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TOTAL PRODUCTIVITY GROWTH IN THE FACULTIES OF ANBAR UNIVERSITY USING MALMQUIST PRODUCTIVITY INDEX

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ABSTRACT
The aims of this study is to evaluate the productivity growth of nineteen Faculties of Anbar University (FAUs) in Iraq. The FAUs performance is determined on the change in total factor productivity (TFA) and technical efficiency. We used the output orientated DEA-Malmquist index in estimating the productivity growth from panel data of 19 of FAUs in two periods of time 2010-2011 and 2011-2012 academic years, the model calculated using two educational outputs and two inputs. The results showed that (14) FAUs or or 73.6% are efficient. In terms of total factor productivity, FAUs obtained an index score of 0.879, which means that (7) FAUs or 36.8% remarkable productivity growth. The technological index shows that (2) FAUS or 10.5% only shows a technological progress.
Keywords: Total Productivity Growth, Malmquist Productivity Index ,Technological index

1-INTRODUCTION

In recent years, Higher Education Institutions (HEIs) have been increasingly studied. In nowadays ‘‘knowledge economy’’ their importance for economic development, social equity, mobility, social cohesion and integration is widely acknowledged (Brennan & Teichler, 2008). Furthermore, given the difficult situation of public finances, considerations about resources allocation have been raised in many countries, calling for more evaluations and accountability (Agasisti et al ,2011)

Productivity management in (HEIs) is one of the major sources of sustainable organizational effectiveness and a systematic understanding of the factors that affecting productivity is very important. The measurement and analysis of productivity change in (HEIs) is always a controversial topic and has enjoyed a great deal of interest among (HEIs) (Mohammadi & Ranaei, 2009).

Productivity growth in (HEIs) is one of the major sources of economic development and a thorough understanding of the factors affecting productivity is very important. In recent years the measurement and analysis of productivity change has enjoyed a great deal of interest among researchers studying firm performance and behavior (Rayeni et al, 2010).

This study aims to measures the productivity growth of nineteen Faculty of Anbar University (FAUs) in Iraq by using the output orientated DEA-Malmquist index in estimating the productivity growth from panel data of 19 of FAUS in two periods of time 2010-2011 and 2011-2012 academic years.

2-METHOD

2-1 Data Envelopment analysis

Data envelopment analysis (DEA) has been a technique for measuring the relative efficiency of decision making units (DMUs) with multiple inputs and multiple outputs (Charnes et al., 1978 ;

Banker et al., 1984). The method has become popular in university performance measurement (Prichard , 1990; Youn & Park, 2009). In fact, there are literally various kinds of DEA methods such as constant return to scale, variable return to scale, (Cooke & Zhu 2005). DEA is a mathematical linear programming approach based on the technical efficiency concept (TE), it can be used to measure and analyze TF of deferent entities : productive and non productive, public and private, profit and nonprofit seeking firms. It is non parametric approach that calculate efficiency level by doing linear program for each unit in the sample (Al- Delaimi & al-Ani ,2006).

DEA measures the efficiency of the decision making unit (DMUs) by the comparison with best producer in the sample to drive compared efficiency. DEA submits subjective measure of operational efficiency to the number of homogenous entities compared with each other, through a number of samples unit which form together a performance frontier curve envelopes all observations. So, this approach called Data Envelopment Analysis.

2-2 DEA-Malmquist productivity index

The Malmquist productivity index, as a kind of consumer price index was first proposed by the Sweden economist and statistician Sten Malmquist (1953). Later it is developed into the index to appraise the department productivity progress for multi-inputs and multi-outputs by Fare et al. (1985). Here after Fare et al. (1994) have consummated this index unceasingly, established the Malmquist productivity index which can be used to estimate the total factor productivity (TFP) growth in 1994, and decomposed this index into the technical change and the technical efficiency change by using the Shephard distance function . The essence of Malmquist index analysis method is to appraise the productivity. The productivity appraisal may analyze the fountainhead of the economic growth (Hu & Liang,2008). The Malmquist index analysis is to utilize the directional output or the input method to define the distance function, and then appraises the efficiency change of each decision-making unit.

The total factor productivity (TFP) approach provides the most comprehensive summary of school's performance. The Malmquist productivity index typically measures the TFP growth change between two data points: period t technology (observation) and the other period t + 1 technology.

Equation 1 shows the Malmquist productivity change index (Fare et. al 1994 p. 71) as stated:

$$M_o(x^{t+1}, y^{t+1}, x^t, y^t) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \mathrm{X} \left[\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right]^{1/2} \quad (1)$$

Mo = Malmquist productivity Index
Do = Distance function
(xt+1, yt+1) = represents the production point of the productivity
(xt, yt) = relative production point of the productivity
t = period of benchmark technology

t+1 = the next period of technology

Equation 1 presents the components of the Malmquist index. The first equation on the right represents the efficiency change, which is the distance function from period *t* technology to period *t+1* technology, using input and output quantities. The equation inside the bracket represents the technical change from period *t* to period *t+1*. The Malmquist index is composed of geometric means of two output-based Malmquist index from period *t* to period *t + 1*. Geometric means are used because DEA does not account for measurement noise. In the Malmquist index, all values are ranged from 0 to

1. DEA-Malmquist captures the performance relative to the best practice in a given sample of educational institutions (Castano & Caband,2007) , whose best-practice institutions are operating on the efficient frontier. A value greater than one (>1) using Malmquist index indicates a positive improvement while a value lesser than one (<1) indicates a decline in an institution's performance over the period or denotes deterioration in performance. A constant 1 value means no improvement in performance.

3-DATA AND RESULTS

The data which have been used in this paper have been taken from the data base of department of planning in Anbar University for the two academic year 2010-2011 and 2011-2012. Input variables used are (1) academic staff, (2) general staff. The output variables are (1) number of graduates, (2) number of research. (appendix 1 & 2). DEAP software has been used for analyzing the information.

DEA-Malmquist (output-orientated) method is employed to decompose the total factor productivity change (TFPCH) into technological change (TECHCH) and technical efficiency (EFFCH). Technical efficiency is further decomposed into scale efficiency (SECH) and pure efficiency change (PECH).

Table (1) shows the list of FAUS with five Malmquist indices . fig (1) show total factor productivity change

From the table (1) We see that the mean SECH (1.006) of FAUS is slightly lower than the mean PECH (1.066), but both obtained values greater than one. This result indicates the presence of better management and also operations at optimal scale.

Table (1) Malmquist productivity Index of FAUs

Faculties	TFPCH	TECHCH	EFFCH	SECH	PECH
Education for Girls	1.239	0.622	1.482	0.836	0.77
Education for the Humanities	1	0.507	1	1	0.507
Engineering	1.176	0.807	0.906	1.299	0.949
Sciences	1.223	0.743	1.279	0.956	0.909
Medicine	1.259	0.852	1.418	0.888	1.073
Dentistry	1.756	0.888	1.886	0.931	1.56
Agriculture	1.338	0.921	1.233	1.085	1.232
Administration and Economics - Fallujah	0.896	0.762	0.974	0.92	0.683
Computer	1	1.169	1	1	1.169
Law – Fallujah	0.762	0.803	1	0.762	0.612
Arts	1.181	0.776	1.148	1.029	0.917
Law and Political Science-Ramadi	1.233	0.781	1.307	0.943	0.963
Administration and Economics - Ramadi	0.816	0.847	0.934	0.874	0.691
Islamic Sciences - Ramadi	1.319	0.842	1.042	1.267	1.111
Physical Education	1.512	0.83	1	1.512	1.255
Veterinary Medicine	0.899	1.141	0.828	1.085	1.025
Islamic Sciences - Fallujah	0.777	0.958	0.884	0.879	0.744
Education - Qaim	0.498	0.85	0.44	1.132	0.423
Education for Pure Sciences	1.345	0.693	1.297	1.036	0.932
Geometric Mean	1.076	0.818	1.066	1.009	0.879

Source: The output of DEAP software ver 2.1

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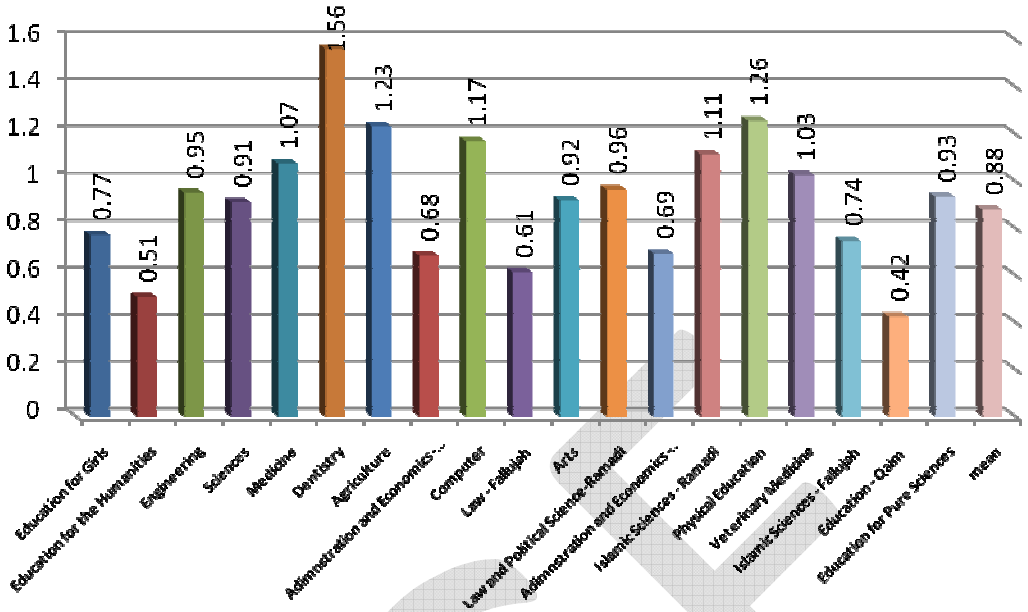

Fig 1: total factor productivity change in FAUs

The TFPCH index of FAUs (0.879) decomposed into managerial or technical efficiency index (1.076) and technological change index (0.818). The decline in TFPCH was brought about by a decrease in technological change index of 18.2 percent per year. In short, FAUs have managed efficiently their resources (inputs); although, technological innovation is a factor, which has to be improved further to reach the frontier of 1.0. The TFPCH of FAUs was achieved more due to the optimal use of given resources than innovations. On average, FAUs lack more technological innovation and need additional 18.2 percent to reach the technological frontier. The technological change shows that 2 out of 19 FAUS or 10.52 percent scored above the frontier level. The institution, which scored the highest is the Faculty of Computer (1.169).

There are 5 out of 19 FAUs, or 37.6 percent of the educational institutions are technically (managerial) efficient led by faculty of Dentistry. This means that the majority of FAUs have managed their inputs (academic and general staff) efficiently and productively so that there is productive growth in their outputs (graduate students and research). Most of the growth in the FAUs productivity during the period of study stemmed from catching up or best management practices rather than technological progress.

4-CONCLUSIONS

The aims of this study is to evaluate the productivity growth of nineteen Faculty of Anbar University (FAUs) in Iraq. The FAUs performance is determined on the change in total factor productivity (TFA) and technical efficiency. using DEA –Malmquist Productivity Model. The results showed that (14) FAUs or 73.6% are efficient. In terms of total factor productivity, FAUs obtained an index score

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of 0.879, which means that (7) FAUs or 36.8% remarkable productivity growth. The technological index shows that (2) FAUs or 10.5% only shows a technological progress.
The important finding in this paper is that (2) out of 19 FAUS are showing technological progress and the rest are experiencing technological regression. This may call for the FAUs to give considerable attention to technological progress, the enhancement of existing applications and the development of more technology-oriented systems and procedures that will enable the educational institutions to remain effective and competitive. The Ministry Higher Education in Iraq and Anbar University should exert more efforts to provide modern teaching and learning faculties in every college to improve its deteriorating technological performance. Thus, the new findings in this paper may give impetus to Anbar University , and the faculty administrators to adopt measures that would be beneficial to the improvement Faculties of Anbar University in terms of inefficiency and unproductive growth.

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