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Research Article

MEASURING AND FORECASTING TFP IN AGRICULTURE SUBSECTORS OF IRAN DURING 5-YEAR SOCIO-ECONOMIC DEVELOPMENT PLANS

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ABSTRACT
Agricultural is one of the most important economic sectors in Iran. On the other hand, Improving and promoting productivity is always a major topic in this sector and it has been considered during the 5-year development plans continuously. However, first step for achieving to this goal is measuring it. Therefore, the main purpose of this paper is measuring and forecasting TFP changes in agriculture sectors of Iran during 5-Year Development Plans. The malmquist index is a suitable technique for measuring it apparently; but a serious criticism to this technique is using deterministic data for inputs and outputs. Also, Due to the lack of deterministic data cannot predict TFP index for future periods. Therefore, the proposal technique is Stochastic Malmquist Productivity Index (SMPI) regarding to purposes of the paper. This index provides the possibility of recognition of the probable progress or regress of units. Time period is 1990-2014 and in order to measuring productivity are used three inputs and two outputs. The results showed that TFP has had regress during first to fourth 5-year development plans and is predicted that it will continue in fifth plan.

Keywords: *Stochastic Data, Malmquist Productivity Index, Total Factor Productivity (TFP), 5-Year Socio-Economic Development Plans*

INTRODUCTION
Iran is a country with large mineral deposits and abundant natural resources that almost one-tenth of the world's oil and one-fifth of its natural gas reserves are located in it. However the agricultural sector plays an important role in the Iran economy. For example, there are about 20 percent of gross domestic product (GDP), 23.4 percent of total employment, 80 percent of domestic food requirements, more than one-third of non-oil exports, about 88 percent of the needs of industrial units, 22.6 percent of banking credits and 32.8 percent of total investments in this sector (Raayatpanah and Ghasvari, 2011).
After the Iranian revolution in 1979, the government decided to implement a series of 5-year Development Plans in order to eliminate Iran's economic problems and its development in the various dimensions of economic and social. The first 5-year Development Plan started at the period 1990-1994.The second, third and fourth 5-year Development Plan was performed at the periods of 1995-1999, 2000-2004 and 2005-2009 respectively, also The fifth 5-year Development Plan has started since 2010. Due to agriculture sector share in Iran economy and its serious impact on other sectors, development of this sector always has special place in the 5-year Development Plans (Kausar, 2009).
On the other hand, due to population increase and resources scarcity, the productivity is an important concept in agricultural sector of Iran and final goal of agricultural development plans is improving and increasing it. The first step for access to the goal is measuring productivity index. Thus, the main objective of this paper is measurement of Total Factor Productivity Changes (TFPCH), Efficiency Changes (EFCH) and Technology Changes (TECH) in the agricultural sectors of Iran during first to fourth 5-year Development Plans and also forecasting these indexes during fifth 5-year Development Plan. For this purpose, we can use non-parametric techniques, that they are based on DEA method (Data envelopment analysis (DEA) is a non-parametric technique which is based on mathematical programming for evaluating the efficiency of a set of Decision Making Units (DMUs)). One of the best methods for compute productivity changes during a certain time period is Malmquist index (This index is based on DEA techniques). A serious criticism to this technique is the condition of deterministic data for inputs and

outputs, but in application and the real world problems, It is important to note that in current and future planning, we can not control the quantity of inputs and outputs usually, because these quantities depend upon many external factors such as political, economic, climate and geography conditions. On the other hand, unavailability accurate data is a more serious problem. this problem is inevitable in third world countries especially. Therefore , it is better that the inputs and outputs be used in the form of random variables (Pratt *et al.*, 2008). Hence, in the current study we measure TFP index in agricultural sectors of Iran by Stochastic Malmquist Productivity Index (SMPI).

The remainder of this paper has the following structure: in section 2, we present literature review. Section 3 introduces methodology and proposed model. Section 4 illustrates inputs and outputs. Section 5 focuses on analysis of the results. Finally, conclusions are given in section 6.

Literature Review

In recent years numerous studies have been done on productivity and its measurement. For example:

Kausar (2009) investigated total factor productivity of agriculture crops in the North West Frontier Provinces (NWFP) of Pakistan from 1970 to 2004 by Malmquist index. Empirical results showed reduction of productivity of the agriculture sector in NWFP and there has been no improvement in the efficiency level (Shahabinejad and Akbari, 2010). Pratt *et al.*, (2009) have measured total factor productivity growth in agricultural sector of China and India. Their findings showed that efficiency improvement played a dominant role in promoting TFP growth in China, while technical change has also contributed positively and in India, the major source of productivity improvement came from technical change, as efficiency barely changed over the last three decades, which explains lower TFP growth than in China (Belloumi and Matoussi, 2009). Shahabinejad and Akbari (2010) measured the agricultural productivity growth in Developing Eight (D-8) from 1993 - 2007. This study focused on growth in total factor productivity and its decomposition in to technical and efficiency change components. The result of this study showed that all D-8 countries improved technology more than efficiency in the reference period (Deliktas and Candemir, 2007).

Belloumi and Matoussi (2009) have used a non parametric analysis to investigate the Patterns of agricultural productivity growth in Middle East and North Africa (MENA) countries during the period 1970- 2000. Their findings showed, in average, agricultural productivity growth increased at an annual rate of 1% during the whole period. Their estimations demonstrate that technical change is the main source of this growth (Cooper *et al.*, 2004).

Deliktas and Candemir (2007) have used data envelopment analysis approach to measure productivity index in agricultural enterprises of Turkish in during the period 1999- 2003. Their finding showed that, the agricultural enterprises experienced technical regress, while the technical efficiency improved by 1.5%. Also, the results of regression estimation indicated that irrigation rate, tractor as an indicator of existing technology and the geographic positions of enterprises are important determinants of production efficiency (Hosseinzadeh *et al.*, 2007).

Cooper *et al.*, (2004) studied solving method of stochastic DEA by chance constrained programming formulations. This leads to a class of non-linear problems. However, it is shown to be possible to avoid some of the need for dealing with these non-linear problems by identifying conditions under which they can be replaced by ordinary (deterministic) DEA models (Hosseinzadeh *et al.*, 2010). Hosseinzadeh *et al.*, (2007) measured efficiency in Iranian commercial banks with stochastic inputs and outputs by Stochastic DEA (Hosseinzadeh *et al.*, 2011).

Hosseinzadeh *et al.*, (2010) studied two different methods for ranking efficient units with stochastic data are proposed. In these methods according to the useful characteristic of coefficient of variation, some indexes for ranking have been defined. These methods are applicable for situations in which some of the input and output coefficients of variation are significant for managers (Behzadi *et al.*, 2010). Hosseinzadeh *et al.*, (2011) and also Raayatpanah and Ghasvari (2011) studied a new approach based on DEA is presented for estimating Malmquist index in future. They calculate this index with the contribution of stochastic data and this approach provides the possibility of recognition of the probable progress or regress of units (Khodabakhshi and Asgharian, 2008; Khodabakhshi, 2009).

MATERIALS AND METHODS

Methodology

Methods of Measuring TFP

There are two new techniques for the measurement of productivity changes. These techniques are including: Parametric technique and Non-parametric technique. These two techniques have an advantage in decomposing TFP growth into its associated components. In parametric technique is used the econometric technique and called Stochastic Frontier Analysis (SFA), but in Non-parametric technique is used the linear programming technique and called Data Envelopment Analysis (DEA). The parametric technique requires specific functional form, but Non-parametric technique is not such. In this study is used Non-parametric technique, because it does not require the imposition of a possibly unwarranted functional form on the structure of production technology, as required by the econometric approach (Khodabakhshi, 2009).

There are different indices such as Fischer and Tornqvist that are used to evaluate technological changes and productivity. Meanwhile Malmquist index is a suitable Non-parametric approach to measure TFP. The Malmquist index has three main advantages relative to the Fischer and Tornqvist indexes. Firstly, it does not require the profit maximization, or the cost minimization, assumption. Secondly, it does not require information on the input and output prices. Finally, if the researcher has panel data, it allows the decomposition of productivity changes into two components (technical efficiency change or catching up, and technical change or changes in the best practice). Its main disadvantage is the necessity to compute the distance functions. However, the Data Envelopment Analysis (DEA) technique can be used to solve this problem (Khodabakhshi, 2009).

Malmquist Productivity Index (MPI)

Färe *et al.*, have constructed Malmquist productivity index by using DEA concepts as the geometric mean of the two Malmquist productivity indexes which are defined by Caves and et al by a distance function. Färe *et al.*, decompose their Malmquist productivity index into two components, measuring the change in efficiency and measuring the change in the frontier technology (Behzadi *et al.*, 2010). The frontier technology determined by the efficient frontier is estimated using DEA for a set of DMUs. However, the frontier technology for a specific DMU under evaluation is only represented by a segment of the frontier. Suppose we have a Production Possibility Set (PPS) in time period t as well as period t+1, Here we consider variable return to scale principle for constructing PPS; constant return to scale assumption is the same. Assume that there exist n homogenous DMUs such that $X_j^K = (x_{1j}^K, x_{2j}^K, ..., x_{mj}^K)$ and $Y_j^K = (y_{1j}^K, y_{2j}^K, ..., y_{sj}^K)$ represent the input and output vectors of $DMU_j(j = 1,...,n)$ at time k. Calculation of Malmquist productivity index requires two single period and two mixed period measures. The two single period measures can be obtained by using the input-oriented BCC model in (1) (Behzadi *et al.*, 2010):

$$D_0^K(x^L, y^L) = \text{Min } \theta \qquad (1)$$

$$\text{S.T}:$$

$$\sum_{j=1}^{n} \lambda_j x_{ij}^K \le \theta x_{i0}^L \rightarrow i = 1,2,...,m$$

$$\sum_{j=1}^{n} \lambda_j y_{rj}^K \ge y_{r0}^L \rightarrow r = 1,2,...,s$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \ge 0 \rightarrow j = 1,2,...,n \qquad K, L = \{t, t+1\}$$

The value $D_0^t(x^t, y^t)$ determines the efficiency score of DMU_0 in time period t that is the amount by which observed inputs of DMU_0 can be reduced proportionally, while still producing the given output level. For determining $D_0^{t+1}(x^{t+1}, y^{t+1})$, Substituting t+1 instead of t in the model (1), this value obtains the efficiency score for DMU_0 in time period t+1. Also evaluating DMU_0 in time t+1 by frontier of DMUs in period t is defined as $D_0^t(x^{t+1}, y^{t+1})$ and similarly, evaluating DMU_0 in time period t by frontier of DMUs in period t+1 is defined as $D_0^{t+1}(x^t, y^t)$. Färe et al have provided an input-oriented Malmquist productivity index, which measures the productivity change of a specific DMU_0 in time t+1 and t as follows (Pratt *et al.*, 2008):

$$TFP_0(x^{t+1}, y^{t+1}, x^t, y^t) = \sqrt{\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)}}$$

Färe *et al.*, defined that $TFP_0 > 1$ indicates productivity gain $TFP_0 < 1$ indicates productivity loss and $TFP_0 = 1$ means no change in productivity from time t to t+1. Färe *et al.,* (Deliktas and Candemir, 2007) decompose the Malmquist productivity index (TFP) into two components as follows:

$$TFP_0 = ECI_0 \times TCI_0 = \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \sqrt{\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)}}$$

ECI measures the change in technical efficiency and TCI measures the technology frontier shift between time period t and t+1. Färe *et al* mentioned that a value of TCI greater than one indicates technical progress, a value of TCI less than one indicates technical regress and a value of TCI equal to one indicates no shift in technology frontier (**Pratt *et al.*, 2008**).

Stochastic Malmquist Productivity Index (SMPI)

Recently stochastic inputs and outputs in DEA field have been studied by a number of researchers including: Cooper *et al.*, (Hosseinzadeh *et al.*, 2010), Huang and Li, Khodabakhshi and Asgharian (Huang and Li, 2001), Khodabakhshi *et al.*, (2009) and Hosseinzadeh *et al.*, (Pratt *et al.*, 2008; Hosseinzadeh *et al.*, 2011; Behzadi *et al.*, 2010). Here we consider this type of data for estimating Malmquist productivity index. Suppose for each time period $t = 1,2,...,T$, there are n $DMU_j(j = 1,...,n)$ that $\tilde{X}_j^t = (\tilde{x}_{1j}^t, \tilde{x}_{2j}^t, ..., \tilde{x}_{mj}^t)$ and $\tilde{Y}_j^t = (\tilde{y}_{1j}^t, \tilde{y}_{2j}^t, ..., \tilde{y}_{sj}^t)$ represent $(m \times 1)$ and $(s \times 1)$ random input and output vectors of DMU_j at time t and these components have been deemed to be normally distributed that $\tilde{X}_{ij}^t : N(\mu_{ij}^t, \sigma_{ij}^{2t})$ and $\tilde{Y}_{rj}^t : N(\mu_{rj}'^t, \sigma_{rj}'^{2t})$. Chance constrained version of output oriented stochastic BCC model is as follows (Behzadi *et al.*, 2010):

$$D_0^K(\tilde{x}^L, \tilde{y}^L) = Min \quad \theta$$

$$S.T:$$

$$p\left\{\sum_{j=1}^n \lambda_j \tilde{x}_{ij}^K \le \theta \tilde{x}_{i0}^L\right\} \ge 1 - \alpha \rightarrow i = 1,2,...,m$$

$$p\left\{\sum_{j=1}^n \lambda_j \tilde{y}_{rj}^K \ge \tilde{y}_{r0}^L\right\} \ge 1 - \alpha \rightarrow r = 1,2,...,s$$

$$\sum_{j=1}^n \lambda_j = 1 \qquad \lambda_j \ge 0 \rightarrow j = 1,2,...,n \qquad K, L = \{t, t+1\}$$

Where in the above models, *p* means "probability" and $\alpha \in [0,1]$ is a level of error which is a predefined number. In accordance with the definitions and theorems which have been proposed in (Hosseinzadeh *et al.*, 2010), the above model can be converted into the following deterministic model:

$$D_0^K(\tilde{x}^L, \tilde{y}^L) = \text{Min } \theta$$

$$\text{S.T}:$$

$$\sum_{j=1}^{n} \lambda_j \mu_{ij}^K - \phi_K^{-1}(\alpha)\sigma_i^{I,K}(\theta,\lambda) \le \theta \mu_{i0}^L \rightarrow i = 1,2,\dots,m$$

$$\sum_{j=1}^{n} \lambda_j \mu_{rj}'^K - \phi_K^{-1}(\alpha)\sigma_r^{0,K}(\lambda) \ge \mu_{r0}'^L \rightarrow r = 1,2,\dots,s$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \ge 0 \qquad K, L = \{t, t+1\}$$

Where:

$$\sigma_i^{I,K}(\theta,\lambda)^2 = \sum_{j\ne 0}\sum_{p\ne 0} \lambda_j \lambda_p \text{Cov}(\tilde{x}_{ij}^K, \tilde{x}_{ip}^K) + 2(\lambda_0 - \theta)\sum_{j\ne 0}\lambda_j \text{Cov}(\tilde{x}_{ij}^K, \tilde{x}_{i0}^K) + (\lambda_0 - \theta)^2 \text{Var}(\tilde{x}_{i0}^K)$$

$$\sigma_r^{o,K}(\lambda)^2 = \sum_{i\ne 0}\sum_{j\ne 0} \lambda_i \lambda_j \text{Cov}(\tilde{y}_{ri}^K, \tilde{y}_{rj}^K) + 2(\lambda_0 - 1)\sum_{i\ne 0}\lambda_i \text{Cov}(\tilde{y}_{ri}^K, \tilde{y}_{r0}^K) + (\lambda_0 - 1)^2 \text{Var}(\tilde{y}_{r0}^K)$$

Here, $\phi(\alpha)$ is the cumulative distribution function of the standard normal distribution and $\phi^{-1}(\alpha)$ is its inverse in level of α . The above model is nonlinear programming; also Stochastic Malmquist Productivity Index (SMPI) in α level of error can be used to forecast Malmquist index in the future is as follows:

$$TFP_0(\tilde{x}^{t+1}, \tilde{y}^{t+1}, \tilde{x}^t, \tilde{y}^t) = ECI_0 \times TCI_0 = \frac{D_0^t(\tilde{x}^{t+1}, \tilde{y}^{t+1})}{D_0^t(\tilde{x}^t, \tilde{y}^t)} \times \sqrt{\frac{D_0^t(\tilde{x}^{t+1}, \tilde{y}^{t+1})}{D_0^{t+1}(\tilde{x}^{t+1}, \tilde{y}^{t+1})} \times \frac{D_0^t(\tilde{x}^t, \tilde{y}^t)}{D_0^{t+1}(\tilde{x}^t, \tilde{y}^t)}}$$

In expression above, ECI measures the probabilistic change in technical efficiency and FS measures the probabilistic frontier shift between time period t. Finally, TCI>1 shows the probabilistic progress and TCI<1 shows the probabilistic regress with confidence of $100 \times (1-\alpha)$ percent (Behzadi *et al.*, 2010).

Introduction of Inputs and Outputs

In this paper has been used Stochastic Malmquist Productivity Index (SMPI) for measurement of TFP changes in agricultural sectors of Iran. The time period is first to fifth 5-year Development Plans (FYDP) that it has been shown in Table 1.

Table 1: Time periods in 5-year Development Plans (FYDP) of Iran

Scenarios	**5-year Development Plans (FYDP)**				
	First FYDP	**Second FYDP**	**Third FYDP**	**Fourth FYDP**	**Fifth FYDP**
Time period	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014

Reference: study results and findings

In this paper, the agricultural sectors are including: Cultivation, Horticulture, Animal husbandry, Poultry, Fishery, Pastures and Forests and Agricultural Industries (including food, pesticides and fertilizers, agricultural machinery and equipment); Also in this paper have been used of three inputs and two outputs for measurement of TFP changes. Inputs are including: total investments conducted at each sector

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(including: banking facilities, government credits & subsidies and private sector investments), total labor force in each sector and total energy consumed each sector; also outputs are including: total added value generated in each sector and total value of exports in each sector. Information and statistics has been provided from Majlis Research Center (Kausar, 2009) and Ministry of Agricultural Jihad (Raayatpanah and Ghasvari, 2011). In this study has been used from MAPLE and Lingo software for solving models.

Analysis of the Results

In this study, Malmquist Productivity Index has been decomposed to the technical change index (TCI) and efficiency changes index (ECI). Table 2 shows efficiency changes index in agricultural sectors of Iran during first to fifth 5-year development plans. With attend to Table 2; it is clear that efficiency changes index is less than one during performance of first to fourth plans. This means is that the implementation of these plans has not been successful for promoting and improving efficiency in the agricultural subsector of Iran. Also, if goals of fifth plan realized completely, our prediction is that the efficiency would be progress just in animal husbandry and poultry with 95% confidence. On the other hand, this index will regress in other sectors. Finally, with attend to mean efficiency changes index is determined that the efficiency for total agriculture sector of Iran has had regress during first to fourth plans and our prediction is continues of regress trend during fifth plan for it.

Table 2: Efficiency Changes Index in Agricultural Sectors of Iran with level 95% confidence (α=0.05)

Sectors	**5-year Development Plans**			
	First-Second FYDP	**Second-Third FYDP**	**Third-Fourth FYDP**	**Fourth-Fifth FYDP**
Cultivation	0.659	0.789	0.806	0.891
Horticulture	0.698	0.885	0.961	0.936
Animal husbandry	0.896	0.993	0.905	1.239
Poultry	0.693	0.859	0.928	1.037
Fishery	0.365	0.569	0.796	0.956
Pastures and Forests	0.329	0.589	0.763	0.892
Agricultural Industries	0.452	0.593	0.763	0.863
Mean	0.585	0.754	0.846	0.973

Reference: study results and findings

Table 3 shows technology changes index in agricultural sectors of Iran during first to fifth 5-year development plans. With attend to Table 3; it is clear that technology changes index is more than one for cultivation, animal husbandry, poultry, fishery and agricultural industries sectors (unlike horticultural and pastures and forest) during performance of first to fourth plans.

This means is that the implementation of these plans has been successful for promoting and improving technology in above sectors, however horticultural and pastures and forest sectors have regress. Also, if goals of fifth plan realized completely, our prediction is that the technology would be progress in all agricultural sectors with 95% confidence.

Finally, with attend to mean technology changes index is determined that the technology for total agriculture sector of Iran has had regress and progress during first to third and third to fourth plans respectively; And our prediction is continues of progress trend during fifth plan for it.

Table 3: Technology Changes Index in Agricultural Sectors of Iran with level 95% confidence (α=0.05)

Sectors	5-year Development Plans			
	First-Second FYDP	Second-Third FYDP	Third-Fourth FYDP	Fourth-Fifth FYDP
Cultivation	0.856	1.125	1.426	1.626
Horticulture	0.656	0.856	0.963	1.115
Animal husbandry	0.896	1.256	1.426	1.926
Poultry	1.256	1.369	1.693	1.795
Fishery	0.569	0.632	1.023	1.034
Pastures and Forests	0.236	0.632	0.889	1.115
Agricultural Industries	0.369	0.502	1.036	1.459
Mean	0.691	0.910	1.208	1.439

Reference: study results and findings

Table 4 shows malmquist index in agricultural sectors of Iran during first to fifth 5-year development plans. With attend to Table 4; it is clear that malmquist index is more than one for cultivation, animal husbandry and poultry sectors (unlike horticultural, fishery, agricultural industries and pastures and forest) during performance of first to fourth plans. This means is that the implementation of these plans has not been successful for promoting and improving technology more sectors, however cultivation, animal husbandry and poultry sectors have progress. Also, if goals of fifth plan realized completely, our prediction is that the productivity would be progress in cultivation, horticulture, animal husbandry, poultry and agricultural industries with 95% confidence, On the other hand, this index will regress in fishery and pastures and forests sectors. Finally, with attend to mean malmquist index is determined that the productivity for total agriculture sector of Iran has had regress during first to fourth plans; and our prediction is progress it during fifth plan.

Table 4: Malmquist Productivity Index in Agricultural Sectors of Iran with level 95% confidence (α=0.05)

Sectors	5-year Development Plans			
	First-Second FYDP	Second-Third FYDP	Third-Fourth FYDP	Fourth-Fifth FYDP
Cultivation	0.564	0.888	1.149	1.449
Horticulture	0.458	0.758	0.925	1.044
Animal husbandry	0.803	1.247	1.291	2.386
Poultry	0.870	1.176	1.571	1.861
Fishery	0.208	0.360	0.814	0.989
Pastures and Forests	0.078	0.372	0.678	0.995
Agricultural Industries	0.167	0.298	0.790	1.259
Mean	0.450	0.728	1.031	1.426

Reference: study results and findings

The results of table 5 indicate that all the agricultural sectors have regress in efficiency during first to fifth 5-year development plans; In between animal husbandry and pastures and forests sectors have lowest and highest regress in efficiency respectively. Also, cultivation, animal husbandry and poultry sectors have progress in technology, but other sectors have regress in it. Meanwhile, poultry and pastures and forests sectors have highest progress and regress in technology respectively and cultivation and horticulture sectors have lowest progress and regress in it respectively. On the other hand, just animal husbandry and poultry sectors have progress in total factor productivity, and other sectors have regress in it. Meanwhile, animal husbandry and pastures and forests sectors have highest progress and regress in productivity respectively and poultry and cultivation sectors have lowest progress and regress in it respectively.

Table 5: Results of indexes during total period with level 95% confidence (α=0.05)

Sectors	**First to Fifth 5-year Development Plans**		
	Stochastic Efficiency Changes Index	**Stochastic Technology Changes Index**	**Stochastic Malmquist Productivity Changes Index**
Cultivation	0.782	1.222	0.956
Horticulture	0.863	0.881	0.761
Animal husbandry	0.999	1.326	1.325
Poultry	0.870	1.512	1.315
Fishery	0.631	0.785	0.495
Pastures and Forests	0.603	0.620	0.374
Agricultural Industries	0.648	0.727	0.471
Mean	0.771	1.011	0.814

Reference: study results and findings

Conclusion

In this paper has been used a method for measurement of efficiency changes, technology changes and TFP changes indexes in agricultural sectors of Iran with regard to uncertainty conditions and random variables. From the above analysis it was concluded that mean efficiency changes index and mean technology changes index are less and more than one respectively; And total factor productivity changes index are less than one. Therefore efficiency and productivity are low in agricultural sector of Iran and these two factors has had regress during first to fourth 5-year development plans and is predicted that it will continue in fifth plan. However technology has had progress during first to fourth plans and is predicted that it will continue in fifth plan.

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