The estimation of productivity of walnut production in Chaharmahal and Bakhtiari province

Hossein Ostadi, Reza Ganji Salah Chini [*]

Department of Economic, Dehaghan Branch, Islamic Azad University, Isfahan, Iran

Abstract: Improving productivity is concerned as an important source of economic growth and increasing competitiveness of firms, in a way that industrial countries and successful developing have gained considerable parts of their production growth from this way. If scarce production factors with suitable methods and with minimum costs for to achieve to highest amount of production in terms of quality and quantity are organized, can be argued that is closed to development in the economic dimension. This dimension of development is more close to productivity concept with regard to the issue that agriculture constitutes the considerable amount in GDP in most of the countries in all around the world. The statistical society of this research, is selected the cities of Chaharmahal and Bakhtiari province and it is used from the data related to production, forces and capital force in order to estimate the productivity of total factors of producing the walnut product during years 2006-2012 with the use of panel data method. The results of F Limer and Hasman test in this study show the prove panel data method with the use of accidental effect method. According to the results of research, the productivity process of total factors of producing walnut product in cities of Chaharmahal and Bakhtiari province has not had that much increasing process and in fact there has not been the productivity improvement. Also, according to the obtained coefficients for forces and capital force, the forces force coefficient is bigger which means employing more forces force in the production process, therefore, it is required to apply policies in mechanizing agriculture in this province.

Key words: Productivity of production factors; Walnut product; Chaharmahal and Bakhtiari province

1. Introduction

Productivity means the optimal use of resources and access to more production by determined resources. Improving productivity is concerned as an important source of economic growth and increasing competitiveness of firms, in a way that industrial countries and successful developing have gained considerable parts of their production growth from this way. Due to the descending nature of output, we cannot lead the output growth with continuous growth of input in long term. It means as more and more inputs are used, we can expect less extra output from a unit of extra used input. For continued growth in output, the productivity growth of total factors production is necessary and therefore, TFP growth is synonymous with long-term growth and it is reflect of growth capacity. Therefore, the growth rate of this index in macro level, shows the economy situation of the country in terms of optimal use of resources and its increase in level of one organization can lead to develop in competitive market, improve the performance of various sector, more approaching to the planned target, reduce the costs, increase the incomes, improve the quality of production or services and etc.

On the other words, productivity is the comparison of efficiency. The method of productivity evaluation is divided into two categories: parametric method and non-parametric. Parametric method refers to the ways in which first a particular form is considered for production function. Then with the use of conventional methods of econometrics, unknown coefficients (parameters) of this function are estimated and with using of estimated function, productivity is calculated.

In fact, one of the most important development components of countries is production power and since the power of the country's production is largely confined to the resources, all of them due to lack of resources for optimum use of the available resources in their countries. For this reason, in all countries, government has had to adopt appropriate policies for the available optimal allocation of resources and services in the community and various sectors of the economy.

In this regard, the objective of this research is to study and estimate the productivity of total factors production of walnut product in the cities of Chaharmahal and Bakhtiari with using of Cobb-Douglass production function and Kendrick index.

2. Literature and research background

2.1. The role of productivity in agriculture development

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[*] Corresponding Author.

Knowing the direction of productivity growth in agriculture sector of Iran both in terms of weak economic infrastructure as well as intense competition on the world stage for better economic opportunities, contributes to push our resources and production facilities toward that we can get our rightful place in international relations. Economic growth in a sector is required production increase in that sector. According to the theory of production and supply, production growth is possible from two ways: first increasing the production by applying more production factors and second increasing the production by use of advanced technologies and efficient and using of more effective production factors. In Iran and most of the developing societies, the lack of water and other inputs limits the first approach of increase in production in long-term, therefore, the attention is on the second method which means increase in productivity of production factors is inevitable require to increase the supply of products. So, in the forth five-year plan of developing economic, social and cultural of the country (2005-2009), an important assignments are determined for improving productivity across the total economy, economy parts, and also agriculture sectors of Iran. In this plan, the average growth of added value in the agriculture sector is considered 6.5 percent yearly which 4.3 percent of that should be achieved by increase the new investment (more use of inputs especially human and capital forces) and 2.2 percent of that should be achieved by productivity growth of total factors production (TFP). Also, the growth rate related to human and capital forces in agriculture sector during the fourth program years is considered in order 4.6 and 0.1 percent (the low of developing fourth plan of the country, 2004).

2.2. The productivity of total factors (labor and capital force together)

The productivity of total factors, in fact, expresses the average of production to each unit of total production resources. This index indicates the resultant changes in the productivity of labor and capital. The growth of GDP in national level and or added value in each of economic sectors is done by two resources: Increase inputs of labor and capital, Improvement of machinery and equipment structure, improve the quality of labor and management and so on.

It should be noted that in present situation, due to obtain of compressed competition among the countries for gaining a greater share of world trade; they attempt to provide the growth of GDP or added value of parts possibly with improving the structures. On the other words, instead of increasing the human forces, they try to perform short-term specialized training programs in order to increase the level of workers' skill and or instead of providing new capacities, they try to equipoise the available capacity to new mechanism and this way, they produce high quality production and increase their competitiveness ability.

3. Research model

In this research, for investigating the productivity of total production factors, the Neo Classical (Solow) and Cobb-Douglass Production Function are considered. Solow (1957) assumed that the production function with Hicks neutral technology (alignment of technological change) had relocation parameter A_t and it had constant return to scale:

$$Y_t = A_t . F(K_t, L_t) \qquad (1)$$

In here, γ_t is the amount of production and L_t is labor and K_t is capital inventory, and $F(0)$ shows the Neo Classical production function which has conditions in below:

$$\partial Y/\partial L \equiv F_L(0) > 0 \qquad (2)$$
$$\partial Y/\partial K \equiv F_K(0) > 0 \qquad (3)$$
$$\partial^2 Y/\partial^2 L \equiv F_L^2(0) < 0 \qquad (4)$$
$$\partial^2 Y/\partial^2 K \equiv F_K^2(0) < 0 \qquad (5)$$

That the equations 3 and 4 the first order derivative and equations 5 and 6 the second order derivative shows the production function to the production inputs.

Differential (logarithmic) of the total production function is equal to:

$$\frac{\dot{Y}_t}{Y_t} = \frac{\partial Y_t}{\partial K_t} \cdot \frac{K_t}{Y_t} \cdot \frac{\dot{K}_t}{K_t} + \frac{\partial Y_t}{\partial L_t} \cdot \frac{L_t}{Y_t} \cdot \frac{\dot{L}_t}{L_t} + \frac{\dot{A}_t}{A_t} \qquad (6)$$

Therefore, the real Output growth in left side can be decomposed into labor and capital growth rates with their Output pull weights and Hiksi efficiency growth rate index. Growth input causes the movement through the production function and maybe succession factors, while the growth rate moves the growth rate of production function efficiency index (Romer, 1996; Hulten, Dean and Harper, 2001). With considering S_t^K and S_t^L as a share of labor and capital, Hiks efficiency growth rate, Solow residual, are equal to:

$$\frac{\dot{A}_t}{A_t} = \frac{\dot{Y}_t}{Y_t} - S_t^K \cdot \frac{\dot{K}_t}{K_t} - S_t^L \cdot \frac{\dot{L}_t}{L_t} \qquad (7)$$

Residual growth rate can be estimated by Output growth data, input growth, and factor shares. Residual growth rate is the growth rate of output which is not because of input growth and it is called TFP growth. TFP is productivity of total production factors, the ratio of added value (Y), to one weight average of production inputs like labor and capital inventory (Dollar & Wolff, 1993). Therefore, the productivity is able to calculate as follow:

$$TFP_t = \frac{Y_t}{\alpha L_t + \beta K_t} \qquad (8)$$

In this research, it is used of data related to production, labor and capital inventory in cities of Chaharmahal and Bakhtiari province where manufacturer of walnut product are in order to estimate productivity of total production factors of this product. In this research, in order to analyze data and estimate the model, panel data model is used.

4. Model estimation

In this study in order to test the panel unit root, it is used from Levin, Lin and Chu method (LLC). The

zero hypotheses in this test express the variables stationary. This way, if the probability amount is less than 0.05, the zero hypotheses will be rejected. Therefore, the obtain results of stationary test for panel data in table 1 is visible.

Table 1: The results of stationary test for model variables

Variable	Levin Lin and Chu test	
	Coefficient	Probability
Capital inventory	-0.59	0.27
Labor	-7.25	0.01
Production	3.66	0.99

To study and estimate the productivity of total production factors, the suitable model is mentioned. This model is as follow:

$$Y_t = AK_t^{\alpha}L_t^{\beta} \qquad (9)$$
$$LY_t = A + \alpha LK_t + \beta LL_t + U_t \qquad (10)$$

To study productivity, first of all with the use of panel data model and STSTS software, α and β are estimated, then with the use of Kendrick index which is as below, the productivity of total production factors is calculated.

$$TFP_t = \frac{Y_t}{\alpha L_t + \beta K_t} \qquad (11)$$

According to the models in above and with the use of time series data 200

6-2012, the coefficients in table 2 are estimated.

Table 2: The results of model estimation

Variable	Coefficient	Z Statistic	Probability
Capital inventory	0.38	2.99	0.003
Labor	0.50	3.67	0.000
F Limer	F = 30.07 Prb. = 0.006	Hasman test	Chi Square = 5.83 Prb. = 0.054
R²			0.38

To determine the issue whether data are inserted to the model as panel and or pooling, F Limer test is used. Accordingly, if the probability of related statistic to this test is less than 0.05, data should be considered as panel. As it can be seen in table above, the related probability to statistic of F Limer test is 0.005 which shows the inserting data as panel.

Aside with using of Hasman test, the fix effect or accidental will be examined. Statistic X2 is used in this test, in a way that if the probability of this statistic is bigger than error threshold 0.05, the model should be estimated with accidental effects, so, the studied model in this research is accidental.

According to the obtained results, estimated coefficients are significant in level of 0.99. Now, based on obtained results, the productivity of total production factors of walnut product for cities of Chaharmahal and Bakhtiari province is calculated that the results are visible in table 3.

Table 3: The productivity of total production factors of cities

Cities/ Year	Koohrang	Ardal	Lordegan	Farsan	Shahrekord	Broojen
1385	1.7069	2.0901	1.8464	1.9387	1.9999	1.9872
1386	1.7447	2.1026	1.8530	1.9603	1.9959	2.0003
1387	1.7323	2.0307	1.9055	1.9842	2.0014	1.9592
1388	1.7887	2.0447	1.9177	2.0011	2.017	1.9843
1389	1.8285	2.0569	1.9074	2.0073	1.9948	1.9847
1390	1.8329	2.0664	1.9269	2.0148	1.9797	1.9818
1391	1.8979	2.1371	2.1713	2.0868	2.1615	2.0077

Then, it has been dealt with the study of the impact of effective factors on walnut productivity which is dependent variable of productivity of production factors in this model and independent variables includes: the amount of required machinery (capital amount), amount of water consumption, fertilizer consumption and labor.

Table 4: The results of model estimation

Variable	Coefficient	Statistic Z	Probability
Intercept	-0.32	-0.01	0.003
Amount of required machinery (capital amount)	0.41	3.88	0.001
Amount of water consumption	0.21	6.01	0.0001
Amount of fertilizer consumption	0.12	3.01	0.001
Labor	0.34	2.88	0.011
F Limer	F = 41.18 Prb. = 0.001	Hasman test	Chi Square = 8.89 Prb. = 0.015
R²			0.68

The amount of required machinery (capital amount), amount of water consumption, fertilizer consumption and labor are caused to increase the productivity of walnut product in province and among the effective factors on productivity, capital has had the most effect on productivity of walnut product in province.

In the next step, it can deal with the study of obtain the long-term equilibrium relationship among variables. The results of panel co integration test based on Pedruni seventh statistics are presented in table 5. According to the test results, most of the test statistics (in each test at least four statistics) rejects strongly the zero hypotheses based on the absence

of co integration vector. Therefore, we can say there is long-term relationship of variables.

Table 5: The results of Pedruni co integration test

Statistic	Test statistic	Prob.	Test statistic	Prob.
Among dimensions				
V panel statistic	1.014302	0.1552	0.822123	0.2055
Rho panel statistic	-0.266374	0.3950	-0.029177	0.4884
Pp panel statistic	-1.531920	0.0628	-1.374870	0.0846
ADF panel statistic	-1.365567	0.0860	-1.307327	0.0956
Among dimensions				
Rho group statistic	1.496916		0.9328	
Philips-Peron group statistic	-2.144860		0.0160	
(ADF) group statistic	-1.221819		0.1109	

The results of Kao co integration test also is presented in table 6. The result of this test indicates that zero hypotheses based on absence of co integration vector are rejected strongly. Therefore, in here also we can say there is long-term relationship among variables.

Table 6: The results of Kao co integration test

Kao co integration test	
Statistic t of ADF test	-2.288320 (0.0111)

5. Conclusion

According to what was observed, generally, the productivity of total production factors of studied cities during the studied period has not had that much changes and its range of changes is negligible. Also, the obtained numbers mostly are between 1 and 2 and with regard to the positive effect of two variables labor and physical capital on productivity, the functional suggestions are presented as follow:

According to the obtained results, since the productivity process of total production factors of walnut product in cities of Chaharmahal and Bakhtiari has not had that much changes and in fact, there has not had any improvement in productivity, therefore, it is suggested that careful study will be done about the policies of agriculture sector in province and if it is necessary, it is revised again.

Also, since the obtained coefficient for labor and capital, the labor coefficient is bigger which means more use of labor in the manufacturing process, therefore, it is recommended the policies in the field of mechanization of agriculture and applying more capital in the production process of agriculture products must be taken.

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