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Efficiency measurement and Evaluation in Turkish Hospitals

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Efficiency Measurement and Evaluation in Turkish Hospitals

Survey Report

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INTRODUCTION

The most fundamental goal of health care systems worldwide is to raise and improve health status of individuals in a society. In order to achieve this goal, health care services should be accessible, equitable, qualified and sustainable for all people. Moreover, protecting health service users from financial risks, avoiding interruptions in service delivery and ensuring efficient and effective exploitation of resources are other fundamental goals of health care systems.

The situation of our national health care system required to make changes in most system dimensions varying from health service delivery to health service financing and from human resources to information systems. Given this requirement, a radical program was launched in 2003, which is called the Health Transformation Program and which is designed to restructure and reorganize the national health care system with all its dimensions.

Since the beginning of the implementation, it is observed that Turkey has become one of a very few middle-income countries which have achieved effective implementation of such an "enormous" reform. In this regard, the HTP has not only contributed a lot to the social aid mechanism in Turkey but also proved to be "a good example of success" for other countries struggling with similar challenges.

Health system reform, undoubtedly, is a continuous process. In this context, health expenditures constitute one of the most significant pillars of a health care system. International experience indicates that Turkey will have to determine proper policies and implement these policies effectively in order to ensure financial sustainability of the health care system in long run and assure continuous promotion of health and welfare of Turkish people. I hold the strong belief that this study will make valuable contributions to determining and implementing proper policies and I extend my most sincere thanks to all persons who got involved and made immense efforts in conducting this study.

Prof. Dr. Recep AKDAG
Minister of Health

FOREWORD

According to the World Health Organization, health care system of a country should provide high-quality health care services for all people who need them. Also, these services should be effective, affordable and acceptable to society. It is recommended that every country tailor its national health care system considering these factors and responding its domestic needs.

Undoubtedly, the most outstanding goal of health care systems - among all other primary goals – is to achieve sustainability in long run in addition to obtaining desired outcomes. In our country and in the world, a great many factors such as raised expectations, recent technological advances, aging population, changing demographic characteristics and evolving disease patterns increase health service costs on one hand while they urge health sector reforms on the other hand.

Since the introduction of the Health Transformation Program in 2003, Turkey has made a quantum leap in improving the performance of the national health care system by taking many successful steps such as raising public satisfaction with heath care services, improving service efficiency and providing health service providers with financial sustainability.

It is essential to monitor and evaluate health expenditures systematically and to develop necessary strategies in order to ensure quality-cost effectiveness in health care services. Hospitals, which make a big share of health expenditures in Turkey, play a significant role in reaching this goal. Therefore, financial performance of hospitals and hospital departments should be measured by appropriate methods and measurement results should be set out and discussed.

I believe this study, which was conducted within the afore-mentioned framework, will help all policy-makers and decision-makers in the health sector for better policy making and decision making, and I give my special thanks to all persons who contributed to this study.

Dr. Salih MOLLAHALILOGLU
Director of the School of Public Health

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Also, we believe that special thanks should be given to all persons who invested time and energy in this study.

School of Public Health

INTRODUCTION and OBJECTIVES

The improvement of health system performance has become a key policy issue in most developing and developed nations.[1] Public hospitals are a significant component of health systems in many developing countries, generally responsible for 50 to 80 percent of recurrent government health sector expenditure.[2] Health administrators and policymakers are placing increasing emphasis on efficiency in the health sector. Efficiency considerations have been central to health system reforms in many countries. [3]

At the beginnings of the 2000s, Ministry of Health (MoH) initiated new program titled as "Health Transformation Program". This program aimed at restructuring organization and functioning of Turkish health care system. Similar to other countries, the purpose of these reforms, in Turkey, is to make resource allocation in health care more efficient, more innovative and more responsive to consumers preferences while maintaining equity. [4] Consequently health transformation project has created radical changes in the organization, financing and provision of health services. Health Transformation Project has also stimulated competition among health care organizations and forced health care managers to focus on efficiency and quality in the provision of health services.[5] [6]

1. Administrative and functional restructuring of the Ministry of Health,

2. Covering all the citizens by the universal health insurance,

3. Gathering the health institutions under one umbrella,

4. Providing the hospitals with an autonomous structure administratively and financially,

5. Introduction of the family medicine implementation,

6. Giving special importance to mother and child healthcare,

7. Generalizing the preventive medicine,

8. Promoting the private sector to make investment in the field of health,

9. Devolution of authority to lower administrative levels in all public institutions.

10. Eliminating the lack of health personnel in the areas which have priority indevelopment,

11. Implementation of the e-transformation in the field of health.

As soon as the determination of the Urgent Action Plan, the Health Transformation Program was prepared and announced to the public opinion by the Ministry of Health. The Health Transformation Program aims transformation in the framework of eight themes: [7]

1. Ministry of Health as the planner and supervisor,

2. Universal health insurance gathering everyone under single umbrella,

3. Widespread, easily accessible and friendly health service system,

a. Strengthened primary healthcare services and family medicine,

b. Effective and staged referral chain,

c. Health facilities having administrative and financial autonomy,

4. Health manpower equipped with knowledge and skills, and working with high motivation,

5. Education and science institutions to support the system,

6. Quality and accreditation for qualified and effective health services,

7. Institutional structuring in the rational management of medicine and supplies,

8. Access to effective information at decision making process: Health information system.

Health Transformation Program has been prepared as an improvable and sustainable program which confronts to the socio-economic realities of our country and follows global improvements. The Program is built up on ethical concept aiming equal access to health services for the citizens as individuals with equal rights. During the political methodological preparations of the program, a gradual and sustainable policy cycle enabling well-functioning of health policies was envisaged. Accordingly, first the problems are identified and the conditions leading to these are analyzed. Then policies are developed in order to solve the problems, political decisions are taken with the aim of implementing this policy and these decisions are implemented. [8]

The principle of efficiency, one of the objectives of the Health Transformation Program, is described as production of more services with the same resources by decreasing current costs in accordance with the resources. It is also emphasized in the program that distribution of human sources, management of materials, rational use of medicines, health management and preventive medicine are assessed in this scope. Productivity will be better achieved by inclusion and integration of all domestic sector sources in the system.

Objectives

Principal purpose of this study is to analyze total factor productiviy of hospitals for the periods of 2001-2009. This study was designed to explore changes in the total factor produtivity of hospitals before (2001-2003) and after (2003-2009) the implemantation of Health Transformation Project. Total factor productivity composed two independent components. First component is called as efficiency change index. Efficiency change index shows improvement (or detoriation) in relative efficiencies hospitals and interpreted as the measure of catching up the efficiency frontier or surface. The second component is technological change index. Technological change index, measures improvements

attributed to innovative or technological changes. Technological change index measures shift of efficiency frontier. Total factor productiviy calculations were performed by using DEA based Malmquist Index methodology.

HOSPITAL EFFICIENCY

It is possible to define hospitals with the open system perspective as systems taking inputs from their environment and transforming these inputs into services to the external environment by the interactions of their subsystems. The most important input of hospital is patient and the most important outputs are patient care and treatment.

The purpose of the hospitals can be summarized as "increasing the level of health status of the individual and society by producing health services". Achieving this purpose efficiently can be considered as management's responsibility. [9] Production and presentation of health services is more relevant with organizational process than individual applications. [10] A great expansion emerged in terms of range of operations of the hospitals whish is a crucial subsystem of the health system. The significant increase in the costs of health services in general and in hospital services specifically have forced the social groups and public administration to focus on the production, cost and quality of health care services.

The reports of Health Services Finance Group and Hospital Management Work Group [11] in 1st National Health Conference which was conducted by Ministry of Health took attention to the inefficient use of resources and it was emphasized that it is required to provide rational usage of resources. Cost and efficiency problem referred frequently in the publications relevant to health reform studies of Ministry of Health. For example, strict and centralized structure, insufficiency of managerial professionalism and not to apply principles of efficiency was emphasized in the publication called National Health Policy. [12]. Same issue addressed in the draft document which was presented to the Turkish Parliament[13].

It was claimed that Turkish health system doesn't operate on a satisfactory level and one of the main reasons of this situation is insufficiency resources and failure to provide effective usage of these in a research conducted by Price Waterhouse[14]. The research group emphasized that it is required to have knowledge and cognition about cost-effectiveness in finance and service production; only increasing health expenditure or in other words transferring more resources to the health system can not resolve the problems.

Concept of Efficiency

Efficiency is a concept, which is used to explain the relation between input used and output produced. Efficiency is generally measured by calculating the ratio of outputs to inputs. Sahney ve Warden (1986: 30), claim that the definition made in respect to output/input rate or relation is sufficient and they define efficiency as timing and cost-effectiveness to reach organizational goals. With this perspective efficiency is not only depends on technical inputs

and outputs. In other words, while maintaining input and outputs, improving quality of output can lead efficiency increase.

Efficiency is an indicator showing how an organization is good at using existing resources. A general definition of efficiency can be the relation between the output of a production or a service system and the input used to create the output. Thus, efficiency can be defined as the best usage of resources for the production of various goods and resources. The definition of efficiency does not change depending on the type of production, economic and political system. Regardless of the different meanings of efficiency for different individuals, it is the relationship between amount and quality of goods and services and the resources to produce these [15]. If all production factors like labor, machine and equipment are considered during measurement of efficiency, total efficiency or total factor efficiency can be determined. However, this type of efficiency rarely used due to difficulties in the calculation processes. Instead of using total factor productiviy, partialy efficiency ratios are generally preferred. Partial efficiency is the ratio of output to single input (e.g. physician). In summary, efficiency is the rate or relation between resources, which are given to accomplish a task or activity and the tasks, or activities, which are accomplished. Thus, efficiency can be formulated as:

$$\text{EFFICIENCY} = \frac{\text{OUTPUT}}{\text{INPUT}}$$

This kind of representation shows one to one relation of output to input very clear. However, some problems may emerge when more than onE input and output exist. First of these problems is relevant to relative importance of inputs and outputs. It is required to determine relative importance of inputs in the cases more than one inputs used. Reduction of both inputs and outputs into one variable or in other words, adjustment (standardization) is required. Another important problem is difficulty of measuring inputs of service organization like hospitals with tangible and quantifiable ways.

Productivity in hospitals is more important concept than concepts of income and profit. Because profit shows the end result, whereas productivity determines the effectiveness of structure, strategies, polices and processes of health care organizations. Due to problem of resources scarcity, encountered in developing countries, productivity improvement becomes vital to meet health needs and to improve health status of population.

Measurement Approaches of Efficiency

Efficiency measurements are generally realized within the perspectives of three approaches. These approaches are: ratio analysis, regression analysis and relative efficiency analysis [16] [17] [18].

Ratio Analysis

Ratio analysis is regarded as the most traditional technique of efficiency measurement. In brief, efficiency measurement is based on output/input ratio in this method.

Also, it is a method that is commonly used at hospitals. By using this method, the following efficiency indicators are calculated:

Capacity utilization ratio (Patient day / Bed number * 365)
Number of outpatient clinics per physician (Number of outpatient clinics / Number of physicians)
Patient bed days per nurse (Patient days / Number of nurses)
Bed turnover rate (Number of inpatients / Number of beds)

Ratio analysis is an easily applicable and interpretable method. In system settings such as hospitals particularly, which produce more than one outputs by using more than one inputs, the use of this method will require making a number of ratio calculations. The most significant disadvantage of using this method, on the other hand, is not allowing inter-organizational comparisons. For instance, the data presented in the below Table 1 does not allow to determine which hospital has further efficiency than others as a whole.

Table 1. Indicators of Hospital Efficiency

Hospitals	Capacity Utilization Ratio	Outpatient Clinic/Physician Ratio	Bed Turnover Rate	Surgery/Physician Ratio
A	**80**	1200	40	400
B	70	**1500**	50	500
C	60	1000	**70**	300
D	50	900	60	**600**

This method does not provide effectiveness since it does not take into consideration the structural characteristics and service quality of hospitals either[19]. For example, if technological development of a hospital is high, total costs may also be high then. Therefore, the hospital may seem ineffective in such a circumstance. Measurement of total efficiency may emerge as another problematic area and it is about how to merge different inputs and outputs in a common variable. Some researchers suggest using shadow prices to determine total efficiency. So, it may be possible to merge nominator and denominator within the same measurement unit[20].

Regression Analysis

Regression analysis is a method, used to determine the functional structure of the relationship between dependent and independent variables, which has a cause and effect relation already

known. The most important aspect of regression analysis is the theoretical existence of cause and effect relation. If a researcher not care finding this kind of cause-effect relation, the method will be correlation analysis. Simple linear regression equation can be formulized as indicated below by showing Y dependent and X independent variable:

$$Y = a + bX$$

The constant term a represents, the point which dependent variable takes the value 0 or the point where the regression line intersects with Y coordinate and b represents coefficient of independent variable. When more than one independent variable used the regression equation is going to be:

$$Y= a+ b_1X_1 + b_2X_2 + b_3X_3+....b_nX_n + e$$

The letter e in this formula indicates the error term when independent variables do not explain all the changes occur in dependent variable. The amount of output considered as dependent variable and input as independent variable in regression method used for efficiency analysis and it can be possible to determine whether the organizations are efficient or not by obtaining mathematical equity. The organizations above the regression line can be indicated as efficient and below this line as inefficient in this methodology.

Amount of input and observed outputs of the 6 hospitals (Output-G), theoretical expected output based on regression estimation (Output-K) and the residuals between observed and expected are presented in Table 2.

Table 2. Hypothetical Input and Outputs of Hospitals

Hospitals	Output- G	Input	Output -K	Residual
H1	40	15	43	- 3
H2	45	35	62	- 17
H3	70	40	67	3
H4	85	40	67	18
H5	70	60	85	- 15
H6	90	50	76	14

Y= 29.275 + 0.4840 OUTPUT

Figure 1. Hypothetic Regression Line

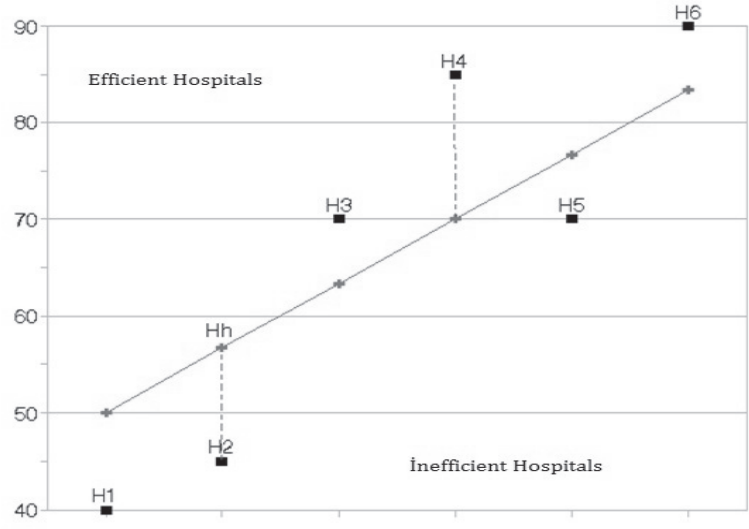


Figure 1 shows the regression line obtained through regression equation. When Figure 1 is examined, it is possible to think that the hospitals H1, H2 and H5 are operating inefficiently. For example, H1 produced 40 units instead of 43 units. It is also possible to observe that H2 produced 45 units (17 units less) instead of 62 units.

An efficient hospital should be at the position of hospital Hh in other words, it is required to use same inputs with the hospital Hh and to produce same amount of output. The hospital H4 emerges as most efficient hospital among the hospitals set. H4 produces 18 units higher when it is expected for H4 to produce 67 units.

There are also some defects in the regression method. The necessity to aggregate both inputs and outputs into one variable is the major defect of this method. The evaluation of efficiency in respect to the average efficiency of the organizational set instead of taking most successful organizations is another deficiency of regression method. Therefore, the method does not provide information regarding to efficiency losses and gains of the hospitals in the sample set. The necessity to define a parametric production function is the last deficiency of regression method. It is not possible to determine some of the variables by measuring (for ex. Number of beds, number of personnel) in some cases[21].

Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a mathematical programming technique [22] [23]that has found a number of practical applications for measuring the performance of similar units, such as a set of hospitals, a set of schools, a set of banks, etc. These units are called Decision Making Units.

Decision-making units can include manufacturing units, departments of big organizations such as universities, schools, bank branches, hospitals, power plants, police stations, tax offices, prisons, defence bases, a set of firms or even practising individuals such as medical practitioners. DEA has been successfully applied to measure the performance efficiency of all these kinds of DMUs Most of these DMUs are non-profit organizations, where the measurement of performance efficiency is difficult. Note that the efficiency of commercial organizations can be assessed easilyby their yearly profits, or their stock market indices. However, such measurable factors are not applicable to non-profit organizations. The problem is complicated by the fact that the DMUs consume a variety of identical inputs and produce a variety of identical outputs. For example, schools can have a variety of inputs, which are the same for each school—quality of students, teachers, grants, etc. They have a variety of identical outputs—number of students passing the final year, average grade obtained by the students in their final year, etc. [24]

In Data Envelopment analysis, relative efficiency is described as the proportion of total weighted outcomes to total weighted inputs. This method is based on giving weight on inputs and outputs in the set of Decision-Making Units (DMUs) within a set of organizations or a method. These weights refer to the values which describe the status of efficiency relevant to other decision-making units based on the amount of outputs produced by a decision-making unit within the set of all decision-making units and the amount of inputs used for this purpose [25] [26] The rationale behind the Data Envelopment Analysis method can be better understood by using a graphic. For instance, let's assume that 10 hospitals produce one output (patient day) by using two inputs (physician and bed). The inputs and outputs of these hospitals are demonstrated in the Table 3.

Graphical Illustration of DEA

To understand DEA metdodology easily, graphical illustration of DEA may be benefitical. Let assume ten hospitals, produced one output (number of inptient admissions) by using two inputs namely nursing hours and medical supplies. Inputs and outputs of these hospitals are shown in Table 1.

Table 3. Inputs and Outputs of Hospitals

Hospital	Physician	Bed	PD
A	45	180	36.000
B	80	160	48.000
C	120	120	48.000
D	180	90	54.000
E	400	100	80.000
F	40	100	40.000
G	50	70	35.000
H	30	45	27.000
I	100	100	80.000
J	60	40	36.000

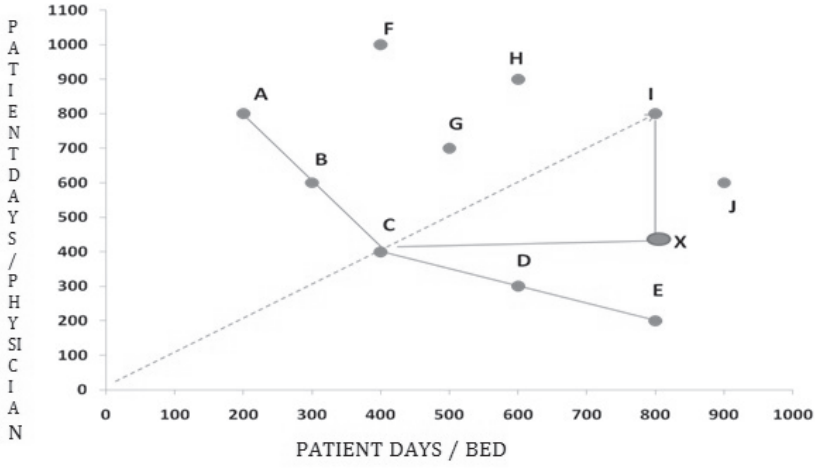
Ratio indicators are calculated easily by dividing outputs to outputs. (efficiency = outputs /inputs). Two different ratio indicators calculated are presented in Table 2.

Table 4. Hospital Performance Ratio Indicators

Hospital	PD/Physician	PD/Bed
A	800	200
B	600	300
C	400	400
D	300	600
E	200	800
F	1000	400
G	700	500
H	900	600
I	800	800
J	600	900

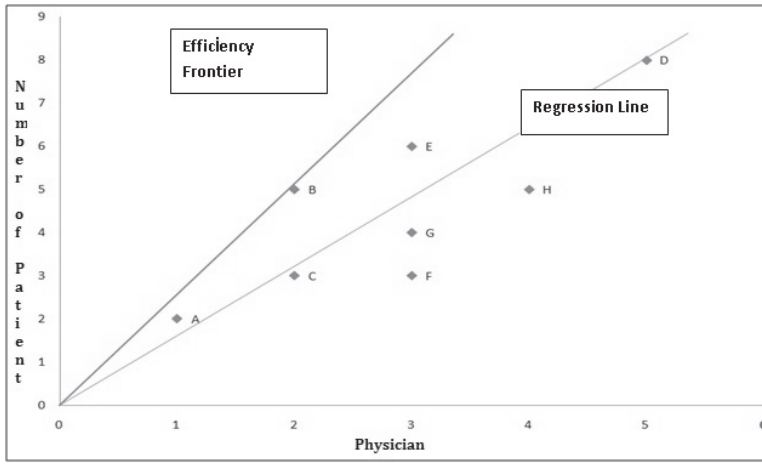
When Hospital Performance Ratio is converted to graphic (see Figure 2), it can be observed; A,B,C,D,E are efficient providers because they are closer to origin that other hospitals. Theese hospitals constitues efficiency frontier. Other hospitals are regarded as inefficient becuase they are far from the efficiency frontier. For example, hospital I can be efficent, if it catch up to C point. To be efficient, Hospital I should reduce inputs while maintaning output level.

Figure 2. Graphical Illustration of DEA



Data Envelopment Analysis (DEA) is a relatively new "data-oriented" approach for evaluating the performances of a set of entities called Decision-Making Units (DMUs) which convert multiple inputs into multiple outputs. DEA has been used in evaluating the performances of many different kinds of entities engaged in many different kinds of activities in many different contexts. Formally, DEA is a methodology directed to frontiers rather than central tendencies. Instead of trying to fit a regression plane through the center of the data as in statistical regression, for example, one 'floats' a piece wise linear surface to rest on top of the observations (see Figure 3).

Figure 3. Graphical Illustration of DEA and Regression Models



Calculation Methodology

In the DEA methodology, the proposed measure of the efficiency of any hospital is calculated as the ratio of weighted outputs to weighted inputs. Obviously, this result is subject to the similar ratios for every hospital be less than or equal to 1.

$$\text{Max } h_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}}$$

Constraints:

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1; \quad j = 1, \ldots, \mathrm{n}.$$

$u_r, v_i \geq 0; \quad r = 1, \ldots, s; \quad i = 1, \ldots, m.$

whr

Y_{rj}, r. Output of j. hospital j,
X_{ij} i. Iinput of j. hospital
u_r, v_i weigth calculated for solving equations given abowe.

Malmquist Index

Monitoring performance over time is essential in health care organizations. The Malmquist index is a method which provides an opportunity to compare the health care facility performance from one period to another. Such a tool was suggested first by Sten Malmquist in 1953, then developed as a productivity index by Caves, Christensen and Diewert [27], and then further developed by Färe et al using Data Envelopment Analysis procedures.

Caves et al, showed that productivity changes, relative to period *t, (M_o^t)* and to period *t+1 (M_o^{t+1})* is equal to

$$M_O^t = \left(\frac{D_O^t(x^{t+1}, y^{t+1})}{D_O^t(x^t, y^t)} \right)$$

and

$$M_O^{t+1} = \frac{D_O^{t+1}(x^{t+1}, y^{t+1})}{D_O^{t+1}(x^t, y^t)}$$

Färe et al [28] [29] using this notation defined Malmquist index as the geometric mean of these two indexes.

$$M_O(x^{t+1}, y^{t+1}, x^t, y^t) = \left[\left(\frac{D_O^t(x^{t+1}, y^{t+1})}{D_O^t(x^t, y^t)} \right) \left(\frac{D_O^{t+1}(x^{t+1}, y^{t+1})}{D_O^{t+1}(x^t, y^t)} \right) \right]^{1/2}$$

Färe et al [30], also decomposed the Malmquist index into two independent indexes, namely efficiency change index

$$\frac{D_o^{t+1}(x^{t+1}, y^{t+1})}{D_o^t(x^t, y^t)}$$

and technological change index.

$$\sqrt{\frac{D_o^t(x^{t+1}, y^{t+1})}{D_o^{t+1}(x^{t+1}, y^{t+1})} \cdot \frac{D_o^t(x^t, y^t)}{D_o^{t+1}(x^t, y^t)}}.$$

Efficiency change index measures how decision making unit (i.e. hospital) is chaching up (or closer) to frontier. More clearly efficiency change index compares efficiency levels of hospitals between time periods (t and t+1). By definition, efficiency change index greater than 1 means efficiency improvement. The next component of Malmquist index, technological change or frontier shift, focuses on technological or innovative improvements between two periods of time analyzed, and measures the movement of efficiency frontier enveloping inefficient units. [31] To calculate Malmquist Index, four linear programs given below should be solved:

$$\begin{aligned} D_i^t(y_{t+1}, x_{t+1}) &= \min_{\theta,\lambda} \theta \\ s.t. -y_{it+1} + Y_t\lambda &\geq 0 \\ \theta x_{it+1} - X_t\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \quad \textbf{(1)}$$

$$\begin{aligned} D_i^t(y_{t+1}, x_{t+1}) &= \min_{\theta,\lambda} \theta \\ s.t. -y_{it+1} + Y_t\lambda &\geq 0 \\ \theta x_{it+1} - X_t\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \quad \textbf{(2)}$$

$$\begin{aligned} D_i^{t+1}(y_t, x_t) &= \min_{\theta,\lambda} \theta \\ s.t. -y_{it} + Y_{t+1}\lambda &\geq 0 \\ \theta x_{it} - X_{t+1}\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \quad \textbf{(3)}$$

$$\begin{aligned} D_i^{t+1}(y_{t+1}, x_{t+1}) &= \min_{\theta,\lambda} \theta \\ s.t. -y_{it+1} + Y_{t+1}\lambda &\geq 0 \\ \theta x_{it+1} - X_{t+1}\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \quad \textbf{(4)}$$

The Malmquist index has numerous superior advantages relative to other productivity indices. For example, for the computational purposes, Malmquist index does not require more assumptions for hospital behavior or objectives (e.g. profit maximization), and any price information for inputs used and outputs produced [32]. For the practical purposes, Malmquist index is computed by using linear programming method, namely Data Envelopment Analysis (DEA) developed by Charnes, Cooper, Rhodas [33] [34]. In contrast to parametric models, DEA, a nonparametric method, requires minimum assumptions for the shape of frontier of production. Informative power of Malmquist index is the most important source of its popularity. Because it divides productivity improvement in two independent components, namely efficiency change and technological change, Malmquist index provides valuable information with managers to analyze and to evaluate sources of inefficiencies or possibilities of efficiency improvements.

Several researchers has used Malmquist Index approach to evaluate the impact of specific health sectors reforms such as hospital reforms (recentralization) [35] [36] [37], changing hospital financing systems [38] [39] [40] [41] [42], introducing new incentives for physicians [43] [44] on hospitals productivity and operational measures such as length of stay. Malmquist index approach was also employed to measure productivity improvements achieved in specific services such as oncology [45], dialysis [46] [47], child and adolescent mental health [48] and primary care [49].

RESEARCH METHODOLOGY

Population and Sample

Nationwide hospitals with 20 beds or more will comprise the study population. Hospitals, 9 years aged, were used to efficiency improvement analysis with malmquist index. Specialty hospitals (e.g. mental hospitals, child hospitals, rehabilitation) and merged hospitals were excluded analysis.

Variables

Input and output variables to be used efficiency measurement are as fallow:

Input Variables
- Number of Beds (available)
- Number of Specialists
- Number of Practitioners

Output variables
- Number of outpatient visits
- Total patient days
- Adjusted surgical operations
- Gross Death Rate (reciprocal transformation)

Data Collection and Analysis

Hospitals' input and output data will be collected by referencing Statistical Yearbook of Turkish Healthcare Institutions (2001-2009) have been published by MoH [50] .

FINDINGS

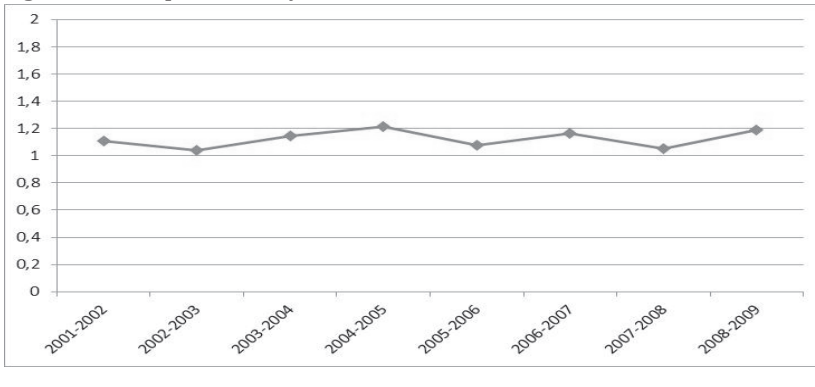
PRODUCTIVITY IMPROVEMENTS IN GENERAL HOSPITALS

The productivity of the General Hospitals by years is shown in Table 4 and Figure 4. During eight years' period, productivity of general hospitals has continually increased. Especially in 2003, the HTP was launched; increase rate of productivity was higher than previous periods. The highest increase in the productivity of hospitals was achieved (by almost 21,2 %) in 2005

Table 5. Malmquist Index by Years

YEARS	MEAN	STANDARD DEVIATION
2002	1,110	0,79
2003	1,038	0,53
2004	1,145	0,40
2005	1,212	0,71
2006	1,077	0,49
2007	1,165	0,56
2008	1,055	0,33
2009	1,192	0,73

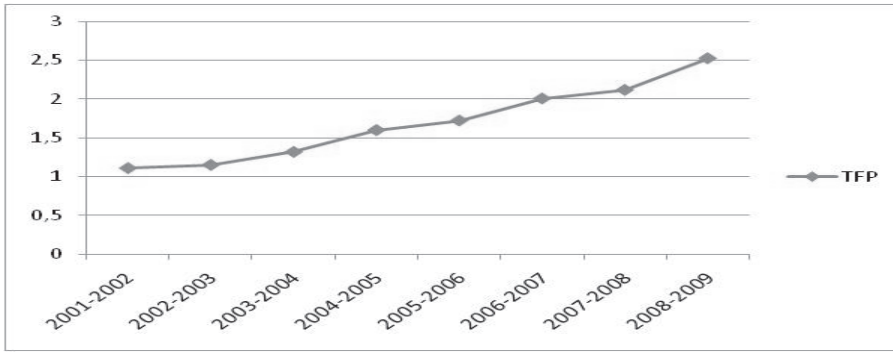
Figure 4. Malmquist Index by Years



Cumulative increase achieved in the total factor productivity of general hospitals is presented in Figure 5. It can be seen that productivity of general hospitals improvement

Cumulative increase of total factor productivity in public and private general hospitals is presented in Figure 5. Total factor productivity of general hospitals has come into faster augmentation propensity since 2003-2004 period and it is thought that the reforms related to health system and private hospitals affected this trend. These reforms led to positive increase both public and private hospitals' total factor productivity, in this respect it can be asserted that reforms led both public and private hospitals to run more productive.

Figure 5. Overall TFP Change by Years



Increase of the total factor productivity is supported by some ratio productivity indicators. For instance, a summary about hospital bed turnover rate and ber turnover interval are presented in Figure 6 – 7.

Figure 6: Bed Turnover Rates

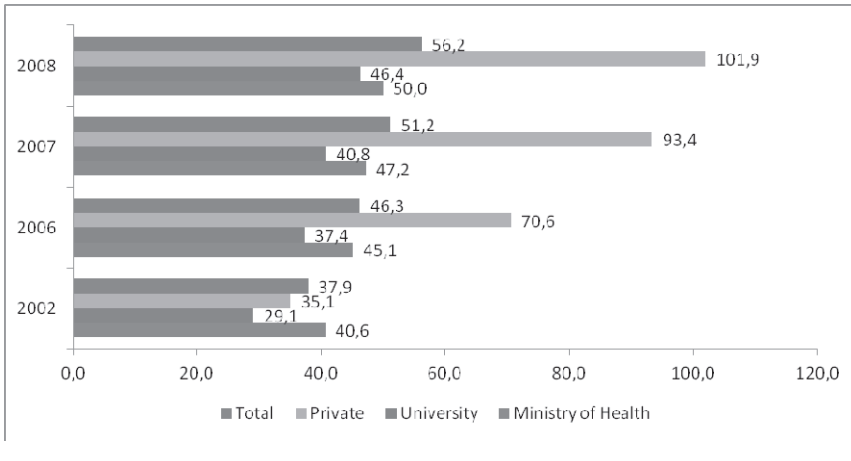
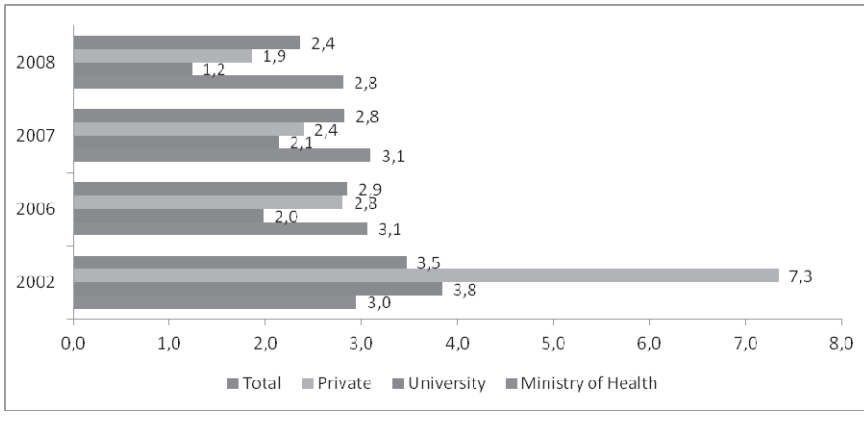


Figure 7. Bed Turnover Intervals by Years

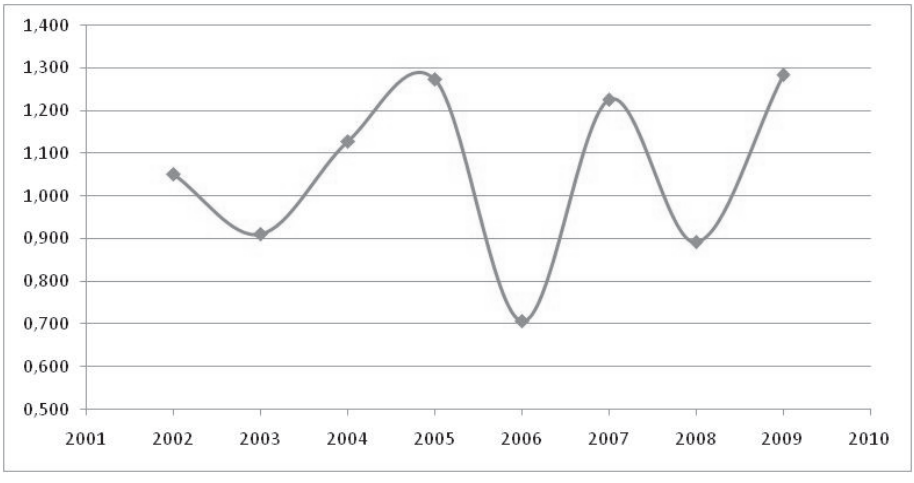


As mentioned methodology section, total factor productivity consist of two independent components. First component is the technological change index, stating shift on productivity frontier. Second component is productivity change, stating degree of approach to efficient (productivity) frontier. Technological change of public and private hospitals by years is presented in Table 6 and Figure 8.

Table 6. Technological Change by Years

YEARS	MEAN	STANDARD DEVIATION
2001-2002	1,051	0,24
2002-2003	0,910	0,31
2003-2004	1,128	0,19
2004-2005	1,272	0,37
2005-2006	0,706	0,13
2006-2007	1,226	0,16
2007-2008	0,891	0,16
2008-2009	1,284	0,26

Figure 8. Technological Change by Years



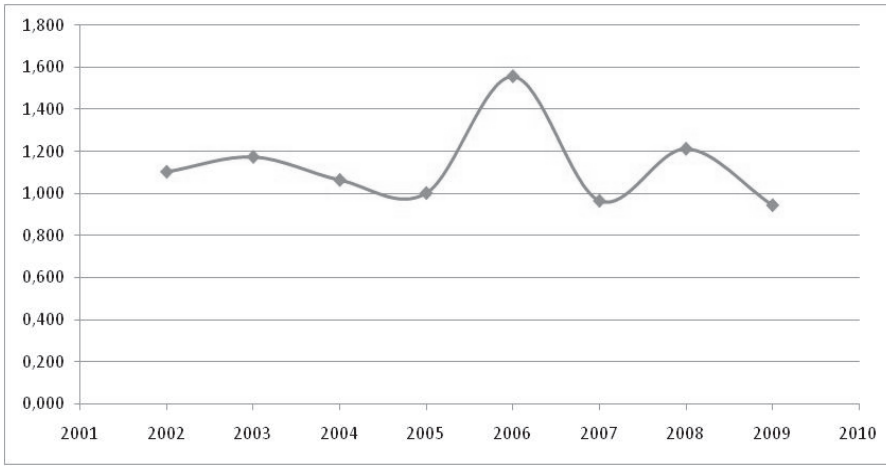
When observing technological change index values, it is seen that index regressed (10%) 2002 – 2003 periods and emerged tremendous increase 2004 – 2005 periods. It was understood that technologic regression for 2004 – 2006 periods (30%) was experienced after 2003 – 2005 periods. Following periods, the regressions come into improvement tendency again. This technologic improvement trend is asserted to result from problems such as technologic infrastructer improvements and innovative practices projected by reforms.

Efficiency change index values of the public and private general hospitals by years are presented in Table 7 and Figure 9.

Table 7. Efficiency Change by Years

YEARS	MEAN	STANDARD DEVIATION
2002	1,103	0,75
2003	1,174	0,66
2004	1,064	0,56
2005	1,002	0,56
2006	1,556	0,63
2007	0,965	0,51
2008	1,212	0,41
2009	0,945	0,42

Figure 9. Efficiency Change by Years



It is observed that the public and private general hospitals increased their efficiency change index values and to be obtained an important development between 2001 and 2009 years except for little regression (3% and 4%) in 2006-2007 and 2008-2009 periods. Especially in 2005-2006 periods, increases of productivity were begun by almost 50%. It is mentioned detail about total factor productivity of the public and private general hospitals in the following sections.

MoH General Hospitals

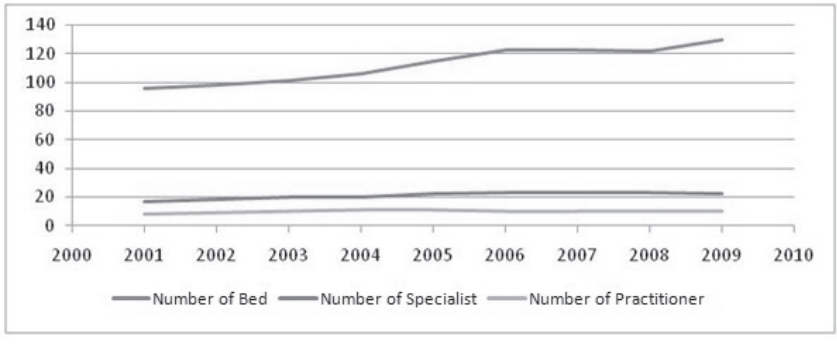
Table 8 and Figure 10 give descriptive statistics on inputs used in MoH general hospitals.

Table 8. Inputs of MoH General Hospitals

	Number of Beds		Number of Specialsts		Number of Practitoner	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	96	110	17	25	8	8
2002	98	110	18	26	9	8
2003	101	115	20	29	10	10
2004	106	119	20	29	11	10
2005	115	135	22	31	11	11
2006	123	141	23	31	10	10
2007	123	142	23	30	10	8
2008	122	139	23	31	10	7
2009	130	154	22	30	10	7

Substantial improvements were appeared in inputs of the general hospitals for the 9 years period. In 2009, average bed capacity were increased by 35,4% with respect to 2001. Besides, it is observed that number of specialist and practitioner were increased by the rate of 29% and 25% respectively.

Figure 10. Inputs of MoH General Hospitals



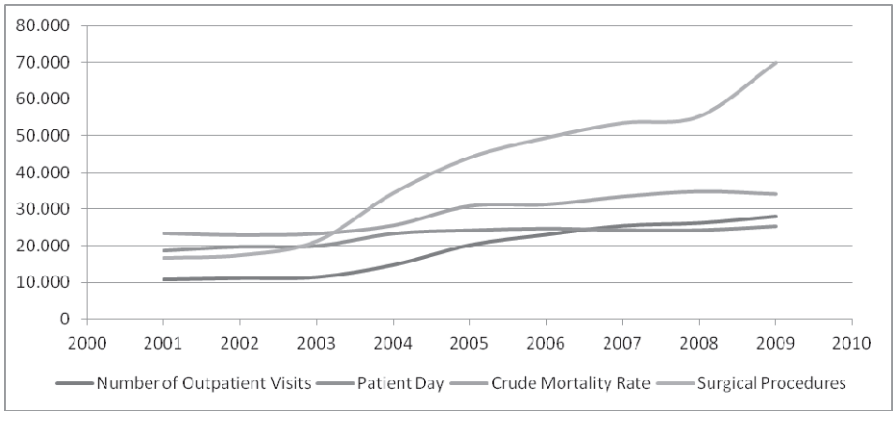
Descriptive statistics on outputs produced by MoH general hospitals are presented in Table 9 and Figure 11.

Table 9. Outputs of MoH General Hospitals

	Number of Outpatient Visits		Patient Day		1/GDR		Surgical Procedures	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	107.633	123.500	18.650	30.435	233	457	16.770	31.861
2002	111.352	126.000	19.733	32.552	228	328	17.522	35.267
2003	114.103	124.521	19.967	32.436	232	296	21.327	40.420
2004	147.399	156.625	23.340	36.674	255	409	34.449	66.661
2005	201.415	228.362	24.227	38.992	309	474	44.110	85.899
2006	229.708	258.212	24.723	39.468	313	538	49.474	93.738
2007	253.816	268.250	24.278	36.305	335	628	53.531	96.767
2008	261.395	261.480	24.283	36.219	349	681	55.319	97.375
2009	279.493	269.547	25.357	36.854	342	576	69.912	108.857

Especially amounts of the output produced by MoH affiliated general hospitals come into high level of increase tendency by bouncing in 2004. This high increase tendency also continued following years. In 2009, MoH affiliated general hospitals increased number of outpatient visit up to 160 %, inpatient days and adjusted surgical procedures 36 % and 317 % respectively. Besides, these general hospitals reduced gross death rate up to 47 %.

Figure 11. Outputs of MoH General Hospitals



In light of the data presented in Table 8 and 9, It is understood that output increase rate of MoH affiliated general hospitals is higher than input increase rate of these hospitals. In other words MoH affiliated general hospitals used their available resources more productively and service quality, as well as quantity dimension of service, was improved.

Total factor productivity index of MoH affiliated general hospitals for the 2001-2009 periods, productivity change index and technologic change index values presented Table 10 and Figure 12-13. Total factor productivity of MoH affiliated general hospitals for these periods is observed to be increased steadily.

Table 10.Total Factor Productivity of MoH General Hospitals by Years

Years	Efficiency Change		Technological Change		Total Factor Productivity	
	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001-2002	1,08	0,70	1,06	0,25	1,11	0,85
2002-2003	1,17	0,55	0,88	0,09	1,02	0,39
2003-2004	1,07	0,44	1,15	0,19	1,18	0,39
2004-2005	0,97	0,46	1,31	0,36	1,21	0,55
2005-2006	1,60	0,64	0,68	0,12	1,08	0,50
2006-2007	0,95	0,48	1,24	0,15	1,16	0,51
2007-2008	1,21	0,38	0,90	0,15	1,07	0,31
2008-2009	0,89	0,27	1,28	0,24	1,11	0,28

Total factor productivity of MoH affiliated general hospitals for the 2001-2009 periods was increased, especially after 2003-2003 periods. For instance, in 2003-2004 and 2004-2005 periods, total factor productivity was increased by 18% and 21% respectively. Steady increase of total factor productivity (MI>1) can be asserted to result from health reform's affect on public hospital nore clearly. That total factor productivity index was bigger than 1 (MI>1) for all periods, is evident that hospital improved their productive situation continually.

Although total factor productivity show increase tendency for all periods, values of productivity change and technologic change index don't show a determination (stability). In 2002-2003, 2005- 2006 and 2007-2008, level of the technological change was negative. In these years, technical efficiency was the highest level and consequently increase of general productivity was supported (MI>1). Technical productivity change was negative in 2004-2005, 2006-2007 and 2008-2009 periods.

Figure 12. Total Factor Productivity of MoH General Hospitals by Years

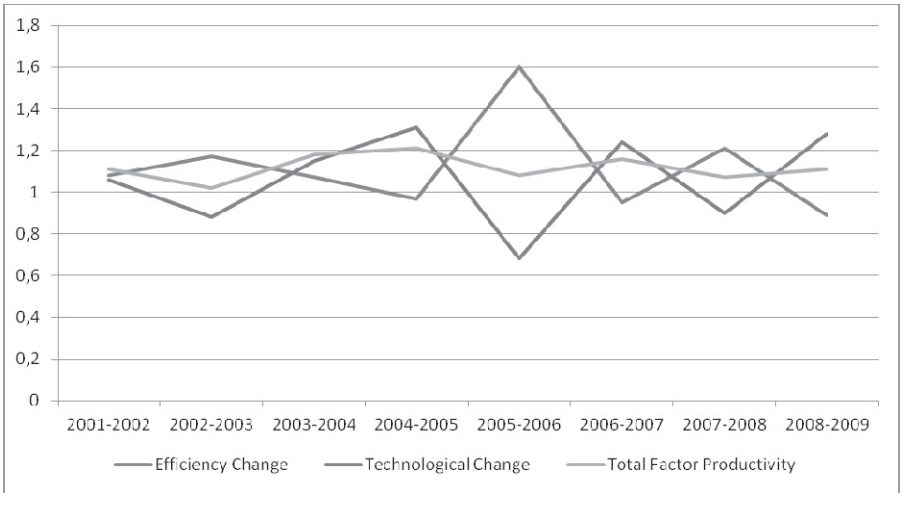
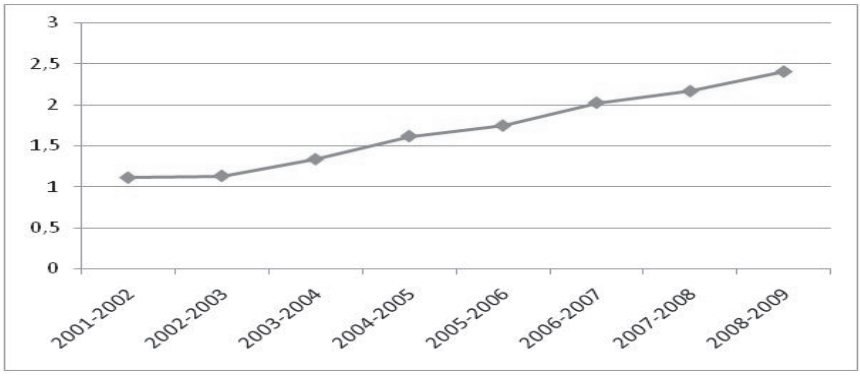


Figure 13. Cumulative Total Factor Productivity of MoH General Hospitals by Years



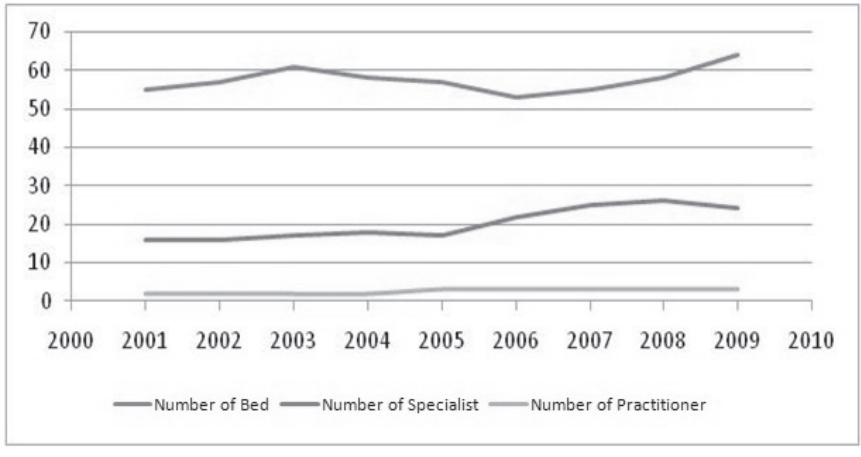
Private Hospitals

Descriptive statistics on inputs used by private general hospitals are presented in Table 11 and Figure 14.

Table 11. Inputs of Private General Hospitals by Years

	Number of Beds		Number of Specialsts		Number of Practitoner	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	55	56	16	13	2	2
2002	57	59	16	15	2	2
2003	61	66	17	16	2	2
2004	58	74	18	18	2	3
2005	57	73	17	12	3	2
2006	53	56	22	17	3	2
2007	55	55	25	18	3	3
2008	58	62	26	18	3	3
2009	64	81	24	13	3	3

Figure 14. Inputs of Private General Hospitals by Years



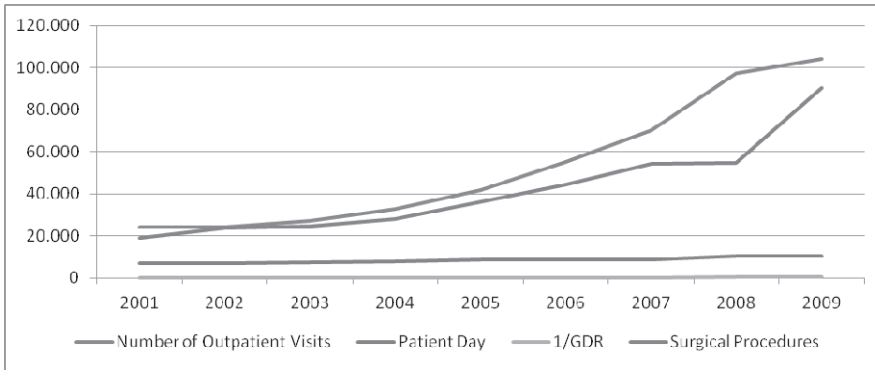
While number of practitioners employed by private general hospitals stayed relatively steady, number of specialist showed increase tendency. Average bed capacity of the private general hospitals increased till 2003 and showed regression tendency for the periods of 2003-2006. Followin years, numbers of beds were increased again.

Descriptive statistics on outputs produced by private general hospitals are presented in Table 12 and Figure 15

Table 12. Outputs of Private General Hospitals by Years

	Number of Outpatient Visits		**Patient Day**		**1/GDR**		**Surgical Procedures**	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	24.012	42.416	7.084	17.351	242	519	19.258	35.544
2002	24.379	38.025	7.099	15.199	346	752	23.874	45.696
2003	27.324	43.480	7.409	16.051	312	834	24.532	45.077
2004	32.763	48.533	7.967	19.571	223	460	28.072	50.946
2005	41.649	58.753	8.861	18.997	270	511	36.114	57.941
2006	55.284	62.578	8.534	13.434	245	389	44.549	68.680
2007	70.269	65.128	8.706	9.882	331	836	54.207	73.828
2008	97.078	92.193	10.427	11.381	432	1.124	54.610	69.912
2009	104.047	90.239	10.593	10.388	422	737	90.274	68.851

Figure 15. Outputs of Private General Hospitals by Years



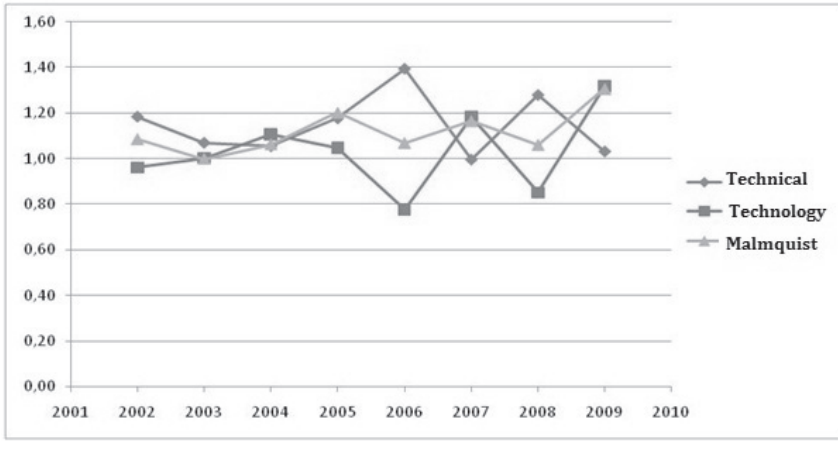
When observed service quantity produced by private general hospitals, it is seen that numbers of outpatients and surgical procedures have increased since 2003. While number of outpatients and surgical procedures increased by 13,8% and 27%, for 2001 – 2003 periods, respectively; these rates for 2003 and 2009 years became 281% and 268% respectively. For the nine years period, private general hospitals increased inpatient days by 49 % and reduced gross death rate up to 74 %.

As shown in Table 13, total factor productivity of private general hospitals was increased steadily for 2001-2009 periods. The highest level of productivity increment was 31% in 2008-2009 periods.

Table 13. Total Factor Productivity of Private General Hospitals by Years

Years	Efficiency Change		Technological Change		Total Factor Productivity	
	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001-2002	1,18	0,95	0,96	0,14	1,09	0,55
2002-2003	1,07	0,54	1,00	0,67	1,00	0,47
2003-2004	1,05	0,91	1,11	0,20	1,06	0,41
2004-2005	1,18	0,79	1,05	0,31	1,20	0,98
2005-2006	1,39	0,57	0,78	0,12	1,07	0,44
2006-2007	1,00	0,64	1,19	0,18	1,16	0,72
2007-2008	1,28	0,51	0,85	0,18	1,06	0,41
2008-2009	1,03	0,50	1,32	0,27	1,31	0,57

Figure 16. Total Factor Productivity of Private General Hospitals by Years



In 2001-2009 period, it is observed that the efficiency change index was effective in the raised total factor efficiency of private hospitals and private hospitals significantly approximated to the efficiency threshold in all periods. However, in 2001-2002, 2005-2006 and 2007-2008 periods, it is observed that the technological development index of private hospitals got worse, that is the efficiency threshold of private hospitals did not have a positive shift in other words. In 2002, 2006 and 2008, the technological change had a negative trend. In these periods with a negative technological change, total factor efficiency was increased due to the increase in the efficiency change index.

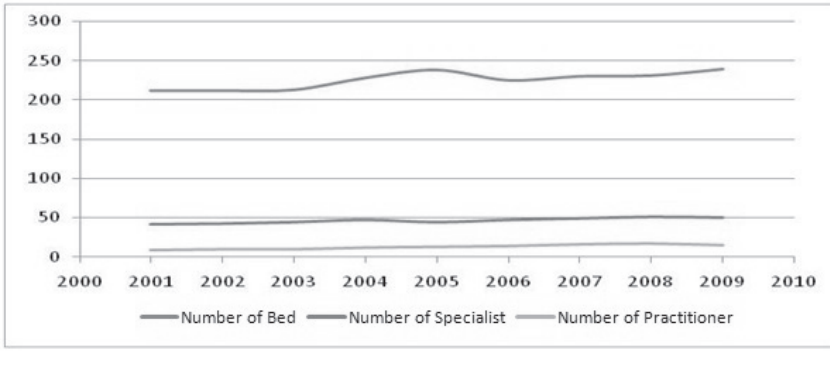
TOTAL FACTOR PRODUCTIVITY OF SSO HOSPITALS

SSO (Social Security Organization) hospitals were transferred to MoH in 2005. Some of these hospitals combined with MoH Hospitals and others kept on running independently (by itself). In this study, total factor productivity of transferred hospitals (Ex-SSH) is examined. Descriptive statistics on inputs used by Ex-SSH are presented in Table 14 and Figure 17.

Table 14. Inputs of SSO Hospitals

	Number of Beds		Number of Specialsts		Number of Practitoner	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	212	148	41	33	9	6
2002	212	136	42	33	10	8
2003	213	146	44	33	10	9
2004	228	166	47	35	12	9
2005	238	174	44	30	13	11
2006	225	160	47	30	14	10
2007	230	165	49	35	16	11
2008	231	181	51	37	17	10
2009	239	179	50	38	15	10

Figure 17. Inputs of SSO Hospitals



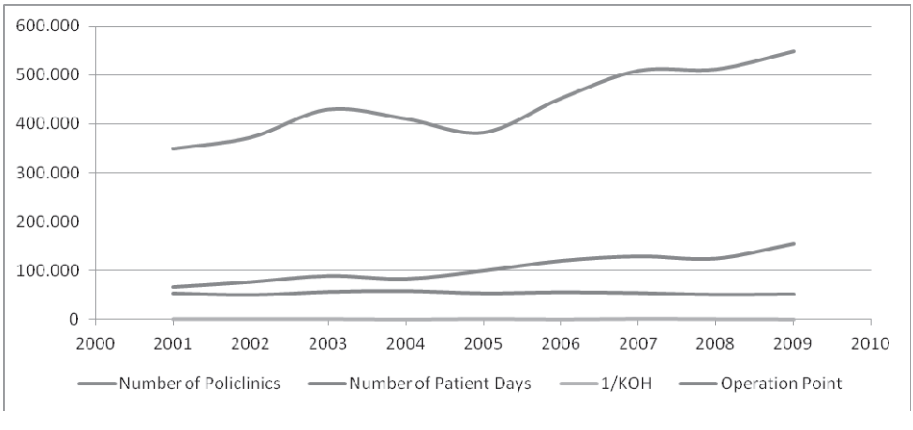
Inputs of Ex Social Security Organization (SSO) General Hospitals, pre and post turnover, were increased relatively determined.Inputs of SSO Hospitals in the post-turnover period (2001-2005) showed same characteristic with pre-turnover period (2006-2009). For instance, number of bed and number on specialist between 2001 and 2005 years (Pre-turnover) increased by 12% and 7% respectively, same rate for 2006-2009 period (post-turnover) were 6% and 6,4%. It is understood that MoH didn't expand inputs of Ex-SSO Hospitals, on the contrary aimed at effective usage of the inputs. Data of outputs and other summary statistics in Table 15 and Figure 18 support this situation.

Table 15. Outputs of SSO Hospitals

	Number of Outpatient Visits		Patient Day		1/GDR		Surgical Procedures	
Years	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation	Mean	Standart Deviation
2001	349.576	227.299	53.254	44.317	339	823	66.599	60.928
2002	372.722	234.074	50.196	40.827	370	799	76.918	87.979
2003	429.444	218.571	55.922	42.398	409	754	89.388	77.086
2004	410.674	208.640	57.469	44.720	110	149	83.397	70.448
2005	382.682	194.032	53.335	46.543	449	718	99.838	78.212
2006	452.039	254.504	55.281	50.096	159	190	119.973	131.964
2007	508.251	284.191	53.909	45.792	524	1.290	129.101	129.792
2008	510.971	305.023	50.783	44.725	337	663	124.653	96.476
2009	547.718	301.251	51.750	44.319	208	266	154.739	109.162

While service quantity of SSO Hospitals showed rapid increase tendency in terms of number of outpatient visit, negative changes were experienced in terms of number of inpatientand and gross death rate. Numbers of surgical procedures were increased for both periods (pre and post-turnover).

Figure 18. Outputs of SSO Hospitals



Total factor productivity, productivity change index and technologic change index of SSO Hospitals are shown in Table16 and Figure 19.

Table 16. Total Factor Productivity of SSO Hospitals

Years	Efficiency Change		Technological Change		Total Factor Productivity	
	Mean	Standart Deviation	Mean		Mean	Standart Deviation
2001-2002	1,10	0,61	1,19	0,37	1,21	0,54
2002-2003	1,85	1,79	0,97	0,15	1,73	1,64
2003-2004	0,97	0,40	0,91	0,13	0,86	0,32
2004-2005	0,67	0,31	1,62	0,28	1,06	0,42
2005-2006	1,64	0,74	0,73	0,28	1,14	0,51
2006-2007	1,01	0,48	1,15	0,18	1,16	0,55
2007-2008	0,93	0,24	1,04	0,19	0,94	0,17
2008-2009	1,00	0,19	1,12	0,19	1,10	0,17

While total factor productivity of SSO Hospitals decreased for 2003-2004 and 2007-2008 periods; other periods, this rate increased. Total factor productivity regressed by 14% in 2003-2004 periods with effect of productivity index and technologic change index regression. In 2002-2003 periods, total factor productivity was the highest level with contributing improvement of productivity change index (85%); but this development couldn't sustain following period (2003-2004). After turning over SSO Hospitals (2005 - 2007), total factor productivity increased 14% and 16% respectively.

Figure 19. Total Factor Productivity of SSO Hospitals

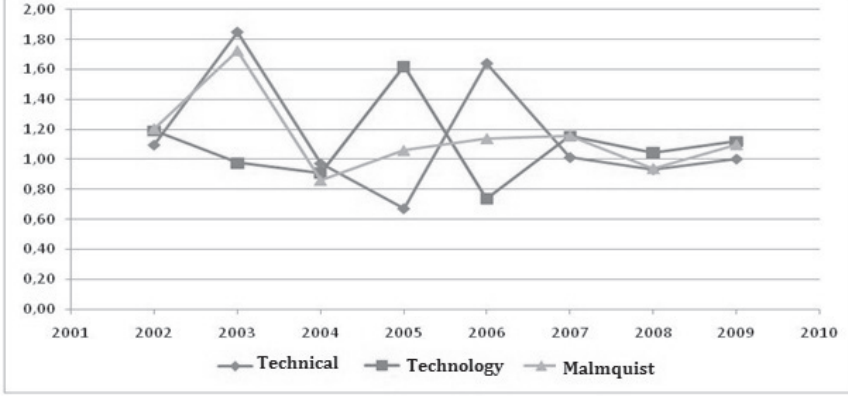
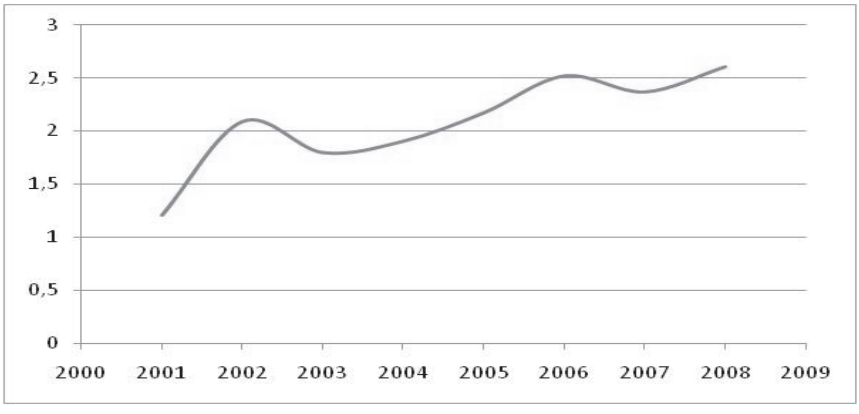


Figure 20. Cumulative Total Factor Productivity of SSO Hospitals



TOTAL FACTOR PRODUCTIVITY OF TRAINING HOSPITALS

Overall Evaluation

The Malmquist TFP indexes calculated by pairs of year are given in Table 17 and Figure 21 and Figure 22. Malmquist index values clearly indicate that TFP of training hospitals were constantly increasing for the period of 2001-2009 except 2006-2007, which indicates that hospitals experienced a productivity growth. Especially in 2005-2006 period, training hospitals have achieved a noticeable productivity improvement (% 75).

Table 17. Malmquist Index by Years

YILLAR	ORTALAMA	STANDART SAPMA
2001-2002	1,110	0,57
2002-2003	1,010	0,20
2003-2004	1,208	0,52
2004-2005	1,052	0,27
2005-2006	1,750	4,00
2006-2007	0,927	0,28
2007-2008	1,188	0,33
2008-2009	1,017	0,16

Figure 21. Malmquist Index by Years

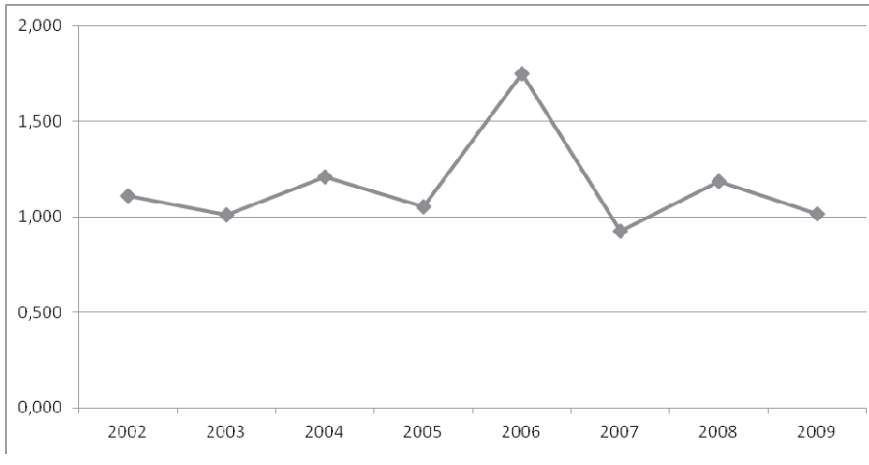
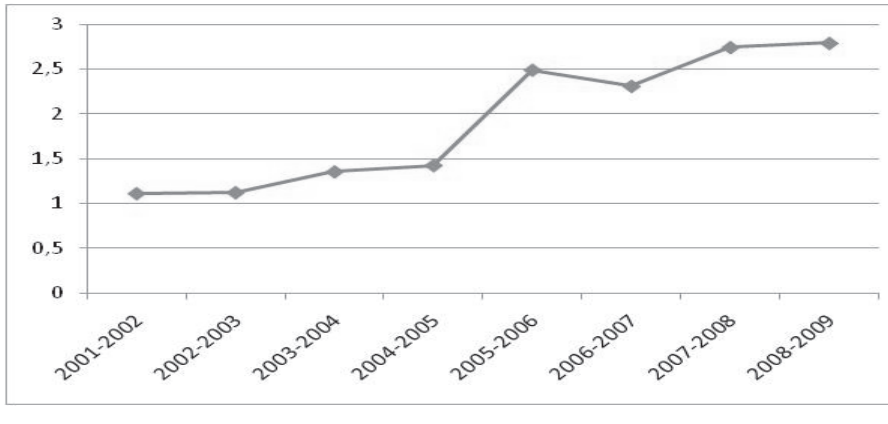


Figure 22. Cumulative TFP Change by Years

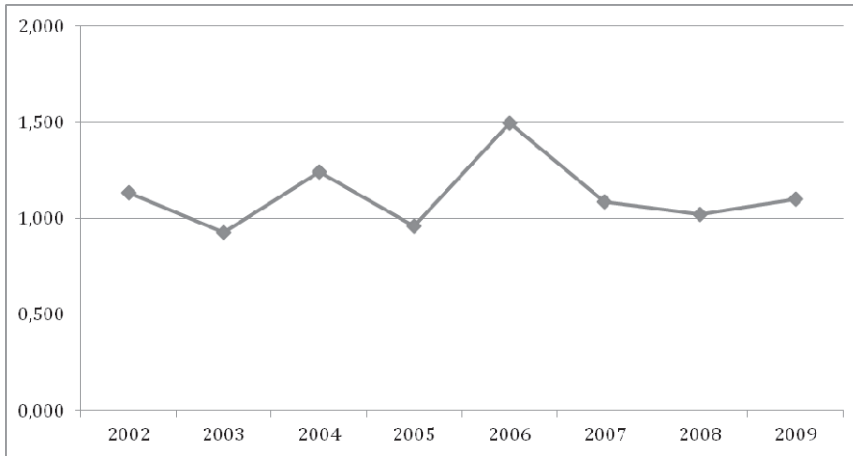


Descriptive statistics of technological change index, independent component of Malmquist Index are given in Table 18 and Figure 23.

Table 18. Technological Change Index by Years

YILLAR	ORTALAMA	STANDART SAPMA
2001-2002	1,132	0,965
2002-2003	0,924	0,226
2003-2004	1,242	0,650
2004-2005	0,960	0,256
2005-2006	1,496	3,309
2006-2007	1,086	0,357
2007-2008	1,021	0,286
2008-2009	1,102	0,242

Figure 23. Technological Change Index by Years



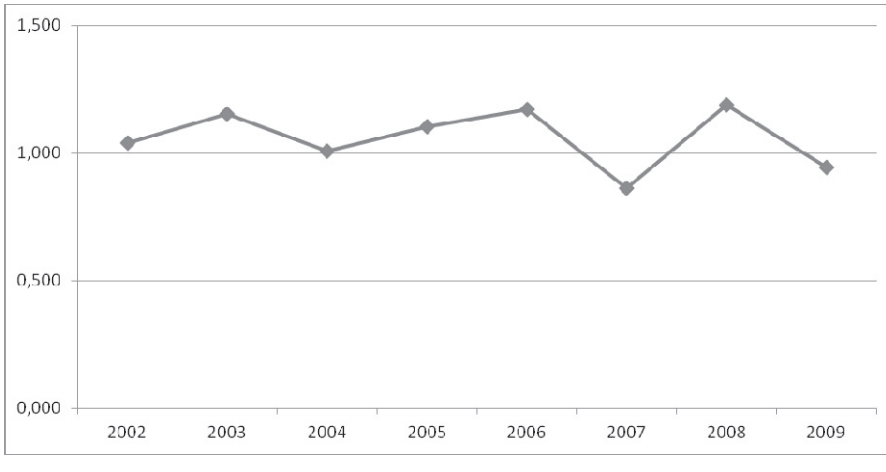
As shown in Table 18, technological change index have constantly increased except 2002-2003 (8%) and 2004-2005 (4%) periods. An improvement in the technological change index clearly indicates that training hospitals adopted new technologies and developed innovative methods to enhance input-output combinations.

Descriptive statistics of efficiency change index, another independent component of Malmquist index, are given in Table 19 and Figure 24. For the period of 2001-2009, efficiency change index are constantly increased except 2006-2007 and 2008-2009 periods.

Table 19. Efficiency Change Index by Years

YEARS	MEAN	STANDART DEVIATION
2001-2002	1,039	0,151
2002-2003	1,153	0,364
2003-2004	1,009	0,156
2004-2005	1,105	0,106
2005-2006	1,169	0,286
2006-2007	0,862	0,137
2007-2008	1,187	0,233
2008-2009	0,945	0,162

Figure 24. Efficiency Change Index by Years



MoH Training Hospitals

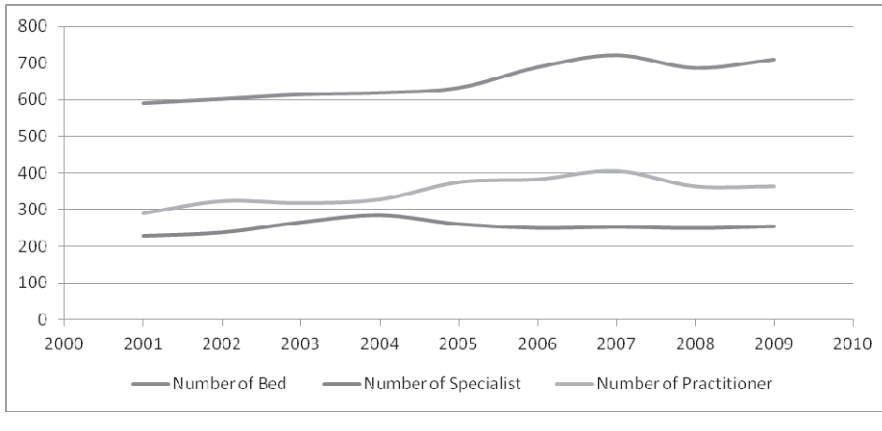
Table 20 and Figure 25 give descriptive statistics on inputs used in MoH training hospitals

Table 20. Inputs of MoH Training Hospitals

Years	Number of Beds		Number of Specialsts		Number of Practitoner	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001	591	241	229	95	290	157
2002	602	235	239	105	323	171
2003	614	248	266	116	318	162
2004	619	254	285	112	328	163
2005	632	259	261	115	375	190
2006	688	266	251	106	383	173
2007	721	292	253	104	406	165
2008	687	270	250	108	363	155
2009	710	266	255	107	363	155

Inputs utilized in MoH training hospitals increased noticeably. Increase rates of number of beds, specialist and practitioner are 20 %. 11% and 25% respectively.

Figure 25. Inputs of MoH Training Hospitals by Years



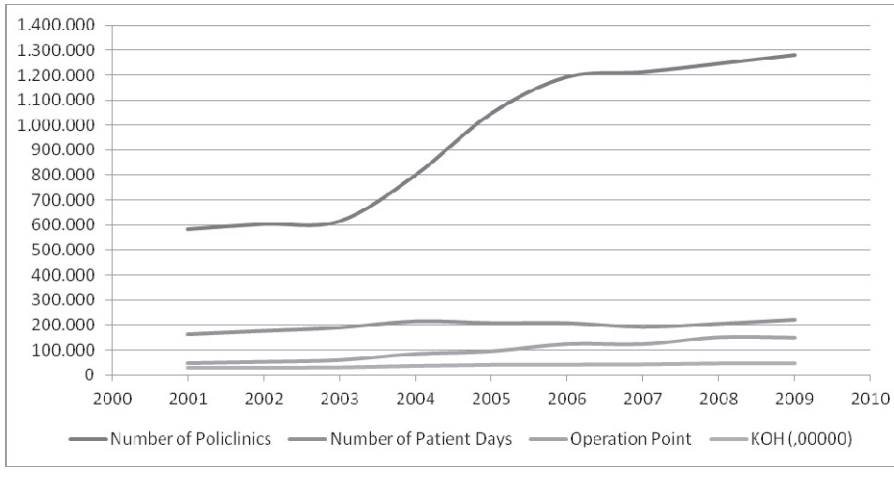
Descriptive statistics on outputs produced by MoH training hospitals are presented in Table 21 and Figure 26.

Table 21. Outputs of MoH Training Hospitals by Years

Years	Number of Outpatient Visits		Patient Day		1/GDR		Surgical Procedures	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001	585.156	182.607	164.175	74.441	46.486	22.650	30	10
2002	605.405	233.533	176.844	73.636	51.797	24.798	29	9
2003	616.894	196.874	189.471	79.098	58.725	28.380	31	10
2004	800.534	255.569	214.232	90.880	83.936	41.905	37	13
2005	1.046.312	284.051	207.624	87.042	94.820	43.684	42	16
2006	1.191.959	290.514	207.402	86.822	123.424	89.822	43	13
2007	1.212.815	302.891	191.895	84.703	123.019	70.916	44	9
2008	1.245.414	265.571	205.016	95.017	151.557	83.103	48	12
2009	1.279.878	264.621	219.811	84.951	150.165	69.076	49	17

While the number of inputs increased slightly or stayed steady over the nine years, MoH training hospitals **increased** their outputs enormously. MoH training hospitals increased number of outpatient visit up to 130 %. For the nine years period, MoH training hospitals increased inpatient days and adjusted surgical procedures 25 % and 228 % respectively. The most noticeable feature of the results presented in Table 21 is the enormous decrease in the gross **death rate.** MoH training hospitals reduced gross death rate up to 300 %.

Figure 26. Outputs of MoH Training Hospitals by Years



The Malmquist TFP indexes calculated by pairs of year are given in Table 22 where the columns show the average change in the TFP and its components, namely technical efficiency and the technological change. Except 2005-2007 periods, Malmquist index values were improved for all periods (see Figure 28). For the period 2005-2006 increase rate was 24,6. Technological change index regressed for the periods of 2003-2004 and 2006-2007 up to 2 % and 4 % respectively. Except these periods MoH training hospitals increased their technological change index by renewing their technological status. For the period 2004-2005 technological change index reached its highest value of 17 %. Efficiency change index fluctuated and did not show constantly increasing trend (see Figure 27).

Table 22. Total Factor Productivity of MoH Training Hospitals by Years

Years	Efficiency Change		Technological Change		Total Factor Productivity	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001-2002	1,093	0,19	1,012	0,08	1,095	0,14
2002-2003	0,974	0,19	1,053	0,09	1,023	0,20
2003-2004	1,224	0,44	0,983	0,15	1,211	0,50
2004-2005	0,824	0,20	1,166	0,12	0,950	0,20
2005-2006	1,246	0,26	1,006	0,17	1,249	0,31
2006-2007	0,981	0,18	0,958	0,07	0,936	0,16
2007-2008	1,073	0,23	1,077	0,08	1,150	0,24
2008-2009	0,991	0,13	1,041	0,12	1,022	0,10

Figure 27. MoH Training Hospitals' Total Factor Productivity and its Components by Years

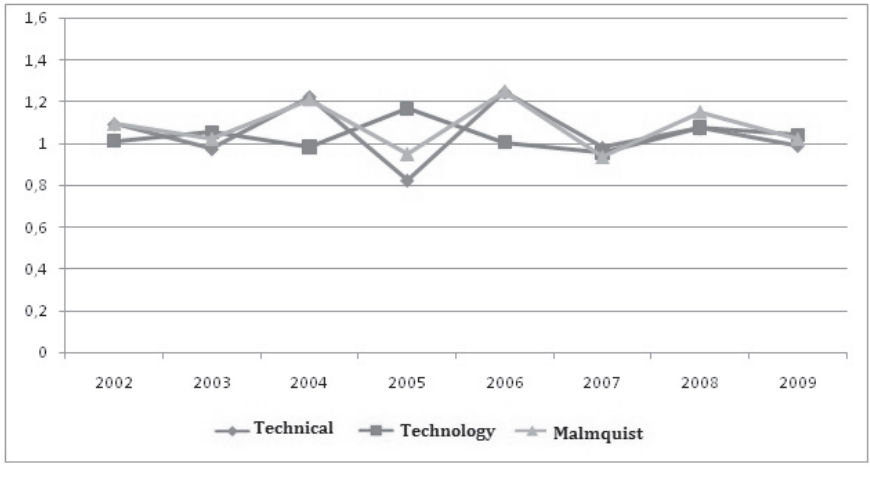
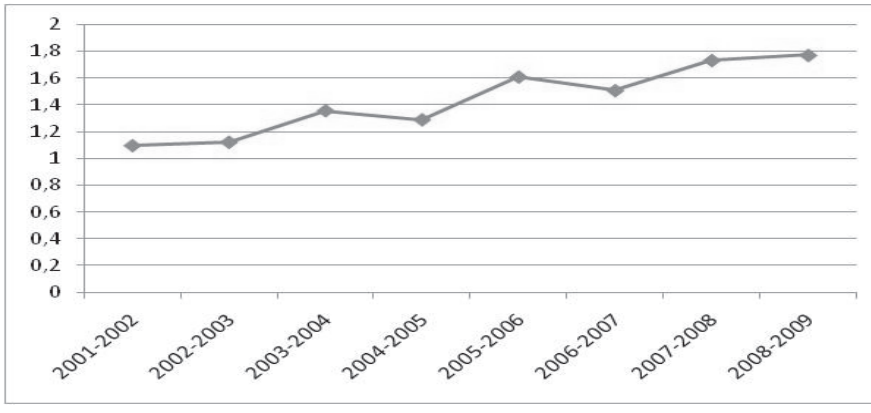


Figure 28. MoH Training Hospitals' Cumulative Total Factor Productivity by Years



University Training Hospitals

Table 23 and Figure 29 present descriptive statistics on inputs used in University training hospitals.

Table 23. Inputs of University Training Hospitals

Years	Number of Beds		Number of Specialists		Number of Practitioner	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001	669	457	198	137	240	144
2002	689	451	217	127	253	147
2003	689	415	221	138	251	140
2004	721	474	244	177	265	144
2005	734	428	250	148	284	193
2006	780	434	259	197	278	160
2007	768	407	271	244	297	155
2008	743	448	298	244	309	143
2009	743	448	321	300	309	143

For the 2001-2009 period, inputs used in university training hospitals apperantly increased. Aevarega bed size, number of specialists and practitioners increased up to 11 %, 62 % and 29 % respectively.

Figure 29. Inputs of University Training Hospitals

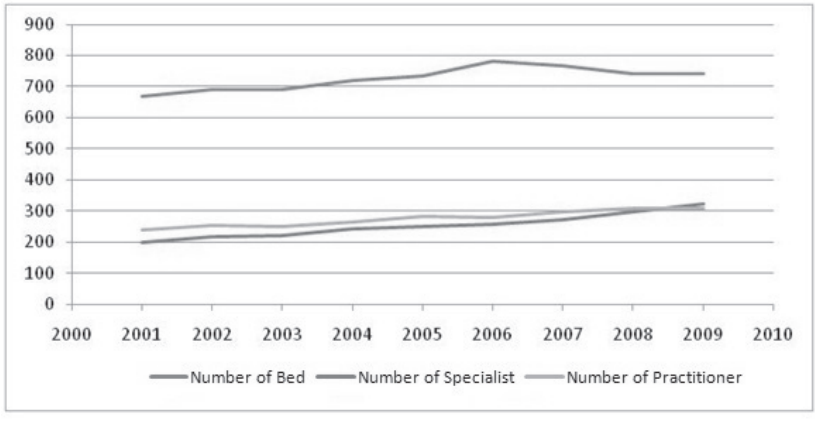


Table 24. Outputs of University Training Hospitals

Years	Number of Outpatient Visits		Patient Day		1/GDR		Surgical Procedures	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001	221.012	126.229	168.855	106.573	35.331	22.662	39	20
2002	227.682	121.317	177.559	107.568	39.343	24.894	38	19
2003	247.843	134.383	185.838	111.538	42.080	25.307	38	19
2004	269.284	136.055	197.147	104.365	47.905	26.237	51	82
2005	282.872	134.334	215.038	115.764	55.664	31.317	61	129
2006	302.302	141.771	229.947	117.617	62.527	36.639	45	24
2007	357.643	170.123	217.485	119.826	68.566	34.242	44	24
2008	435.472	197.718	230.787	112.108	76.287	39.421	49	28
2009	449.552	218.020	222.940	113.631	91.280	50.291	47	17

While the number of inputs increased slightly or stayed steady over the nine years, University training hospitals **increased** their outputs noticeably. Number of outpatient increased by 101 percent by 2001. Similarly For the nine years period, University training hospitals increased inpatient days and adjusted surgical procedures 32 % and 158 % respectively.

Figure 30. Outputs of University Training Hospitals

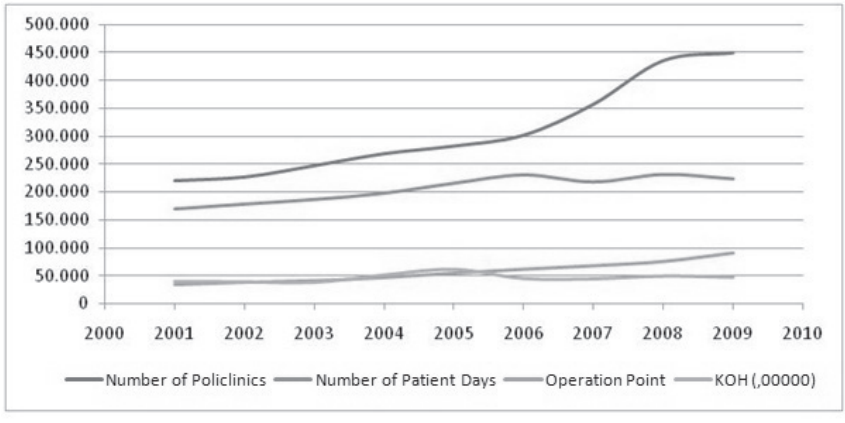


Table 25 and Figure 31 give detailed information on total factor productivity of university training hospitals by years. University training hospitals constantly improved total factor productivity for all periods. The highest improvement (39 %) was achieved in 2005-2006 period. Efficiency change index showed fluctuating pattern that is for the periods 2001-2005 efficiency change index regressed. From 2005 to 2009, efficiency change index began to increase in university training hospitals. Technological change index, contrary to efficiency index, regressed 2005 to 2009 except 2007-2008. Efficiency change index and technological change index assured Malmquist index greater than unity meaning that productivity improvement.

Table 25. Total Factor Productivity of University Training Hospitals by Years

Years	Efficiency Change		Technological Change		Total Factor Productivity	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
2001-2002	0,984	0,369	1,094	0,210	1,053	0,374
2002-2003	1,096	0,478	1,009	0,157	1,069	0,433
2003-2004	0,883	0,762	1,559	0,384	1,279	0,932
2004-2005	0,870	0,374	1,497	0,344	1,264	0,591
2005-2006	1,877	1,417	0,828	0,285	1,392	0,940
2006-2007	1,229	0,504	0,889	0,191	1,023	0,279
2007-2008	1,063	0,508	1,336	0,466	1,294	0,472
2008-2009	1,172	0,417	0,930	0,199	1,033	0,225

Figure 31. Total Factor Productivity of University Training Hospitals by Years

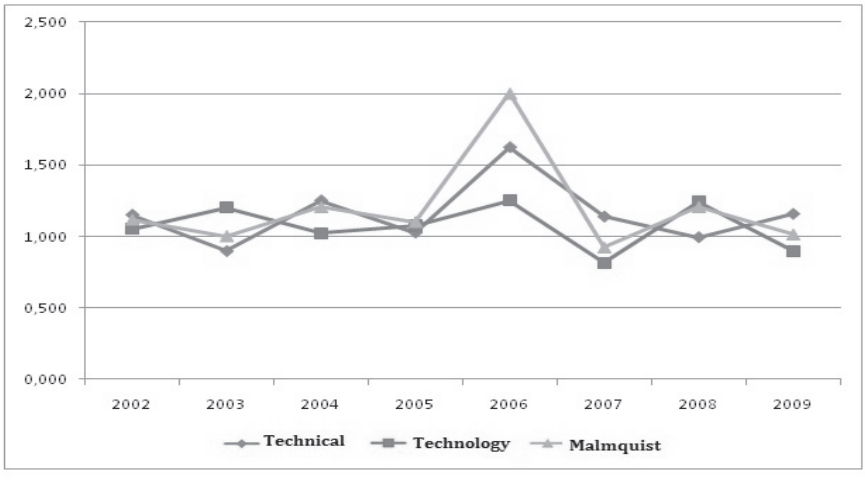


Figure 32. Cumulative Total Factor Productivity of University Training Hospitals by Years

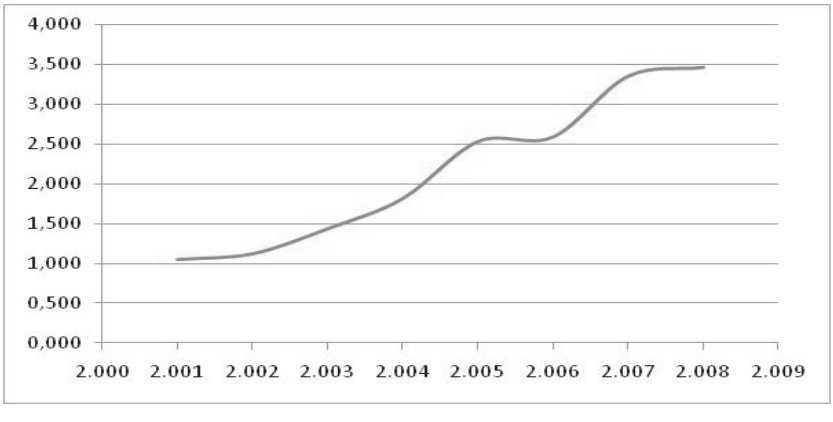


Figure 33. Total Factor Productivity of MoH and University Training Hospitals by Years

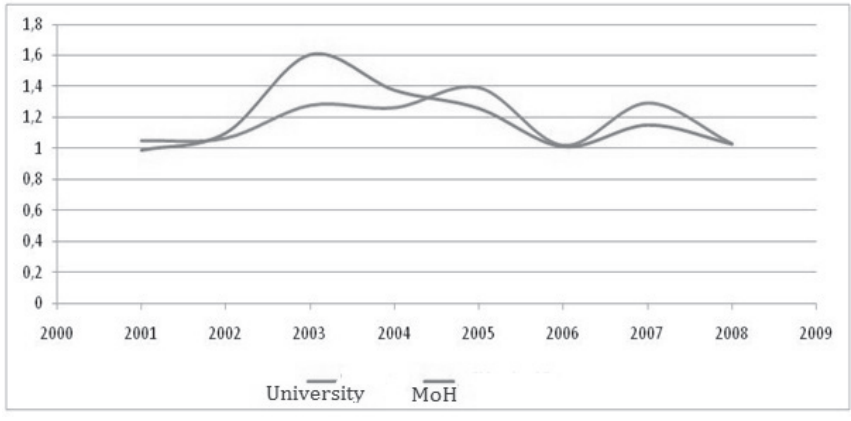
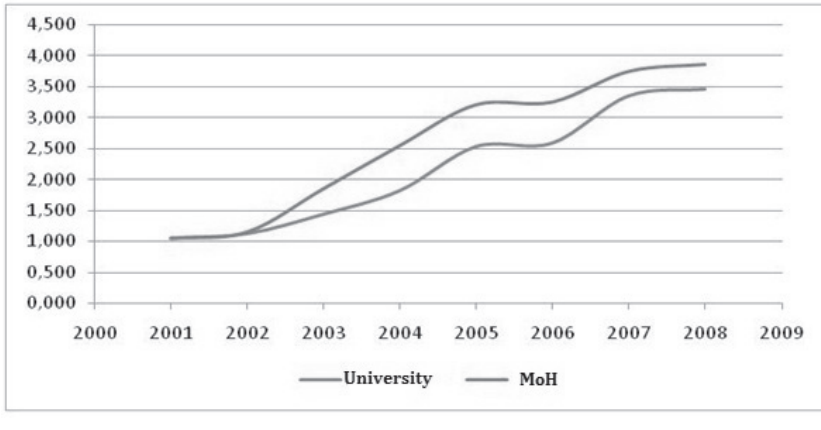


Figure 34. Cumulative Total Factor Productivity of University Training and MoH Hospitals by Years



CONCLUDING REMARKS

In this study, the Malmquist total factor productivity and its components, namely technical efficiency and the technological change and were calculated for the preiods of 2001 – 2010 to analyze productivity improvement achieved in Turkish hospitals by types. Malmquist index clearly indicates that TFP of Turkish hospitals by types (ovnership, education status) were constantly increasing which indicates that hospitals experienced a productivity growth with an annual average increase rate of % 10 over the seven years (2003-2009). Especially after the MoH introduced the HTP in 2003, growth rates of productivity were appeared to be higher than pre- reform periods.

In the general hospitals (public and private), during the reform period (2003 -2009), noticeable productivity improvements were achieved due to catch up effect or efficiency change and technological change. Productivity improvements achieved in Turkish hospitals can be attributed to HTP's ability to mobilize excess inputs causing great inefficiencies and to create efficient service production environment. Studies analyzing the efficiency of Turkish hospitals have commonly indicated that there was a great potential for efficiency improvements in the Turkish health system. Due to great inefficiencies experienced in Turkish health system, health sector reform initiatives have designed a performance oriented health system, which resulted in the great productivity improvements.

Finally, as mentioned OECD Report [51], the HTP in many ways reflects "good practice" in the development and implementation of a major health sector reform in an OECD country. Because HTP is ongoing process, it is too early to regard whole HTP as successful, but productivity improvements achieved indicates that there has been important progress for the creation of efficient service environment.

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