Estimation for The Crop Response of The Small Holders & Agricultural Graduates in New Land of Egypt

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Introduction

Over the period 1952-1982 a total area of about 1.03 million feddans has been reclaimed in Egypt. It is proposed to reclaim an additional new area of about 2.8 million feddans up to the year 2000 (1). This area will help in creating an opportunity for setlement of new agricultural communities, in addition to its role in the management of the increasing food gap. Recently (in seventies), the government has started to distribute the reclaimed land among the landless agricultural labour and the agricultural graduates (2). This policy creates new employment opportunities for such groups. Therefore, this study attempts to measure efficiency of labour employment opportunity versus capital allocation opportunity under both management patterns, i.e. small holders and agricultural graduates, in the new land. Crop production response is the model used for such purpose.

Data & Methodology

The study used data collected from a farm management sample survey applied in a new land site "Samalout", in El Minia governorate. in 1984. The survey coverd the agricultural year 1983/1984. The ford foundation in Cairo spounsured the survey as a guide for the development plan in the new land. The total population rize was 72 farms with the graduates and 100 farms with the small holders. The stratified random sample size was 40 farms, of which 23 agricultural graduates and 17 small holders.

Cropping pattern on the new lands under private management is not imposed on the farmers as the case in the old lands. The farmer is free to make his own dicision to cultivate what he believes profitable. Table 1, presents the cropping pattern of the both farmer groups in 83/1984. Eventhough, wheat and corn are the most frequant crops cultivated by the small holders they are excluded from the analysis because they are subsistance crops rather than profitable commercial ones. For both groups the winter tomatoes is the most frequant crop. Therfore, the comparative analysis between the small holders and the graduates was made emperically with respect to the tomatoes response, in order to measure the labour and capital productivity.

Heady and Dillon (3) cited that "production functions derived from cross-sectional samples for farms of given size in acreage require some particular aggregation and specification procedures,... however, the results are useful for diagnostic purposes in analysing farm resource returns...such as labour or capital productivity or whether great differences exist between different regions in respect to capital or labour productivity".

Statistical Results

Labour and capital response was estimated for the winter tomatoes per feddan cultivated by the both farmer groups. The average farm size with the graduates was 36.6 feddans and with the small holders was 4.6 feddans. The average area occupied by winter tomatoes was 4.9 feddans on the graduate's farm and 0.4 feddans on the small holder's farm, in the agricultural year, 1984.

Y_i represents the yield of tomatoes in tonnes per feddan under the management group i; where i=1 for the graduates and = 2 for the small holders. L_i, represents the total human labour hours used per feddan of tomatoes. K_i, represents an aggregate variable which is the sum of the operating capital inputs allocated per feddan of

tomatoes in Egyptian pounds. The aggregate capital variable is the sum of the chemical fertilizers, organic fertilizers, chemical sprays, seeds, machinary work and animal work.

The Cobb-Douglas farm was applied for the tomatoes-response, as shown in table 2. Estimated coefficient of determination (R^2) was around 0.6 for the graduates' model while it was around 0.7 for the small holders' model, however both coefficients were significant at a probability less than percent. The lower R^2 value of the graduates' model is because of the insignificant response (regression coefficient) of the labour input in the graduates' model. This is due to its high standard error value. On the other hand, labour input-response (representing by its regression coefficient) was highly significant. The capital response was significant in both models at 0.05 significance level.

Economic Implications

The regression coefficients of the Cobb-Douglas form present the production elasticities of the corresponding inputs. Their sum is the return to scale measure. Accordingly, the return to scale from the estimated models, in table 2, is 1.6882 for the graduates and 1.2459 for the small holders. However, practical statement about returns to scale can be made only if the enterpreneur can actually make proportionate changes in all the inputs considered. Where inputs are not under his control, he can not make a proportionate change in every input factor. Distinction therefore may be made between "physical returns to scale", incorporating all inputs, and what might be called "economic return to scale". The latter would include only those inputs under the control of the enterprenear (3). Empirical difficulty arises, however, since exclusion of the uncontrolable inputs from the analysis tend to bias estimates of the economic returns to scale. If it is assumed that no relevant input factors have been excluded, the sum of elasticities provides an indication of returns to scale. On the other hand, if it is believed that constant

return to scale prevail, the sum may be regarded as indicating the importance of omitted variables if it is less than unity, or as roughly indicating the extent of anomalies in the mode of aggregation if it is greater than unity. Returns to scale will be underestimated if the excluded variables vary less than proportionately with changes in the included variables over the sample of observations. If the reverse situation holds true the elasticity of production or returns to scale will be overestimated (4) & (5). Therefore, wheares, the present response estimate is assumed to include all inputs, omission of management from the function or neglecting quality differences in labour, in addition to aggregating will generally lead to overestimation of the returns to capital and underestimation of the returns to labour. Given all the limitations associated with the measurement and interpretation of the over-all production elasticity, it is better not to stress this statistic in discussion.

Capital Productivity:

Estimated elasticity of production for capital allocated by the graduates in tomatoes production is two folds that estimate for the small holders response, (table 2) i.e. 1.9694 and 0.8974, respectively. The marginal product of the capital is derived by equation 1.

$$(1) \qquad Y_i = b_{2i} \; {}^{Y_i}/_{K_i}$$

From this equation the marginal product is 8.9 tonnes of tomatoes per L.E. 100 of capital allocated under the graduates management while it is only 2.5 tonnes per L.E. 100 of capital allocated by the small holders. At farm gate price of L.E. 81 per ton of tomatoes the value of marginal product is L.E. 7.27 and L.E. 2.30 per L.E. used by the graduates and the small farmers (table 3).

To judge by appearances, the capital productivity under the graduate farmers management is more efficient than the small holders, because the production elasticity and the marginal product in tomatoes production by the former is almost two folds these values in the

case of the later group. However, the estimates involve sampling errors, these inferences need to be subjected to a probability test. The simple test made here includes the following task: The elasticity of production for the capital (B_1^*) necessary to give a marginal product under graduates management equal to the marginal product of the same resource under the small holders management is computed (equations 2 and 3). The standard error (SbP), for the pooled variances is then computed as equation 4. The value of t is givin in equation 5.

$$(2) \quad d\bar{Y}_1/d\bar{K}_1 = b_1 \frac{\bar{Y}_1}{\bar{K}_1} = b_2 \frac{\bar{Y}_2}{\bar{K}_2}$$

$$(3) \quad b_1 = b_2 \frac{\bar{Y}_2 \bar{K}_1}{\bar{Y}_1 \bar{K}_2}$$

$$(4) \quad SbP = S^2 + \left(\frac{\bar{Y}_2 \bar{K}_1}{\bar{Y}_1 \bar{K}_2}\right)^2 S_2^2$$

$$(5) \quad t = \frac{b_1 - b_2 (\bar{Y}_2 \bar{K}_1 / \bar{Y}_1 \bar{K}_2)}{S_1^2 + \left(\frac{\bar{Y}_2 \bar{K}_1}{\bar{Y}_1 \bar{K}_2}\right)^2 S_2^2}$$

Using this model, the value of t was calculated for comparing elasticities of the capital derived in tomatoes production by the graduates with computed elasticity necessary to give marginal production for capital under graduates management equal to marginal productivity for capital under the small holders management the calculated t-value was 0.352. Therefore, in terms of probability, it is possible to infer that the marginal productivity of capital allocated by the graduates is not significantly greater than for the capital allocated by the small holders, in tomatoes production in 1984. Accordingly both farmer groups showed the same efficiency of capital use in tomatoes production in the new land of samaloute.

Within the limits of statistical reliability, the marginal return to opportunity cost ratio provides a measure of the efficiency of resource use. If the ratio is less (greater) than one, it indicates that too much (too little) of the particular resource is being used under the existing price conditions. As shown in table 3, additional capital allocation creates higher productivity for both groups response, however it is more productive in the case of the graduate farms.

Labour productivity:

From table 3, the labour production elasticity is of a negative but insignificant value for the graduates. It is positive and significant of a value 0.349, for small holders. This not only implies that the human labour is more productive in the case of the small holder management but it also shows that the graduate farmer uses much more intensive labour, which is beyond the economic stage of production. The average human labour level per feddan, used by the graduates, was around 706 hours. It was much less intensive on the small holder farm, i.e. 398 hours per feddan for tomatoes cultivation. The graduates use two times the number of human labour per feddan used by the small holders. Human labour used by the graduates is completely hired, while the small farmers depend completely on family labour. This leads to a very high labour costs for the graduates which may reach one half of the total costs of production. It also causes a low (even negative) productivity of the labour. Surprisingly, the graduates also use more machinary hours per feddan, i.e. 33 hours while the small holders used only 27 hours per feddan of winter tomatoes. This result may, also, indicates that a high positive effect of human labour on yields is due to efficient family labour in terms of quality and quantity, while the graduates use excess labour per feddan because it has either a weak or negative effect on yields. Since two thirds of the graduates do not live permanently at the site they require additional labour for supervision and management. Also, they were originally high ranking employees and they do not like to do operations themselves like driving the tractor or other machines or performing routine maintenance, although, half of them own machinaries.

Table 3 shows a comparison of the marginal return to opportunity cost ratio with respect to labour use by the two farmer groups. Such comparison implies that less labour density is required to be applied by the graduates and labour should be replaced for more capital (particularly machinary work). The small holders have an opportunity to apply more capital and labour to expand the yield and to raise the inputs productivity.

References

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Table 1. Average Cropping Pattern per Holding in 1982/1983

Crops	Average Crop Area per holding (feddan)		% of the total holders of each group	
	Graduates	Small Holders	Graduates	Small Holders
Winter Crops				
Tomatoes	6.71	0.98	78.0	80.0
Onion	6.33	0.30	72.0	24.0
Bean	3.98	0.84	68.0	71.0
Berseem	2.24	0.42	52.0	41.0
Pea	3.10	0.00	26.0	00.0
Barley	0.54	0.19	13.0	21.0
Wheat	0.04	1.24	4.5	88.0
Sub-total	23.12	3.97		
Summer Crops				
Corn	1.46	1.15	30.0	71.0
Groundnuts	5.43	0.96	67.0	58.0
Sesame	5.94	0.61	67.0	44.0
Tomatoes	1.20	0.10	13.0	6.0
Watermelon	7.53	1.14	76.0	68.0
Sweet potatoes	0.04	0.00	4.0	00.0
Sub-total	21.6	3.96		
Permanent Crops				
Alfalfa	2.77	0.43	54.0	41.0
Elephant grass	0.16	0.00	11.0	0.0
Guava	2.00	0.00	28.0	0.0
Citrus	0.18	0.00	6.5	0.0
Pomegranate	0.31	0.00	11.0	0.0
Sub-total	5.42	0.43		

Source: The sample survey in El minia governorate (Samalout Site), in 1984.

Table (2): Labour-Capital Response of Winter Tomatoes.

Farmers Group	Estimated Model	Standard Error of The Estimates $SE_1(b_1)$	$SE_2(b_2)$	R^2	F. Ration
Agri. Graguates	$Y_1 = 0.00087L_1^{(-0.2812)} C_1^{(1.9694)}$	0.2246 ns	0.1212 **	0.591	11.6 **
Small Holders	$Y_2 = 0.00734L_2^{(0.3488)} C_2^{(0.8971)}$	0.1599 *	0.1401 **	0.962	101.3 *

* Significant at a probability level less than 0.01

** Significant at a probability level less than 0.05

ns Not statistically significant

Number of observations are 19 for agricultural graduates, and 11 for the small holders.

Table (3): Comparison of labour and capital productivity in tomatoes production on graduates and small farmer farms in a new land area.

Economic Derivative	Graduates	Small Holders
Production Elasticities		
Labour	0.0#	0.3488
Capital	1.9694	0.8971
Input Means		
Labour (hours/feddan)	705.8	398.0
Capital (L.E./feddan)	408.3	319.3
Average products		
Labour (tonnes/hour)	0.282	0.0241
Capital (tonnes/L.E.)	0.487	0.0301
Value of Marginal products*		
Labour (L.E./hour)	0.0	1.8537
Capital (L.E./hour)	7.769	2.1855
Opportunity Costs of Inputs**		
Labour (L.E./hour)	0.70	0.70 7 0
Capital (L.E./L.E.)	1.075	1.075
Marginal Return to Opportunity Cost Ratios.		
Labour	0.0	2.791
Capital	7.227	2.033

\# Imperically it is considered zero; because statistically it is not significant.

* Sale price of farm gate per ton of winter tomatoes was L.E.81 in 1984.

** Assuming that the annual interest rate for the capital is 15%, therefore the opportunity costs of the capital per 6 months is 1.075. The average wage rate per one hour in the area in 1984 was L.E. 0.7 which was considered as the opportunity costs of the human labour.

Source: Calculated from the estimates of table 2.

Abstract

Estimation for The Crop Response of The small Holders and Agircultural Graduates in New Land of Egypt

The study's objective is to make a comparison between the productivity of labour and capital allocated by the agricultural graduates versus the small holders in a new land site which is samalout in El Minia governorate. A Crop-response was estimated to achieve the objective. The winter tomatoes was the most frequant crop cultivated by both farmer groups. Accordingly, it was choosen for response analysis in this study. A sample survey for 40 farms (23 graduate farmers and 17 small holders) was conducted by the authors in 1984 to cover the agricultural year 1983/1984. The input-output data of this survey was used for the present analysis.

The study concludes that labour use for small holders is more efficient than for graduates. There is overuse of human labour by the graduate farms. For both farmer groups, capital is more efficient than labour. Capital productivity is similer under both management patterns. Increasing capital inputs particularly machinary at the expense of labour inputs is a promising means for raising the productivity of the agricultural graduate farms in the new land. Ecourgement of the graduate' farmilies to live in the new land sites in addition to operating the owned machines by the graduates themselves, will cut the excess labour used per unit of land. The study shows that the small farm size in acreage has no negative impacts on the resources productivity.