Profit Maximization Versus Cost Minimization in Production of Major Vegetables: Case Study of Tomatoes and Onions Production in Egypt

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Abstract: The study aimed at exploring the level of production economic efficiency of Egyptian producers of tomatoes and onions, based on both profit maximization and cost minimization. Results revealed that tomatoes growers are generally more efficient than onions producers, which may be due to reliance of the first upon more skilled labor. Additionally, despite the higher prices procured by producers of the largest area stratum they seem the least efficient as a result of the burden of hired labor wages. Hence, diseconomies of scale appear dominant. The study recommends providing farmers with perfect marketing information in addition to technical support in order to promote economic production efficiency.

Key words: Production economic efficiency · Profit maximization · Cost Minimization · Marginal product · Average product

INTRODUCTION

The principal target for all economic ventures is the highest possible earning. Fulfillment of maximum earnings is the indicator of efficient production operation. However, producers suffering limited resources and budgets may focus on minimization of cost rather than profit maximization, and determine the size of their production to cope with such option. This situation may hold for small agricultural producers in Egypt where nearly 90% of farmers hold each less than one hectare [1]. In this respect, this study tends to test the credibility of such assumption among Egyptian producers of certain major vegetables represented by tomatoes and onions, in addition to assessment of their efficiency level with respect to the size of production for each of the selected crops. It should be taken into consideration that cost of production is not the sole factor determining efficiency, but also perceived marketing information as well as efficiency of agricultural technical extension.

Problem: The study is interested in the problem of deficient information with respect to both the level of efficiency of the Egyptian vegetables producers in determination of the size of production and the influence of short budget upon profit maximization, which resembles the logic principal purpose of any economic activity.

Objectives: Accordingly, the study tends to reveal the role of short budgets upon ability of Egyptian farmers to reach possible maximum revenues. That is in addition to assessment of the level of efficiency according to size of production fulfilling either cost minimization or profit maximization.

Methodology: Production cost functions were estimated and both average and marginal costs were derived. The rules for cost minimization and profit maximization were as following:

$AVC_y = MC_y$ (1) for cost minimization, $MC_y = P_y$ (2) for profit maximization [2, 3].

where: AVC_y = average cost for product "y", MC_y = marginal cost for product "y" and P_y = unit price for product "y".

AVC_y was derived by dividing the total cost function by (y) and MC_y by calculating the first derivative of the estimated total cost function with respect to (y).

Source of analyzed data is a sample survey of the selected vegetable crops producers in Giza governorate, Egypt (2011-12) of a total size of 180 units [4]. For reasons of comparison, analysis was applied on variant farm size strata in addition to the sample as a whole. That is although most producers are considered small farmers, as

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the average landholding was below 1ha. Giza was chosen as a principal producer of the vegetables in Egypt as shown by agricultural production officially secondary data [1].

RESULTS

The statistically best fit for the cost function estimation was the polynomial form as presented in equations (3, 4, 5 and 6) for tomatoes and (7, 8, 9 and 10) for onions. That is for farm strata (< 0.5 ha), (0.5-1.25 ha), (> 1.25 ha) and general, respectively.

$$Tc_i = 15046.7 - 2151.5\ Y_i + 105.0\ Y_i^2\ R^2 = 0.76 \quad (3)$$
$$ (4.2) \quad\quad (2.4)$$

$$Tc_i = 11393.7 - 1501.3\ Y_i + 71.3\ Y_i^2\ R^2 = 0.92 \quad (4)$$
$$ (3.4) \quad\quad (2.6)$$

$$Tc_i = 25222.2 - 3142.5\ Y_i + 130.1\ Y_i^2\ R^2 = 0.72 \quad (5)$$
$$ (2.9) \quad\quad (2.5)$$

$$Tc_i = 10445.3 - 928.5\ Y_i + 48.6\ Y_i^2\ \mathring{R} = 0.61 \quad (6)$$
$$ (18.9) \quad\quad (4.4)$$

$$Tc_i = 50555 + 9223.2\ Y_i - 380.3\ Y_i^2\ R^2 = 0.61 \quad (7)$$
$$ (4.4) \quad\quad (3.2)$$

$$Tc_i = 3723.3 + 178.1\ Y_i - 27.1\ Y_i^2\ R^2 = 0.86 \quad (8)$$
$$ (4.1) \quad\quad (2.9)$$

$$Tc_i = 6994.5 - 279.2\ Y_i + 46.3\ Y_i^2\ R^2 = 0.93 \quad (9)$$
$$ (2.5) \quad\quad (2.3)$$

$$Tc_i = 9754.4 - 1215.3\ Y_i + 76.0\ Y_i^2\ R^2 = 0.67 \quad (10)$$
$$ (14.1) \quad\quad (4.2)$$

where: TC_i = total costs of production of the crop for producer "i", Y_i = total production of either tomatoes or onions for producer "i", R^2 = the determination coefficient, and figures between brackets are "t" ratios.

Accordingly, ATC = $(a / Y) - b_1 + b_2\ Y$ and MC = $2\ b_2\ Y - b_1$ for all [5].

where; ATC = Average total cost and MC = marginal cost

Based on equations (1) and (2), the optimum size of production (Y^*) derived by equations (11) and (12).

$$Y^* = (P_y + b_1) / 2b_2 \quad (11) \quad \text{for profit maximization}$$
$$Y^* = v\,a / b_2 \quad\quad (12) \quad \text{for cost minimization}$$

Tomatoes: Table 1 presents the averages of production (AP), average total cost and marginal cost, unit price and percentages of producers realizing $\geq 90\%$ of full efficiency according to either profit maximization or average cost minimization for tomatoes, based on survey data.

As shown in Table 1, wide variations occur between the averages of marginal and average costs, and the variations are much wider compared to the average prices. However, such variations are not strongly reflected upon those between actual and either profit maximization or cost minimization production levels. Likewise, relatively high percentages of producers able to realize either profit maximization or cost minimization occurred for the lowest area stratum, but dropped fiercely for higher strata, especially for profit maximization. Although traditionally big producers were almost absent in data, indicating narrow dispersion in product areas, analysis for the whole sample revealed far from average results, especially for percent of efficient producers. In general, producers seem to minimize costs rather than maximize profit. Finally, producers apparently gained remarkable profit, especially those of the lowest area stratum.

Table 1: Estimated criteria of production economic efficiency for the sample of tomatoes' growers in Giza Governorate.

Item	< 0.5 ha	0.5-1.25 ha	> 1.25 ha	General
MC (LE)	411.0	420.4	577.9	524.7
Price (LE/ mt)	820	860	870	840
ATC average (LE)	363.4	303.2	479.8	496.7
AP actual (mt)	11.2	13.5	14.3	14.2
AP profit max (mt)	14.0	16.7	15.4	18.3
AP cost min (mt)	11.97	12.7	13.9	14.7
% producers =90% profit maximization	60%	10%	7%	0%
% producers =90% cost minimization	80%	77%	12.5%	9.4%

Source: study data analysis

Table 2: Estimated criteria of production economic efficiency for the sample of onions' growers in Giza Governorate

Area strata				
Item	< 0.5 ha	0.5-1.25 ha	> 1.25 ha	General
MC (LE)	787.0	452.8	870.0	563.4
Price (LE/mt)	710	730	760	720
ATC average (LE)	383.9	454.1	654.6	507.9
AP actual (mt)	11.1	11.7	12.5	11.7
AP profit max (mt)	13.4	28.5	27.6	28.8
AP cost min (mt)	11.5	12.0	12.3	11.5
% producers =90% profit maximization	26.7%	0%	0%	0%
% producers =90% cost minimization	28%	35.3%	13.3%	8.1%

Source: study data analysis.

Onions: Similar to the case of tomatoes, Table 2 presents the production efficiency criteria estimated for the sample of onions' producers. The Table 2 shows fair levels of profit, except for the highest area stratum, as comparing average costs to prices. However, tremendously low percentages of producers fulfilling cost minimization occur compared to the case of tomatoes. Moreover, less than 36% at maximum were able to realize maximum profit in the first stratum and none in other. Such result is also strongly revealed in comparison of actual and profit maximizing levels of production where the levels of the first are much less than halves of those of the second. Similar to the case of tomatoes, producers of the highest area stratum seem to be the least efficient whether with respect to profit maximization or cost minimization. Likewise, producers would most likely seek cost minimization rather than profit maximization [6].

DISCUSSION AND CONCLUSIONS

The study showed that producers of either tomatoes or onions tend to minimize costs of production rather than maximize profits. This conclusion coincides with findings of early studies and the nature of small producers suffering limited resources and low budgets as such [6]. This conclusion is verified by the dramatically low percents of farmers achieving maximum profit, dropping to none in most cases. That is in addition to the wide difference between estimated marginal costs in average compared to product prices, with exception of the largest stratum of onions producers. This result indicates production in an early part of the second phase of production, i.e. lowest level of marginal cost. The higher efficiency revealed for tomatoes growers over onions producers may be explained by more experience enjoyed

by the first as more skill in farming practices are required. On the other hand, despite the narrow gap in crop areas among the studied strata producers of the greatest stratum seem to be the least efficient despite selling at the higher prices, inferring as such diseconomies of scale. This may be most likely due to reliance upon hired labor and bearing as such wages which remarkably reduce their profits. In general, it may be concluded that directing producers to more efficient production practice would require, in addition to technical support, perfect marketing information available to producers prior to undertaking production procedures.

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