السكر تؤدي إلى زيادة في إنتاج قصب السكر 0.922، تعتبر مساحة بنجر السكر في مصر معنوية عند مستوى معنوية 1%، ومعامل الانحدار لهذا المتغير يساوي 1.073 تشير هذه النتيجة إلى أن زيادة 1% في مساحة بنجر السكر تؤدي إلى زيادة في إنتاج بنجر السكر 1.073، توصي الدراسة بتحسين التكنولوجيا المستخدمة في عملية الإنتاج، زيادة البحوث بغرض الاستفادة من التحسينات الجينية التي ينبغي أن تسمح بإدخال أصناف جديدة ذات إنتاجية ونوعية أعلى؛ يجب أن تشجع السياسة الحكومية وتحفز المزارعين في مختلف المحافظات على إنتاج المحاصيل الأكثر كفاءة في محافظاتهم.

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