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Growth Productivity of Wheat in Iran: An Empirical Study

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Abstract: Increasing population and limitation production factors make necessary to raise factor productivity progressively. In this study, substitution between production factors and total factor growth productivity during the 1982-2005 in wheat production was estimated by Allen elasticity of substitution and a Tornqvist index, respectively. Results showed that, output (wheat) growth was 0.79 during the 1982-1994 periods and had fallen to 0.41 in the 1995-2005. Moreover, growth productivity was negative over the whole period and indicated that, input growth has been more than output growth. According to finds, it is essential to move towards suitable combination of input use instead of injection more input in wheat production.

Key words: Total factor productivity · Törnqvist index · Wheat · Iran

INTRODUCTION

Regarding the scarcity of production resources, productivity nowadays is the best and most influential method to achieve economic prosperity.The efficiency of various economic sectors in utilizing production resources can be studied through calculation and analysis of productivity indices for production factors. Among the various economic sectors of a developing country, agricultural sector as the catering agent of the society, is of remarkable importance [1]. Wheat has an outstanding cultivated area among the agricultural products and plays an essential role in the people's nutrition. Thus, addressing the productivity of the production factors in wheat production is especially crucial [2].

Since the alterations in the supply of agricultural products is a fruit of changes in input and product, in order to have a more precise analysis of policies in these two sections, it is necessary to investigate concurrent changes in input consumption and production of goods. Analysis of total-factor productivity is one of the best methods in this regard [3].

The current study tries to calculate the productivity of wheat production factors using the criterion of total-factor productivity index and it has also investigated the role and importance of each input in production and elasticity of substitution for each input.

MATERIALS AND METHODS

Although the productivity has gained an extensive application, the theme is still a little bit ambiguous. Even in academic circles and among pundits of economic and social issues there may not be a concurrence. Anyway, a simple definition for productivity can be considered as the following [4]:

"Productivity is the product volume divided by production factors [1]."

One of the most essential parts of this study is to calculate the elasticity of substitution between inputs. Degree of substitution between inputs is a crucial theme in production theory. Elasticity of substitution indicates the percentage of elasticity of an input replaced by another one on a parallel valued curve. Chambers [5] believes that as long as other inputs have been considered fixed and not allowed to modify while an input changes during calculating the degree of substitution between two inputs *i* and *j*, the calculated el asticity of substitution is a short term elasticity of substitution [5]. To resolve this problem in Hicks Elasticity of substitution, a new elasticity called partial elasticity has been introduced. Allen's partial elasticity between two inputs of X(i) and X(j) in an n-input production system is defined as follows [6] :

$$\sigma_{ij}^{A}=\frac{\sum_{k=1}^{n}x_k f_k}{x_i x_j}\frac{H_{ij}}{|H|};\quad i\neq j;\quad H=\begin{bmatrix}0 & f_1 & \cdots & f_n\\ f_1 & f_{11} & \cdots & f_{1n}\\ \vdots & \vdots & \cdots & \vdots\\ f_n & f_{n1} & \cdots & f_{nn}\end{bmatrix} \quad (1)$$

Where H is bordered Hessian matrix, |H| is determinant of that, H_{ij} is the cofactor of f_{ij} in |H|.

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In productivity concepts there are distinctions among partial productivity and total productivity.Partial productivity or single factor productivity is defined as an output for a determined factor over time. Whenever the concept of average production divided by total consumed inputs is generalized for the production of a specific volume of product, the total-factor productivity will be obtained. This criterion is defined as the relation of output quantity index divided by input quantity index. Since the partial productivity ignores the effects of other production factors applied in the production, it is not deemed as a suitable criterion [7].

Total-factor productivity therefore is considered a more suitable criterion to demonstrate productivity performance in a production unit or economic sector. To calculate total-factor productivity growth, Tornqvist index has been applied in this study [8].

Mathematically, the Tornqvist index is calculated (in log form), between any two consecutive time periods, t and t+1, as[9]:

$$TFP_{t,t+1} = \log Y_{t+1} - \log Y_t - \sum_{i=1}^{n} \frac{1}{2}\left[S_{i,t+1} + S_t\right].\left[\log X_{i,t+1} - \log X_{i,t}\right] \quad (2)$$

Where; S_i denoted the respective input's value-shares, Y is output, X_i is input and t is time.

Required information has been obtained from Statistics provided by Central Bank, Management and Programming Organization and Ministry of Agricultural movement. Data was for the time period of 1982-2005. Intermediate inputs include fertilizers, pesticides, irrigation water and seeds. Values for wheat production, capital and intermediate inputs are for a hectare of land cultivated with wheat nationwide.

RESULTS AND DISCUSSION

In this section the results for the applied methods are demonstrated. To speculate Translog production function, iterative seemingly unrelated regression has been applied. It was proved through the Durbin-Watson test that none of the equations are auto-correlated. The speculation results of Translog production function is demonstrated in Table 1.

Observing Table 1, growth productivity can be calculated. α_T is indicative of growth productivity and β_{iT} is the productivity growth with respect to the capital and intermediate inputs. α_T at 5 percent level is meaningful and its value is-0.56 indicating that the growth productivity for wheat production is negative. This method of productivity calculation is actually a kind of partial productivity calculation. The value of 0.2 obtained for β_{iT} supports this fact that while the other factors are fixed, the productivity growth resulted from intermediate inputs is 0.2.

To calculate elasticity of substitution, Allen's elasticity has been applied whose results are shown in Table 2.

Among the differences between Allen's and Hicks' elasticity of substitution is the distinction between the elasticity of substitution for *i* and *j* and the elasticity of substitution for *j* and *i*.This is true for other inputs as well. In the time period of 1982-1994, the largest (absolute value) elasticity of substitution was for intermediate and labor inputs (-1.13) and the smallest was between capital and intermediate inputs (-0.10). From 1994 to 2005 the largest elasticity of substitution was between labor and intermediate inputs (-1.52) and the smallest was between capital and intermediate inputs (-.0.02).

To calculate the total productivity, Tornquist index has been utilized.

Table 1: Parameter estimates of production function

Parameters	Estimate	Parameters	Estimate	Parameters	Estimate	Parameters	Estimate
αx	-1.98	Bxx	-0.56	βXK	-0.11	BKT	0.20
αK	0.77	Bkk	-0.32	BxL	-0.44	BLT	-0.06
αL	2.21	BLL	-0.64	βXT	0.12		
αT	-1.56	βTT	-0.009	BKL	0.20		

Table 2: Elasticity between inputs

	Elasticity between intermediate and labor inputs	Elasticity between labor and intermediate inputs	Elasticity between labor and capital inputs	Elasticity between capital and labor inputs	Elasticity between capital and intermediate inputs	Elasticity between intermediate and capital inputs
1982-1994	-1.13	-0.97	-0.04	-0.24	-0.01	-0.02
1995-2005	-1.30	-1.52	-0.75	-0.70	-0.02	-0.03

Table 3: growth of product, input and productivity in production of Iran wheat

	Growth				
	Productivity	Product	Capital	Intermediate	Labor
1982-1994	-1.06	0.79	2.59	0.83	1.16
1995-2005	-1.32	0.41	0.14	0.41	0.12
Average	-1.19	0.60	2.87	0.62	0.64

The results obtained from growth productivity calculation and the growth of inputs and the production are shown in Table 3.

As it is determined in Table 3 productivity growth is negative in both periods. From 1994 to 2005 this negative growth has made a 25 percent increase which means even smaller growth productivity. The results in the table suggests that the product growth rate for the courses of 1982-1994 and 1995-2005 has been positive, however this increase has lessen by 0.41 in the second period. From 1982-1994 capital growth (2.59) for wheat production was very high but it shows a remarkable decrease (0.14) during the second period. For intermediate and labor inputs the growth in the first period was greater compared to the second period.

The results of this study demonstrated that the wheat growth production was positive in both periods but has been less in the second period. Given that the wheat production per unit has been inserted in the model, this fact indicates that although the volume of wheat production in the country has increased but the growth productivity has been negative. Capital, intermediate and labor inputs in Iran's wheat production have experienced negative growth from 1995-2005 which can be a result of over-attention paid to the agriculture specially to wheat production in the first decade after revolution and the excessive attention paid to the services and industry sector in recent years. Negative labor growth indicates that the labor force has moved from agriculture to other sectors of the economy. The growth productivity have been negative in both periods and the growth of production inputs has been greater than the product growth per unit. This fact means that the problems of agriculture sector is not merely a result of the shortages in production inputs but inefficient use of inputs and their improper combinations are among the most fundamental problems of the agriculture sector. Regarding the findings it can be stated finally that optimum use of existing inputs and improved combination of them should be emphasized rather than increasing the inputs [9, 10].

REFERENCES

1. Akbari, N. and M. Ranjkesh, 2003. Analysis of the growth of total factors productivity of agriculture sector in Iran (1966-96), Journal of Agriculture Economic and Development, 43: 117-142.
2. Ball, V.E., 1985. Output and productivity measurement in US Agriculture, 1948-79, American Journal of Agricultural Economics, 3: 86-475.
3. Seyedan, M., 2002. Resource allocation and the economy of scale in sugar beet production: A case study of Hamedan province, Journal of Agriculture Economic and Development, 37: 117-142.
4. Mirotchi, M. and D.B. Taylor, 1993. Resource allocation and productivity of Cereal State farms in Ethiopia, Agricultural Economics, 8: 97-187.
5. Chambers, G., 1988. Applied production analysis: A dual approach. New York: Cambridge University Press.
6. Hoff, A., 2004. The linear approximation of the CES functions with n Input variables, Marine Resource Econometrics, 19: 295-306.
7. Salami, H., 1997. Concepts and calculation of productivity in agriculture, Journal of Agriculture Economic and Development, 18: 51-67.
8. Battomley, G. and S. Thirtle, 1992.Total of factor's productivity in agriculture sector of Britain, 1987-90, American Journal of Agricultural Economics, 3: 28-112.
9. Dhehibi, B. and L. Lachaal, 2006. Productivity and economic growth in Tunisian agriculture: an empirical evidence. Poster Paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006.
10. Bakhshi, A. and G.H. Zamani, 2008. Attributions for arm Performance Amongst Farmers in Iran,World Applied Sciences Journal, 3(3): 405-412.