

An Economic Study of the Possibility of Covering Sugar Gap in Egypt

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Abstract: The nutrition gap in Egypt is clearly represented through the inability of domestic production to meet domestic consumption of the main crops such as, sugar. The economy is then faced with the necessity to import a large proportion of its domestic consumption, around 31.3%. of sugar consumption during the period (1998-2006) causing the average value imports of this crop to reach about 2,335 million LE (2004-2007). In this context, the research targets , the estimation of area required for cultivation of sugar beet necessary for covering the sugar gap. It is estimated also the agricultural resource combination required for a local production is sufficient to cover sugar gap and estimation of production cost. A financial feasibility study was under taken for a project objecting a cover up to 100% of sugar gap by using domestic available resources. The most important results show the feasibility indicators of local sugar production to cover gap entirely show the NPV is positive and B/C is 1.14 and IRR is 18%. Here stems the importance of adopting policies and programs to increase essential sugar crops, to cover the food gap in sugar and to encourage investors producers and financing bodies on participating in execution of such policies and programs.

Keywords: Economic Study, Sugar Gap and Egypt

INTRODUCTION

Sugar is considered as one of the strategic commodities all over the world, and is one of the essential energy sources for all people. Sugar is an important industrial agricultural commodity that is consumed by all the community members at its various social and economical levels.

World trade of sugar affected by many variables, such as, world production, world consumption and stock.

Agricultural policy for increasing the agricultural production of sugar crops depends also upon the basis of a national perspective aiming to achieve the Egyptian food security on the long run.

Research Problem:

The research problem focuses basically on the local production deficiency in meeting the consumption need of essential food commodities, such as sugar. In order to cover the gap between local consumption and production the state turned towards importing about 31.1% of the Total local sugar consumption in the average period (1998-2006)⁽¹⁾. National economy incurs annually high amounts of money to cover such gap between sugar production and consumption, which was estimated in the year 2006, as 873 Thousand tons, and is expected to reach to 1022.9 thousand tons in 2008.

The research problem is confined also in that despite of the continual efforts for increasing the Egyptian agricultural production, the gap in sugar is increasing in a way would subject national economy to a cut impact of world variables, which would influence Egyptian food security.

Research Objectives:

The research aims basically at studying how to cover the sugar gap in Egypt. Therefore, sugar gap during the period (2008-2015) had been predicted. Since basic sugar crops face sever competition with other crops in cropping pattern, and that some of such crops cultivation also excel in the new reclaiming land, such as sugar beet, thus research objective is increase of sugar production that depends on expansion in cultivation of sugar beet crop in the new reclaimed land, due to the difficulty of horizontal expansion in sugar cane crop under the limitation of irrigation water.

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Research targets, the estimation of areas required for cultivation of sugar beet necessary for covering the sugar gap, and determination of the areas available. It is estimated also the agricultural resource combination required for a local production is sufficient to cover sugar gap and estimation of production cost.

Research Method and Data Sources:

Analytical research methods have been used in accordance with scientific methodology without ignoring theoretical side that implicates descriptive economic aspects. Quantitative and statistical analytical methods have been used to determine the status of sugar economies within the framework of sugar gap coverage.

The research had basically relied also in gaining of the necessary data published and non published data in governmental and non governmental quarters and institution records and publications such as ministry of Agriculture and land Reclamation, central Agency for public Mobilization and Statistic, and economical publications of the Egyptian National bank, ministry of Supply And Internal Trade, Authority of Supply Commodities, Ministry of Irrigation and water Resources, and Council of Sugar Crops.

RESULTS AND DISCUSSIONS

Sugar Production Crops in Egypt:

Sugar Cane Crop:

It is considered source one for sugar industry and it is also among the most important crops of transformative industries. Based on it the molasses industry and various complementary industries on its leftovers. Such as compressed grain wood and paper pulp industries and the industrial preparations such as alcohols, yeast, and acids. Up to the year 1981, sugar cane crop was the only crop for sugar production in Egypt. Sugar cane crop contribute with about 68% of the total sugar production in the year 2006.

Sugar Beet Crop:

It represents the second resource for sugar production in the world. Such crops importance is maximized in using its leftover in production of untraditional animal fodder.

Attention paid to sugar beetroot crop in Egypt has increased to reduce the sugar gap. Hence, a great development had taken place in the extent of the sugar crop contribution in the total production of sugar in Egypt, as sugar beetroot contribution percentage had risen from 2.5% in 1982 to 28.2% of the total production, in 2001, and about 32% of the total production in 2005. That would be due to some factors represented in the expansion in the areas cultivated with sugar beetroot from 16.9 thousand Feddan in 1982 to 143 thousand Feddan in 2001, and about 184.3 thousand Feddan in 2006, and functioning of the recently established sugar beetroot factories and increasing the productivity of sugar beetroot in accordance with research recommendation.

Due to the limitation of irrigation water resource in Egypt, expansion in sugar production from sugar beetroot crop is considered as the essential mean for extension in sugar production for realization of self sufficiency of sugar. As its needs of irrigation water is less than one quarter of sugar cane needs. Sugar beetroot cultivation excels in the newly reclaimed land and may be established in animal feeds projects based on sugar beet leftover.

Sugar Economic Indicators in Egypt:

Table (1) illustrates the following:

Total production of sugar had risen from about 1.1 million tons in 1998 to about 1.57 million tons in 2006 that is with an increase of 42.7%. By estimating the time trend equation Table (2), it is obvious that production by 0.036 million tons annually or, 2.6 % of the annual average amounting to about 1.36 million tones during the period (1998-2006). Where as national consumption of sugar had risen from about 1.6 million tons in the year 1998 to about 2.48 million tons in 2006, by an increase about 55% with an annual average of increase of about 0.11 million tons, meaning that average of increase in consumption is higher than that in production. That has been reflected in the percentage of self sufficiency from about 73% in 1998 to about 63.3% in 2006. That was due to the increase in the average of per cepita from about 25 kg in 1998 to about 34 kg in 2006,

Table 1: Production, consumption, sugar gap, degree of sufficiency, and average consumption per capita of sugar during the period (1998-2006)

Year	Sugar Production million ton	Sugar Consumption million tons	Sugar Gap million tons	ratio of self sufficiency %	Average of consumption per capita kg/year
1998	1.16	1.6	0.44	72.5	25
1999	1.24	1.7	0.46	72.9	26.1
2000	1.39	1.8	0.41	72.2	27
2001	1.4	1.8	0.40	72.7	27
2002	1.37	2	0.63	68.5	29.2
2003	1.28	2.1	0.82	61	30.2
2004	1.36	2.2	0.84	61.8	32
2005	1.47	2.37	0.73	62	33
2006	1.57	2.48	0.91	63.3	34

Source : Data collected and calculated according to the information ministry of agriculture, economical affairs sector

Table 2: Time trends "Total production, total consumption per capita consumption, and imports in Egypt during the period (1998-2006).

Dependant variable	Equation	R ²	\bar{Y}	t
Total production million tons	$\hat{Y}_1 = 1.18 + 0.035 X_t$	0.64	1.36	3.5
Total consumption million tons	$\hat{Y}_2 = 1.44 + 0.11 X_t$	0.98	1.28	18.5
Consumption per capita Kg	$\hat{Y}_3 = 23.4 + 1.16 X_t$	0.79	29.3	3.53
Imports quantity thousand tons	$\hat{Y}_4 = 267.7 + 74.9 X_t$	0.85	642.7	6.29

Where

Y_i = estimated value of dependant variable , $i=1, 2, 3, 4,$

X_t = time, as = 1,2,8, 9

that is by an increase of 35%, the time trend equation indicated an increase in consumption per capita by an annual average had reached about 1.16 kg or about 3.9% in the average amounting to about 29.3kg during the period (1998-2006).

Sugar Imports Quantity:

Sugar import quantity had risen from about 433 thousand tons in 1998 to about 915 thousand tons in 2006. That was due to the increase in the average consumption per capita from about 25 kg in 1998 to about 34 kg in 2006, as well as the increase in population. Then the annual average of growth of the sugar imports quantity during the period (1998-2006) reached about 74.9 thousand tons or about 11.65 % of the average amounting 642.7 thousand tons.

Sugar Gap in Sugar Crops:

Since the gap estimated is a sugar production crops gap, so in case of sugar the gap would be estimated and then transformed into its raw material which is sugar beet, and subsequently, estimating the agricultural area required, and the resources necessary for excess production of sugar beet that used in industry to produce sugar quantity covering sugar gap.

Annual average of sugar gap reached in Egypt about 626 thousand tons at average of the period (1998-2006), and it is also remarkable from table (4) the increase in sugar gap, estimated as 1485.6 thousand tons in 2015. By dividing the sugar gap by sugar beetroot Feddan productivity, areas required for expansion for cultivation with sugar beetroot to produce sugar quantity covering the gap every year.

Table (4) illustrates that the area required for cultivation in the year 2008 amounts to about 378.5 thousand Feddan, increasing to about 427.5 thousand Feddan in the year 2010. Such area would increase to about 500.9 thousand Feddan in 2013, finally to about 550 thousand Feddan in the year 2015.

A local production equals the sugar gap would require a combination of agricultural resources, as it is shown in the table (5) cultivation of 378.5 thousand Feddan in the year 2008 in new reclaimed land with sugar beet crop, and about 1855 million cubic meter of irrigation water, and about 189.3 thousand tones of seeds, and about 146.5 thousand tons of nitrogen fertilizers and about 81.4 thousand tons phosphate fertilizers, and about 14 million agricultural work day, and about 5.3 million of mechanical work hour, of agricultural trader and irrigation pump. It needs also 1134 tons agricultural pesticides. So needs increase by the increase of the required production for covering the gap where

Table 3: Quantities of sugar imports and the percentage of each to the total consumption during the period (1998-2006)

Years	Imports 1000 tons	Consumption 1000 tons	% total consumption
1998	433	1600	27%
1999	458	1678	27%
2000	407	1800	23%
2001	401	1806	22%
2002	630	2000	31.5%
2003	820	2100	39%
2004	820	2200	37.3%
2005	900	2370	38%
2006	915	2485	37%

Source : Data collected and calculated according to the information ministry of agriculture, economical affairs sector

Table 4: Predicting the sugar gap and the area required for cultivation for local production increase of sugar during the period (2008 – 2015).

Year	Expected sugar gap 1000 tons	Area required for cultivation for covering the gap
2008	1022.9	378.5
2009	1089	403
2010	1155.1	427.5
2011	1221.2	451.9
2012	1287.3	476.4
2013	1353.4	500.9
2014	1419.5	525.4
2015	1485.6	550

Source : Data collected and calculated according to the information ministry of agriculture, economical affairs sector

Table 5: Resources required for local production covering 100% of sugar gap size During the period of (2008 – 2015)

Item	Unit	2008	2010	2012	2015
Area required for cultivation	1000 Feddan	378.5	427.5	476.4	550
Irrigation water quantity	Million cubic meter	1855	2095	2334.7	2695
Seeds quantity	1000 ton	189.3	213.8	238.3	275.2
Fertilizer quantity	Nitrogen 1000 ton	146.5	165.5	184.4	213
	Phosphate 1000 ton	81.4	92	102.4	118.3
Number of agricultural working days	1000 days	14008	15821	17631	20355
Number of mechanical working hours	1000 day	5299	5985	6670	7700
pesticide quantity	Ton	1134	1281	1428	1648

Source : Data collected and calculated according to the information ministry of agriculture, economical affairs sector

as such quantities would amount in 2010 to about 427.5 thousand Feddan, 2095 cubic meter irrigation water, 213.9 thousand tons, 165.5 thousand tons, 92 thousand tons, 15.8 million working day, 5.9 million working hour, 1281 tones pesticide respectively. Regarding 2015 it would require local production equals to the sugar gap, using a combination of agricultural resources as is illustrated in table (5) which amounts to about 550 thousand Feddan 269.5 cubic meter of water 275.2 thousand tones, 213 thousand tones, 118.3 thousand tones, 20.3 million working day 7.7 million working hours, 1648 tons for the area required for agricultural, and quantity of irrigation water required, seeds quality, nitrogen and phosphate fertilizer, number of agricultural working days, number of mechanical working hours, and quantity of pesticide respectively, for the year 2015.

Sugar Beet Production Cost:

Table (6) indicates a development in sugar beetroot production cost in case of covering 100% of the sugar gap during period (2008 -2015). it is estimated for production cost to amount about LE 394 Million through the year 2008, as irrigation cost would reach LE 37.1 Million, seeds cost about LE 22.8 Million chemical fertilizers about LE 93 agricultural labor power about LE 139 Million, mechanical working cost about LE 63Million pesticides cost about LE 9.1 Million.

Total cost of sugar beetroot production cost amount to about LE 411.2 Million in the year 2010 including about LE 41.9 Million as irrigation cost, LE 25.7 Million as seeds cost, LE 105 as chemical fertilizers cost, about LE 157 Million as agricultural work force cost, and LE 71.4 million as mechanical working cost, and about LE 10.2 million as pesticides cost through the year 2010.

A Financial Feasibility and Return Average of Sugar Production at Prevailing Domestic Prices:

A financial feasibility study was under taken for a project objecting a cover up of 100% of sugar gap by using domestic available resources Table (7) shows that results

- The net present value at 15% = LE 241.5 million, i.e. the present value of the income current generated from sugar production of sugar beet covers all costs and realizes current net value of LE 241.5 million
- Percentage of benefit to cost ratio at 15% = 1.14 that is percentage of benefit interest to cost is greater than one when deducting the benefit current and cost current in a mange alternative opportunity cost of capital. Hence in accordance with such scale then sugar production of sugar beetroot feasibility is clear in Egypt
- Internal rate of return = 18% i.e. sugar production of sugar beet in Egypt can retrieve all the capital and production cost and operation cost that have been spent on it is addition to fulfilling an average return of 18% on using the capital invested in production sugar from sugar beet.
- In accordance with the three indicators, sugar beetroot production is considered as Financially feasible in Egypt at the prevailing domestic prices:

Table 6: Production cost required for covering 100% of sugar gap size during the period (2008-2015) in million pounds.

Cost	2008	2010	2012	2015

Years				
Irrigation cost	37.1	41.9	46.7	53.9
Seeds cost	22.8	25.7	28.7	33.1
Chemical fertilizers cost	93	105	117	135
Agricultural labor power cost	139	157	175	220
Mechanical work cost	63	71.4	79.6	91.9
Pesticides cost	9.1	10.2	11.4	13.2
Total	394	411.2	458.6	547.1

L.E = 0.18 \$

Source : Data collected and calculated according to the information ministry of agriculture, economical affairs sector

Table 7: Results of statistical analysis of financial feasibility of sugar production of sugar beet at domestic price

Scale	Value
Net present value	241.5
Percentage of benefit to cost ratio at 15%	1.14
Internal rate of return (IRR).	18%

Source: Data calculated from the results of statistical analysis of financial feasibility according to ministry of agriculture, economical affairs sector.

Equations Used in Calculation of the Main Items of Sugar Beet Crop:

Equation No (1) predicting sugar production gap: Expected gap next year = gap in current year × expected average growth of population, assuming the continuity of increase in production at its average in the post period. Assuming the continuity of average consumption per capita at its values in the post period, the gap may increase in the average of population growth every year, which is 2%

Sugar gap average during the period (1998 – 2006) was used in predicting the gap size up to year 2010. Predicting the gap could be predicted continually to any number of years but world and local moving changes limit the precise prediction for these periods.

Equation No (2). for calculation of the amount of resources required for local production equals sugar gap, the area required to be cultivated to cover gap was multiplied by a Feddan needs of different resources according to the following equation:

Quantity required of any resource = area required to be cultivated × a Feddan need of such resource.

Equation No (3) for calculating local production cost the required quantity of each resource was multiplied by resource unit price according to the following equation

- Resource cost = resource quantity × resource unit price

Then resources cost to be summed to attain total production cost.

Equation No (4): Net present value (NPV)

NPV at certain deduction price = present value of total benefit – present value of total cost. The judgment criterion of NPV scale of the project having net value greater than zero when deducted with the coefficient of alternative opportunity cost of capital, or NPV is positive.

Equation No (5). benefit / cost ratio (B/C)

Benefit/ cost ratio at certain deduction price = present value of total benefit ÷ present value of total cost

The judgment criterion of (B/C) scale of the project having value greater than one when deducted with the coefficient of alternative opportunity cost of capital or (B/C) is greater than one.

Equation No (6) internal rate of return (IRR)

It represents the maximum benefit the project can pay to used resources if the project to retrieve investment, operation, and production cost. For in case of equality between total present cost value and total present benefit value at deduction rate of 18% that would mean that the project can retrieve all capital and operation cost spent on it, and production cost, in addition to fulfilling a return of 18% on using invested capital in the same time.

Judgment criterion based on average internal return for measuring sugar production feasibility in acceptance of all circumstances at which average of internal return equals more than alternative opportunity cost of capital. Equation No (7). Cost of manufacturing sugar from sugar beet.

- Average price of importing one ton sugar (US \$ 341 per /ton) during the period (1990-2006).
- Cost of importing one ton of sugar in Egyptian pounds (LE 1960.75) = Average import price (US \$ 341 per/ ton) × exchange rate \$ (5.75)
- The price that sugar producer may get from production of 7.7 tones of sugar beet that gives one ton sugar (LE 1728.75) = Cost of importing one ton of sugar (LE 1960.75)- cost of manufacturing of one ton sugar in local factories (LE 135)+ trasporation from farm to sugar factory (100).
- Value of main outcome of sugar beet (\$ 348.8 thousand) = Average price of importing one ton sugar \$ (341) × size of the gap required to be covered (1022.9thousand tons)

Conclusions:

To cover the gap between local consumption and production of sugar, the state headed at importing about 25% of local consumption in the period (1998-2006). Despite of the continuous efforts for increasing local production of sugar, sugar gap would increase in the coming years in a way that may expose national economy to sharp impact of world variables

Quantity of local production of sugar had amounted to about 1.727 million tons in the year 2006. Whereas local consumption quantity amounted to about 2.49 million tons. Hence, it is obvious that sugar gap is estimated of about 91 million tons in 2006. Thus it is possible to say that the degree of self sufficiency amounts to about 63.3% in the same year, and average share per capita of sugar consumption amounted to about 34 kilogram through the year 2006.

To study how to cover sugar gap, it was predicted during the period (2008-2015), and was estimated to be about 1022.9 thousand tons in the year 2008, to continue in rising to reach 1485.6 thousand tons in 2015. Area required for covering the sugar gap to be cultivated with sugar beet amount to 513.2 thousand Feddan as an average of the period (2012-2015).

Since the main sugar crops face harsh competition with other crops in the cropping pattern. And that some of such crops agriculture excel in the new reclaimed land, such as beetroot, therefore beetroot agriculture should be stretched out in the new reclaimed land.

Areas to be cultivated with sugar crops was estimated, and the whereabouts were decided and the proposed crop structure was decided also, agricultural resource combination required for a local production sufficient for covering sugar gap that has amounted to distributed on the whole of cost items, such as required agricultural area, amount of irrigation water seed quantity, chemical fertilizers quantities, number of agricultural working days and hours, and pesticides. Sugar imports in 2006 amounted to 915 thousand tone of sugar, whereas consumption amount has reached 2.49 million tons, percentage of imports to consumption reached 37.6% in 2006. It is possible as well to derive the most important results arrived at in such research as following:

- Feasibility indicators case of local sugar production to cover sugar gap entirely show the NPV is positive and B/C is 1.14 and IRR is 18%. Based on the three scales, sugar production through cultivation of sugar beet would be financial. To execute the agricultural policy mechanisms in the field of sugar production the efficiency of delivery of crop to sugar beetroot factories should be escalated and crop prices for the farmer should be risen as soon as possible to encourage farmer to go an in cultivation and expansion in it. An providing funding needed form paying of sugar cane prices for the farmers to pay attention to production and Feddan productivity.

REFERENCES

Abdel Hkim Mohamed Nourel Deen, 2005. Impacts of world trade in Egypt Imports of refined sugar. *Egyption Journal of Agricultural Economics*, 15(3).

Enamm Abd El Fattah, 2001. An economic study of sugar production and consumption in Egypt, *Egyption Journal of Agricultural Economics*, 12(2).

Riad El-Sayed Emara, 2007. An economic study of sugar production and consumption on Egypt. Egyptian Journal of Agricultural Economics, 17(1).

National Bank of Egypt, economical publication, (Various numbers.) Central Agency for public Mobilization and Statistics, commodity consumption publication in ARE (Various numbers).

Annual statistical book (Various numbers) Ministry of Agriculture, economical affairs sector, agricultural economy publication (different volumes).

Ministry of supply and internal trade, supply commodity authority, information department records.

Food and Agriculture Organization, trade year book, Rome, Italy, (different volumes).

Food and Agriculture Organization production year book, Rome, Italy, (different volumes).