The impacts of health care reforms on the efficiency of the Turkish public hospitals: Provincial markets

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The Impacts of Health Care Reforms on the Efficiency of The Turkish Public Hospitals: Provincial Markets[1]

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Abstract: Turkey has implemented major health care reforms to improve the efficiency of the health care system since 2003. The objective of this study is to investigate the impact of these reforms, especially the performance-based payment system (P4P), on the efficiency of public hospitals. We employ the Data Envelopment Approach and the Malmquist index to comparatively examine before and after the reform years, 2001 and 2006 respectively. Our analyses compare the performances of public hospitals served in provincial markets. Inputs of number of beds, number of primary care physician, and number of specialists, and how they are used to produce outputs of inpatient discharges, outpatient visits, surgical operations are investigated. Indeed, as the quality indicators dead rate, hospital bed occupation rate and average length of stay are considered.

We found that the P4P was successful in boosting productivity due to advancements in technology and technical efficiency. It is seen that the average technical efficiency gains took place because of the significantly improved scale efficiencies, but the average pure technical efficiency did not improve. The lower pure technical efficiencies compared to scale efficiencies affirms the lack adaptation of the hospital management to the renewed system. Additionally, our analysis indicates that in the socio-economically disadvantaged provinces productivity gains have not been achieved. Lastly, it is seen that the hospital quality indicators have not improved in the short run.

In the international literature, P4P has been examined extensively for the developed countries. However there are a limited number of studies on developing countries. As it has been noted in the OECD health system review of Turkey: "Turkey is closing the performance gap with other OECD countries and, on a number of measures including overall costs, performs well relative to other comparable upper middle-income countries. Indeed, there may be much that other countries can learn from the recent health reforms in Turkey, especially in the use of performance-related pay to raise staff productivity". Thus, our study would contribute to the existing literature with a comprehensive analysis of the health system efficiency in Turkey.

Keywords: Turkey, Healthcare reform, Performance based supplementary payment system, Hospital efficiency, Data Envelopment Approach.

JEL classification: I11, I12, I18, C33

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Introduction

In order to align its health care system with the health regulations of the European Union and OECD countries, Turkey initiated the "Health Transformation Programme" (HTP) in 2003. The health system prior to HTP reforms was fragmented in terms of provision and financing. Health insurance was provided by five separate public schemes, each with its own provider network and varying benefit packages. Turkey's health care delivery system was composed of public and private providers. Within the hospital sector, there were three main public providers: the Ministry of Health (MoH), the Social Insurance Organization (SSK) and universities (there were 751 hospitals operated by the MoH, 118 SSK hospitals, 43 university hospitals, and 267 private hospitals in 2001 [20]).

Since 2003, Turkey has implemented major health care reforms in order to improve the efficiency of its health care system. As part of the major structural changes in the health care system, which includes the integration of security schemes under the Social Security Institution (SSI) and the implementation of Universal Health Insurance, the MoH has implemented important reforms in the financing of the hospital sector. The SSK health facilities have been transferred to the MoH, thereby separating the purchaser and the provider of health services. A performance-based supplementary payment system (P4P) has been initiated in the MoH health facilities. The health information systems have been upgraded. Moreover, health personnel in the MoH hospitals had access to improved medical technology and diagnostics through both increased government investments and out sourcing these services to the private sector. [22, 23, 26]

The objective of our study is to investigate the impact of the HTP reforms, especially the performance-based payment system, on the efficiency and productivity of public hospitals in Turkey. During the reform period, the dynamic of the hospital sector has been changing due to a rapid increase in the number of private hospitals. Between the 2001 and 2006 the number of private hospitals increased 24.3%, rising from 267 to 332 [20,21]. SSI has been contracting with private facilities for the delivery of outpatient and inpatient health services. But still, the public hospitals have the greatest share of the hospital sector in Turkey; there were 769 hospitals operated by the MoH and 56 university hospitals in 2006 [21]. Thus, measuring the impact of the reforms on hospital efficiency is crucial for policymakers to evaluate the health care reforms.

This study employs Data Envelopment Analysis and the Malmquist index on the multiple inputs and outputs of the public hospitals in 81 provincial markets in years 2001 and 2006 (pre and post reform years, respectively). In the DEA, the numbers of beds, primary care physicians and specialists are considered as input variables and the numbers of inpatient discharges, outpatient visits and surgical operations are taken as output variables. Indeed, as the quality indicators dead rate, hospital bed occupation rate and average length of stay are considered. We employ Data Envelopment Analysis (Computer) Program (DEAP) version 2.1 to conduct the DEA and the Malmquist index analysis [7].

In the 2009-2013 Strategic Plan, the MoH states that the establishment of public hospital unions will be completed until 2013 [1] and, according to the Public Hospital Unions Law, all MoH hospitals in the same province will be united under one union and jointly carry out the program, planning, budgeting, and implementation. Therefore, to provide the necessary feedback to the policy-makers, our analyses compare the public hospitals in terms of provinces serving as the Decision Making Units.

P4P has been examined extensively for the developed countries in the literature but there are a limited number of studies on developing countries [18]. Thus, our study would contribute to the existing literature with a comprehensive analysis of the system in a developing country. Turkey case is especially interesting since it is an upper middle income developing country having a long history of European alignment and is presently engaged in extensive health reforms.

The Turkish Health Care System and The HTP Reforms

Overview

Turkey is an upper-middle-income country with a per capita gross domestic product (GDP) of US$10,436 in 2008, which was a lower-middle-income country with per capita GDP of US$3,383 in 2003. Parallel to rapid growth on Turkish economy, health expenditures has also increased. Total health expenditure was US$18.2 billion in 2003 and it has reached to US$30.6 billion in 2006 by increasing 68%. During this period, even though there was a increase in health expenditures, health expenses ratio to GDP decreased from 6% to 5.7%. Public sector expenditures comprised 72.4% of total health expenditures, while the private sector comprised the remaining 27.5%. [22, 25].

Turkey's population is about 73 million in 2006. The age composition of Turkey is much younger than that of other OECD countries. In Turkey, children 0 to 14 years constitute 28.1% of the population while individuals aged 65 and above constitute only 6%. In other OECD countries, children 0 to 14 years constitute on average 17.6% of the population, while individuals aged 65 and above constitute on average 14.9% of the population [25].

The latest estimates show that life expectancy at birth in Turkey was 72 in 2007 [34]. Moreover, Turkey's infant mortality rate has decreased steadily (from 55.4 per 1000 live births in 1990 to 17.6 per 1,000 live births in 2008), but it is still higher than other OECD countries' average (4.6 per 1000 live births in 2006[3]) [24, 25].

Before the HTP reforms, there were three different social security schemes: the Social Insurance Organization (SSK), Government Employees Retirement Fund (GERF), and the Social Insurance Agency of Merchants, Artisans and the Self-employed (Bag-Kur). These security funds provided both pension and health insurance. SSK covered private sector employees and blue-collar public sector employees, Bag-Kur covered self-employed people and GERF covered retired civil servants. In addition, health spending of active civil servants is financed from the general government budget through the budget of public institution they work for. Moreover, the Green Card scheme, which provided free health services for the poor is directly funded by the government budget through the MoH budget transfer item. Each of these five separate schemes had varying benefit packages and regulations; GERF had the most generous benefits package. Prior to the HTP reforms Green Card scheme did not cover outpatient care. SSK insurers were restricted to only access to SSK hospitals (they had limited access to other type of hospitals only if there were referred). The HTP reforms aimed to eliminate the differences in the benefit packages of public health insurance schemes and provide equal access to health services for all insured people. Green Card scheme started to cover outpatient health expenses in 2004. In order to harmonize the system and control it from under one management SSI was established in 2006; SSK, Bag-Kur and GERF have been integrated into one institution. Most significantly, in 2008 Universal Health Insurance (UHI) was initiated. UHI aims to extend GERF benefits to all insured people. Thus, the benefit

[3] For Belgium, Canada and USA we used 2005 data.

generosity across the various health insurance schemes is unified under UHI. Ultimately, UHI will cover the whole population. However, the reform will take some time; green card holders have been planned to be covered by UHI in three years. Active civil servants joined the UHI recently (in January/2010). [26, 33 and our own search]

When the HTP was initiated, the number of physicians per 100 thousand people in Turkey (123.6) was 47% lower than the average ratio of OECD (181.7 excluding Turkey) in 1999 [25, 34]. Furthermore, because of low salaries in the public sector, doctors usually preferred dual practice. By the end of 2002, the share of full-time physicians was 11 % compared to 89% working part-time [1]. Indeed, according to a study in 2001, public sector physicians who work part-time in private health care facilities earned 5 times more with respect to those working full-time in public sector [35]. Consequently, there was a scarcity in the number of doctors at the MoH hospitals. The conditions of the MoH facilities (overcrowding, long waiting times, poor quality, poor responsiveness, and lack of adequate operational resources) were satisfactory neither for the patients nor for the health personnel. Furthermore, the HTP reforms improved access to health care services and caused an increase in demand for health care services. The increased demand has been aimed to be counterbalanced by increased productivity of health staff in the MoH facilities. Thus, the supplementary payment system has been initiated in 2004. The P4P system links the individual bonus payments of the staff members to their performance and encourages them to provide productive and qualified health care services. Besides the improvement of health personnel performance, the P4P system has fostered full-time work in the public sector by adding a positive multiplier in the formulation of the bonus payments. Also, an aggregate amount of bonus payments is adjusted by the institutional performance multiplier. In this approach, the institutional performance of the hospital affects the supplementary payment of health staff, thus inducing group incentives to achieve overall institutional performance criteria.

Furthermore, prior to the HTP reforms, there was an inequality in the distribution of health workers. Socio-economically less-developed eastern and southeastern areas had the lowest ratio of health personnel to population. This region of Turkey had the lowest number of outpatient visits, because of both the inefficiency in the supply of the health services and the poorness of the population. [22-24, 26] However with the HTP reforms on the planning of health staff, newly graduated doctors are encouraged to serve in disadvantaged areas with a combine of regulatory and financial incentives. [10, 35].

The MoH Hospitals' Finance

The MoH Hospitals are operated as extra-budgetary revolving funds (RFs). RFs revenues are financing more than 80% of the total hospital budget. The greatest financer of the MoH hospitals' RFs is the SSI, whose reimbursements constitute 70% of the MoH hospitals' total RFs revenues in 2007.[4] Although RFs provide flexibility over hospital budget management, this was in fact not the case before the HTP reforms. With the HTP, the MoH has focused on its stewardship role and provided more independence and flexibility to the management of the MoH hospitals. Essentially, the P4P provides freedom over the management of the RFs. According to the P4P, up to 40% of the RF revenues can be distributed as supplementary payments to the hospital staff.

[4] The MoH Strategy Development Headship Data, 2009.

When the HTP launched, payment by health insurance schemes operated on a retrospective basis (fee-for-service). The payment system was showing differences across the five separate public health insurance schemes. Indeed, charge of the health services was changing depending on the type of hospital. In order to coordinate health payments, SSI has developed a bundled price for inpatient and outpatient health services under the 2007 health budget law. Bundled prices of health services were set upon procedural and ICD 10 coding systems. Thus, identical prices across all health insurance schemes and public and private health facilities have been introduced.[5] In this sense, the health payment system has started to approach a prospective payment scheme.

Although the health expenditures were sustainable during the period of reforms, its burden was ever-increasing for the SSI. In response to rapidly growing MoH expenditures, the SSI agreed with the MOH on a capped annual budget (global budget) for all MoH hospitals in 2006. This global budget was decided depending on the past realizations of the MoH hospitals revolving funds expenditures and the medium-term budget forecasts. The MoH hospitals were paid on a monthly basis. These payments were regulated by the MoH to meet the capped annual budget. In practice since 2006, a global budget has been applied in the MoH hospitals but its law was officially inured in January 2009. [1, 24, 26]

Background on Efficiency and Its Measurement

According to Farell [14], if a firm is producing maximal output given its available inputs, or equivalently utilizing the minimum level of inputs given the amount of outputs, it is said to be technically efficient. Furthermore, scale efficiency refers the losses due to non-optimal production size. The productivity on the other hand is an absolute concept. It is defined as the ratio of an index of the outputs to an index of the inputs utilized to produce them. Total factor productivity (TFP) growth evaluates how much productivity changes over time. When there are more outputs relative to the quantity of given inputs, then TFP increases. TFP change can be decomposed into technical efficiency change (EFFCH) and technological change (TECHCH) [12]. TFP rises if the firm uses its existing inputs more efficiently, so the firm can produce more while consuming the same levels of inputs. In other words, TPF grows as technical efficiency grows. Also, TFP can increase because of technological change such as adopting innovations like advanced IT technologies, improved designs and products.

In this paper we focus on technical and scale efficiencies. Furthermore, we analyze the TFP changes and their causes for the public hospitals which are compared in terms of provinces. In order to compute these analyses, we employ the data envelopment analysis (DEA) method. The DEA is a nonparametric technique which estimates the production functions and has been extensively used to evaluate technical efficiency (TE) in a range of industries when a set of reasonably homogeneous decision-making units (DMUs) have multiple inputs and outputs. DEA constructs a non-parametric envelopment frontier (envelopment surface) over the data points so as all observed combinations of inputs and outputs lie on or below the production possibilities frontier. DMUs that define (lie on) the frontier are deemed technically efficient and are assigned an efficiency score of one. Units that lie below the efficiency frontier are termed inefficient compared to their peers. The inefficient DMUs are assigned a score between one and zero. A larger score denotes a more efficient a DMU. [5, 7, 8].

[5] At the beginning, private health providers were allowed to charge 100% above the prices paid by SSI. However, in July 2008, private facilities are restricted to bill at most 30% above the price paid by SSI.

DEA offers various models according to scale. There are two scale assumptions usually employed: constant returns to scale (CRS) and variable returns to scale (VRS). The CRS assumption is suitable if all DMU's are working at an optimal scale. The technical efficieny score of a DMU under CRS is termed total technical efficiency (TE_{CRS}). Total technical efficiency can be decomposed into pure technical efficiency (that is, technical efficiency score under VRS, TE_{VRS}) and scale efficiency. Under imperfect competition and constraints on finance, DMUs can not operate at optimal scale. The VRS model handles such situations. VRS states the fact that production technology may display increasing, constant, or decreasing returns to scale. The difference between total and pure technical efficiency scores implies the scale inefficiency of that DMU. Scale efficiency (SE) can be stated: SE = TE_{CRS}/ TE_{VRS}. If a DMU performs under increasing returns to scale, that firm is scale inefficient since it has potential to produce a larger number of outputs. If a DMU operates under decreasing returns to scale, it is inefficient because of achieving outputs that are too large. Furthermore, the orientaion of the DEA model should be chosen depending on which quantities (inputs or outputs) the managers have the most control over.

In this study, we employ the output-oriented VRS DEA model to achieve the pure technical and scale efficiencies of public hospitals before and after the reform and then compare the mean of the efficiency scores. The VRS is chosen since, in the Turkish hospital market, there are imperfect competition and financial constraints. The output orientation is preferred, since the P4P system encourages the MoH hospitals to increase the number of health care services provided (i.e. the outputs) given available inputs. Indeed, the MoH managers have limited autonomy to hire or fire staff and all staffing decisions were made by the MoH.[26].

The output-oriented VRS DEA model is a very well-known technique. It can be seen in detail from Färe, Grosskopf and Lowell [13] and Seiford and Thrall [30].

Furthermore, in our analysis the output-oriented model of DEA-Malmquist is employed in order to assess TFP change, EFFCH, and TECHCH between the years 2001 and 2006, the years before and after reform. The output based Malmquist productivity change index is defined as follows [12, 13]:

$$m_0(y_{t+1}, x_{t+1}, y_t, x_t) = \{ [d_0^t(x_{t+1}, y_{t+1})/ d_0^t(x_t, y_t)] * [d_0^{t+1}(x_{t+1}, y_{t+1})/ d_0^{t+1}(x_t, y_t)] \}^{1/2} \quad (1)$$

This equation states the productivity of the production point (x_{t+1}, y_{t+1}) with respect to the production point (x_t, y_t). This index is the geometric mean of two output based Malmquist TFP indices, such that one index applies period *t* technology and the other period *t*+1 technology. If the Malmquist productivity change index is greater than one, the improvement in productivity is gained relative to the previous year. However, if the index is less than one the productivity deteriorates, and if the index is equal to one then no productivity change occurred.

The Malmquist index of total factor productivity change (TFPCH) can be decomposed into technical efficiency change and technological change, as follows:

$$\text{TFPCH} = \text{EFFCH} \times \text{TECHCH}. \quad (2)$$

Technical efficiency change evaluates the change in efficiency between period t and t+1, as the technological change (progress) captures the shift of the production frontier.

Literature Survey

Since hospitals employ multiple inputs to produce multiple outputs, the use of DEA in the study of hospital efficiency is very common [16]. Indeed, there are a number of studies

that employ the DEA based Malmquist productivity index analysis to evaluate the impact of financial reforms in the health sector on the efficiency of the hospitals, such as: Linna [19], Sommersguter-Reichmann [31] and Chen [6]. Linna [19] found significant improvement in productivity and efficiency in Finnish hospitals after the 1993 health care financing reform. Sommersguter-Reichmann [31] considered the 1997 hospital financing reform in Austria and observed a noticeably positive shift in technology, whereas no technical efficiency improvement occurred after the reform. Chen [6] assessed the 1995 Taiwan hospital financing reform. His study indicates significant technical efficiency gains, but technological progress does not take place. Furthermore, Aletras et al. [2] evaluated the efficiency impact of the 2001 Greek National Health System reform. They employed DEA methodology to achieve the technical and scale efficiencies of public hospitals for the pre and post reform years and then compared the mean of these efficiency scores. Their analyses point out that technical and scale efficiency has been reduced following the reform.

There are three major studies considering the hospital sector efficiency in Turkey employing the DEA: Ersoy et al. [9], Sahin and Ozcan [28], and Sahin et al. [29]. Ersoy et al. [9] computed the technical efficiencies of 573 Turkish acute general hospitals in 1994. Their results illustrate that more than ninety percent of hospitals operated inefficiently compared to their counterparts. They found that inefficient hospitals, relative to efficient ones, use 32% more specialists, 47% more primary care physicians, and 119% more staffed bed capacity while producing 13% less outpatient visits, 16% inpatient hospitalization, and 57% less surgical procedures on average. Sahin and Ozcan [28] have examined the public sector hospital efficiency in 80 provincial markets in Turkey in 1996. They found that there were inefficient structures in 44 provinces, which means that 55% of the public hospitals in served markets were operated inefficiently. They point out that compared to efficient provinces, inefficient provinces are collectively over-bedded, use an excessive number of health laborers including the specialists, and spend almost $70,000,000 in excess from their revolving funds. Sahin et al. [29] examines the operational performance of the 352 MoH general public hospitals after the HTP took place during 2005–2008. They found that the operational performance of these hospitals progressed during the considered period.

In this study we consider the public sector hospital efficiency in all provincial markets in Turkey to assess how the HTP reforms have affected public hospitals' performance considering the years of 2001 and 2006 (pre- and post-reform) by employing the DEA approach. Similar to Sahin and Ozcan [28], we compare public hospitals in terms of provinces serving as the Decision Making Units.

Data

Data and Data Sources

In 2001, there were 751 hospitals operated by the MoH, 118 SSK hospitals and 43 university hospitals. Although, SSK's total number of hospitals was relatively small, it was the second biggest producer of the health sector services. In 2001, 35% of total outpatient visits and 27% of total inpatient cases have been produced by the SSK hospitals. Indeed, the SSK hospitals constituted 16% of the hospital sector bed capacity and the total number of specialists that worked in SSK was 15% of the all the specialists who were employed in the health care sector. In 2004, the MoH and SSK signed protocol for common use of their health facilities, and in 2005, all SSK hospitals had been transferred to the MoH. Indeed, during 2005 and 2006 most of these transferred hospitals were merged with the MoH hospitals. Therefore, the increase in the MoH hospitals' healthcare services after the reform (in 2006)

could be attributed to these transfers and mergers. This situation would obviously cause a bias in our efficiency analysis. As we could not eliminate the SSK hospitals from 2006 data since they were already transferred to the MoH management, for 2001 we have also included the SSK hospitals' input and output data into our analysis.

The university hospitals are operated according to totally different operational systems and regulations. Consequently, the university hospitals are not included in our analysis. Hence, main public health care providers, except university hospitals, in 81 provinces in Turkey that responded to the annually published MoH Statistical Year Book of Inpatient Health Care Organizations of Turkey, 2001 and 2006, were included in this analysis [20, 21]. The input and output variables used in this analysis are obtained from these statistical year books.

Measures

In this study, the output and input variables have been chosen according to the literature and availability of the data. The descriptions of input and output variables are presented in Table 1.

Table 1. Description of the Variables of Interest

Variables	Description
Output variables	
Outpatient visits	The number of outpatient visits within a year.
Inpatient cases case-mix adjusted	The annual number of hospitalized cases (including both discharges and deaths) adjusted for case-mix by Roemer index.
Total number of surgery	The total number of surgeries within a year.
Input variables	
Beds	The number of existing patient beds within the hospital ready for use.
Specialists	The total number of specialist medical doctors employed in the public hospitals in the province.
General practitioners	The total number of general practitioners employed in the public hospitals in the province.
Hospital quality indicators	
Hospital mortality rate	Hospital mortality rate is the ratio of the number of inpatients die during hospitalization to the number of inpatients.
Bed occupation rate	It refers to the percentage of beds that are occupied by inpatients at any given time (= total patient days*100/existing patient beds*duration) duration is taken as 365.*
Average length of stay	It is the average amount of time spent in hospital which is defined as the mean number of days that an inpatient stays in hospital from the time of admission to discharge (= Total patient days/(total number of patients discharged or death)).*

Notes: *: Definitions are taken from the MoH Statistical Year Book of Inpatient Health Care Organizations, 2006.

The outputs of visits to hospital emergency and outpatient facilities, the number of hospitalized cases (discharges and deaths), and the number of surgical operations performed, capture the major outputs of the hospitals. However, hospitals do not serve the patients that are in identical conditions; there are always differences in terms of patient's characteristics,

complications, and severity of illness. In order to manage this situation, previous studies have introduced case mix indices or such a correction is neglected at all [2, 11, 27]. In Turkey, with the 2007 health budget law, all public and private hospitals under agreement with SSI are obligated to report claims including a patient's information (such as a patient's age, sex, and diagnosis) through the MEDULA, which is an integrated claims and utilization management system. However, access to this data is not yet accessible to researchers. Because of lack of data, we used a quite basic case-mix index proposed by Roemer et al. [27] to adjust hospital inpatient cases. Roemer case-mix index multiplies average length of stay (ALS) of a DMU by its occupancy rate and divides this by the average occupancy of all the samples. Here, ALS depends on case-mix complexity as well as other factors such as bed availability and age. According to the Roemer formula, ALS will be adjusted upwards if the DMU's occupancy rate is above the average level, because that DMU is inclined to hospitalize its patients longer if they do not have a space availability problem. Finally, to compute case-mix adjusted inpatient cases, the annual number of hospitalized cases in each DMU has been multiplied by the Roemer case-mix index and divided by the respective mean in the sample [15, 17].

Besides the individual performance, the P4P system also encourages the hospital to fulfill overall institutional quality. The occupation rate and average length of stay are among the crucial institutional productivity indicators that the MoH considers during audits of institutional performance [24]. Thus, in this study we consider the hospital mortality rate, the occupation rate, and average stay length as quality indicators of the inpatient health care services supplied by the hospital. We compare and statistically analyze their pre and post reform realizations by employing t-tests. However, in the efficiency analysis, dealing with the quality has been quite the exception [2, 4]. Indeed, although DEA is a powerful optimization technique, the discriminatory power of the DEA will be limited if one has to manage with a large numbers of factors (inputs and outputs) when a small number of DMUs are under assessment. This limitation is defeated by eliminating the factors which are strongly positively correlated with each other. We have implicitly included the mortality rate, ALS, and the occupation rate in our data by considering case-mix adjusted inpatient cases. Therefore, to prevent correlation among factors, we did not use these quality indicators in our DEA analysis.

The input variables employed in this study can be classified as labor and capital. The annual numbers of the specialists and the general practitioners are used as labor inputs. The annual number of hospital beds is used as capital proxy. The MoH Statistical Year Book of Inpatient Health Care Organizations (2001, 2006) does not include the number of nurses and other allied professionals at the hospital nor provincial level. Therefore, these variables are not included.

The pre-reform study of Sahin and Ozcan [28] employs the revolving funds expenditures to reflect other operational costs. In this study, the RF expenditure data is not available for the MoH hospitals for 2006. Indeed, we do not have the data of operational costs for the SSK hospitals. As a result, the RF expenditures were not included in our efficiency analysis. In this study Data Envelopment Analysis (Computer) Program (DEAP) version 2.1 is used to conduct the data envelopment analysis [7].

Empirical Results

Descriptive statistics for the public hospitals in terms of provinces serving as DMUs in this study are presented in Table 2 relative to the years 2001 and 2006. First, it is seen that all output and input variables have increased between 2001 and 2006. The mean of the outpatient visits has increased 78%, from 1,317 thousands to 2,339 thousands, and this difference is statistically significant ($t= 2.58$, $p<0.01$). The mean of inpatient cases rose 30.3%, from

50,000 to 65,000, but this increase is not statistically significant (t=1.32, p>0.05). Similarly, the mean of case-mix adjusted inpatient cases rose approximately 20%, from 50,000 to 65,000 (t=0.62, p>0.05). Following the reforms, the mean of total number of surgeries greatly increased 122%, from 16,000 to 36,000 (t= 2.39, p<0.05). Even though the mean number of inpatient cases and surgeries dramatically increased, the bed occupation rate almost stayed same (slightly increased from 55.2% to 55.9% between the years of 2001 and 2006). Indeed, the ALS decreased slightly from 4.80 days to 4.75 days between pre and post reform years. Furthermore, the mean hospital mortality rate slightly yet insignificantly increased (from 0,010 to 0,012) (t=0.68, p>0.05). Lastly, all of the input variables rose between 2001 and 2006. During this period, the total number of beds, specialists, and general practitioners rose around 18%, 26% and 27.7%, respectively.

Table 2. Descriptive statistics of output and input variables in 2001 and 2006 (N=81)

	2006				2001				
Variables	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**t-test**
Output variables									
Outpatient visits	2338545	3024247	116493	21935848	1317115	1879192	98865	14809609	2.58(a)
Inpatient cases (discharges+death)	65473	83657	3092	553519	50231	62026	3588	420309	1.32
Inpatient cases (Case-mix adjusted)	80243	138244	797	1003171	66995	133564	855	1039415	0.62
Total number of surgery	35752	67386	1259	385164	16105	30254	457	183162	2.39(b)
Hospital mortality rate	0.012	0.026	0.000	0.240	0.010	0.005	0.001	0.029	0.68
Bed occupation rate (%)	55.9	12.0	14.8	82.3	55.2	12.98	20.6	86.8	0.36
Average length of stay	4.75	1.02	2.57	8.47	4.8	1.14	1.8	9.2	-0.29
Roemer index	4.83	1.73	1.24	10.67	4.92	1.98	1.17	12.18	
Input variables									
Beds	1473	2006.5	110	15038	1249	1874	100	14661	0.73
Specialists	294	594	24	4126	233	492	2	3648	0.71
General practitioners	189	585	5	4244	148	421	6	2956	0.51

Source: Our own findings using the data obtained from the Statistical Year Book of Inpatient Health Care Organizations of Turkey, 2001 and 2006. **Notes:** The statistical tests are computed against the reference group which is taken as the 2006 variables. (a) and (b) denote the statistical difference respectively at 1% and 5% significance levels.

The mean Malmquist productivity index changes between 2001 and 2006 for DMUs that are obtained from the output oriented Malmquist DEA model (Table 3). The results show that, on average, the MoH hospitals in terms of provinces experienced total factor productivity growth during the period analyzed since TFPCH=1.32>1. The TFP has improved in 74 provincial markets and decreased only in 7 provincial markets (Ardahan, Elazığ, Kars, Kırıkkale, Muş, Siirt, Şırnak) that are all among the socio-economically least developed provinces, except Elazığ and Kırıkkale, according to the State Planning Organization categorization. Furthermore, the results indicate that the average changes are positive in both technological progress and technical efficiency, with growth indices of 1.21>1 and 1.09>1, respectively. Thus, in our case, the overall TFP growth has occurred because of both the technology progress (frontier shift) and the technical efficiency growth.

Table 3. Malmquist Productivity Change Index Summary for provincial markets

	Overall mean for all (N=81) provincial markets	Min.	Max.
TFPCH	1.32	0.37	2.50
TECHCH	1.21	0.53	1.77
EFFCH	1.09	0.29	1.87
	Number of provincial markets that Malquimst indexes are:		
	>1 (improvement)	**=1 (no change)**	**<1 (decrease)**
TFPCH	74	0	7
TECHCH	76	0	5
EFFCH	50	6	25

Source: Our own findings. **Note:** All Malmquist index averages are geometric means.

We then focused on the technical efficiency gain in detail by decomposing it into pure technical and scale efficiency components. The technical and scale efficiency statistics and the ranking of the provincial markets have been given in Table 4. We used the Wilcoxon test to compare the performance of the public hospitals in served markets in the two study years. The analysis indicated that between years 2001 and 2006, the mean technical efficiency of all provincial markets significantly increased from 77% to 83.5% when we assume constant returns to scale in the production ($z= -3.3$, $p=0.001$). This information implies that before the reform (in 2001) the output could have been increased on average 23% with the same input levels. The respective feasible increase after the reform (in 2006) was found to be considerably lower, 16.5%. Under CRS technology, 50 provincial markets have increased their technical efficiency, 25 have reduced it, and 6 were efficient in both periods. When we consider the mean pure technical efficiency (under variable returns to scale in the production), a statistically insignificant increase from 87% to 88% is observed ($z=-0.58$, $p=0.562$) between 2001 and 2006. This information implies that in 2001 the output could have been increased on average 13% with the same input levels. The respective feasible increase after the reform was seen to be almost same 12%. Under VRS technology, 32 provincial markets have increased their pure technical efficiency, 30 have reduced it, and 19 were efficient in both periods.

[see Table 4]

The mean scale efficiency has risen significantly from 88.4% to 94.8%, ($z=-4.24$, $p<0.0001$). According to our analysis, 53 provincial markets have increased their scale efficiency, 22 have reduced it, and 6 were efficient in both periods. The average scale efficiency improvement after the reform could have been attributed to a considerable increase in the mean bed size. Moreover, it is interesting to report that before the reform only 7 DMUs were operating under increasing returns to scale (IRS) and 56 DMUs were employing decreasing returns to scale (DRS). But after the reform 28 DMUs became operating under IRS and 37 DMUs under DRS (Table 4). IRS implies that a DMU should produce a bigger number of outputs whereas DRS implies that DMU should scale down its production in order to improve efficiency.

Our analysis shows that the overall mean technical efficiency gains have been reached because of significantly improved scale efficiency; as the average pure technical has only

slightly and insignificantly improved. Furthermore, the lower mean pure technical efficiency, in comparison to the mean scale efficiency, suggests that inefficiencies are mostly due to inefficient management practices. Since 2003, the HTP has initiated important institutional, administrative, and operational changes. Our analysis suggests the lack of adaptation of the public hospitals' management to the renewed health system in the short-run.

Table 4. Technical efficiency statistics and ranking of all provincial markets (N=81, Roemer index applied)

Descriptive statistics	CRS model		W-test	VRS model		W-test	Scale efficiencies		W-test
	2001	2006		2001	2006		2001	2006	
Arithmetic mean	77	83.5	-3.3(a)	87	88	-0.58	88.4	94.8	-4.24(a)
Std. Dev.	15.7	13.3		13.6	12.4		10.2	7.8	
Median	75.1	81.9		89.4	88.4		89.6	97.9	
Min.	42.9	21.5		46.7	28.7		65.2	64.3	
Max.	100	100		100	100		100	100	
Ranking of provincial markets	**CRS model**			**VRS model**		**Returns to scale**			
	2001	2006		2001	2006		2001	2006	
100%	17 (21%)	16 (19.8%)		32 (39.5%)	25 (30.9%)	IRS	7 (8.6%)	28 (34.6%)	
90-99.9%	2 (2.5%)	10 (12.3%)		8 (9.9%)	14 (17.3%)	CRS	18 (22.2%)	16 (21%)	
80-89.9%	14 (17.3%)	25 (30.9%)		17 (21%)	24 (29.6%)	DRS	56 (69.1%)	37 (45.7%)	
70-79.9%	20 (24.7%)	20 (24.7%)		13 (16.1%)	11 (13.6%)				
60-69.9%	14 (17.3%)	8 (9.9%)		7 (8.6%)	6 (7.5%)				
50-59.9%	12 (14.8%)	1 (1.2%)		3 (3.7%)	0				
40-49.9%	2 (2.5%)	0 (0%)		1 (1.2%)	0				
<40%	0 (0 %)	1 (1.2%)		0	1 (1.2%)				

Source: Our own findings. **Notes:** (a) and (b) denote the statistical difference respectively at 1% and 5% significance levels. W-test: Wilcoxon test. IRS: Increasing returns to scale, CRS: Constant returns to scale, DRS: Decreasing returns to scale.

The HTP aimed to reduce the regional disparities in utilization of health services and improve access to health services in disadvantaged areas by providing equality in the distribution of health workers as well as improving the health insurance coverage for the poor [10, 35]. However, our DEA Malquimst index results find that 5 provinces out of 7 provinces, whose TFP have been deteriorated, were belonging to the socio-economically least developed

area. Therefore, we further investigated the efficiency and productivity of the hospitals served in socio-economically least developed provinces. According to the State Planning Organization categorization, there are 17 provinces that constitute the socio-economically least developed group [32]. Thus, we separately consider these provinces in Table 5. The findings of the DEA Malmquist index indicate that no change occurred after the reforms in the productivity of the public hospitals that served in the least developed provinces (average TFP change index was equal to 1). Also, it is found that the average technical efficiency deteriorated as the average of indices was 0.94. However, the technological progress has upgraded, as the average index growth was 1.06. Hence, in the public hospitals that served in the socio-economically least developed provinces, the TFP has not been upgraded mainly due to the deterioration in the technical efficiency, even though improvement was achieved in the technological progress.

Table 5. Socio-economically disadvantaged provinces: Malmquist index efficiency change summary, between 2001 & 2006

Provinces	**EFFCH**	**TECHCH**	**TFPCH**
Adıyaman	0.97	1.13	1.09
Ağrı	1.22	1.07	1.30
Bingöl	1.00	1.04	1.04
Bitlis	1.48	0.88	1.30
Gümüşhane	1.33	0.94	1.24
Hakkari	1.42	1.27	1.79
Kars	0.79	1.15	0.91
Mardin	1.20	1.10	1.32
Muş	0.70	1.25	0.88
Siirt	0.29	1.27	0.37
Tunceli	1.23	0.89	1.09
Van	1.07	1.32	1.41
Bayburt	1.00	1.17	1.17
Batman	1.00	1.22	1.22
Şırnak	0.72	0.53	0.38
Ardahan	0.72	0.86	0.62
Iğdır	0.81	1.31	1.06
Overall Average	**0.94**	**1.06**	**1.00**

Note: All Malmquist index averages are geometric means.

Lastly, we analyzed the efficiencies of the MoH hospitals in all provincial markets without employing the case-mixed adjustments (that is with out the Roemer index adjustments). The results are given in Table 6. First of all, it is seen that between 2001 and 2006 the mean technical efficiency increased from 78.7 to 86.5 ($p<0.01$). Second, the mean pure technical efficiency has slightly decreased from 95.9% to 93.7% ($p<0.05$). Finally, the mean scale efficiency was 81.9% in 2001 and increased to 92.4% in 2006 ($p<0.01$). Hence, these results are parallel to our previous findings that the overall technical efficiency gains have been reached because of improved scale efficiency.

Table 6. Technical efficiency statistics and ranking of all provincial markets (N=81, without Roemer index)

Descriptive statistics	CRS model		W-test	VRS model		W-test	Scale efficiencies		W-test
	2001	2006		2001	2006		2001	2006	
Arithmetic mean	78,70	86,50	3,83[a]	95,90	93,70	-2,10[b]	81,89	92,38	5,79[a]
Std. Dev.	14,78	10,81		6,12	7,15		13,18	9,60	
Median	78,60	85,30		100	96,90		81,10	96,63	
Min.	47,40	57,70		78,40	73,60		47,40	57,70	
Max.	100	100		100	100		100	100,00	

Ranking of provincial markets	CRS model		VRS model		Returns to scale		
	2001	2006	2001	2006		2001	2006
100%	15 (18,5%)	17 (21,0%)	44 (54,3%)	31 (38,3%)	IRS	0 (0%)	8 (9,9%)
90-99.9%	7 (8,6%)	14 (17,3%)	22 (27,2%)	24 (29,6%)	CRS	15 (18,5%)	23 (28,4%)
80-89.9%	14 (17,3%)	33 (40,7%)	13 (16%)	22 (27,2%)	DRS	66 (81,5%)	50 (61,7%)
70-79.9%	21 (25,9%)	10 (12,3%)	2 (2,5%)	4 (4,9%)			
60-69.9%	18 (22,2%)	5 (6,2%)	0 (0%)	0 (0%)			
50-59.9%	5 (6,2%)	2 (2,5%)					
40-49.9%	1 (1,2%)	0 (0%)					
<40%	0 (0 %)						

Source: Our own findings. **Notes**: (a) and (b) denote the statistical difference respectively at 1% and 5% significance levels. W-test: Wilcoxon test. IRS: Increasing returns to scale, CRS: Constant returns to scale, DRS: Decreasing returns to scale.

Discussion

Our analysis finds out that there is a rapid raise from a stagnant and inefficient system into an active system in the short-run. Therefore, we will discuss the main possible effects of this situation on the other dimensions of hospital performance.

One of the weaknesses of the P4P system applied in the MoH hospitals in Turkey is that the bonus payments are done mainly depending on the output but not the outcome. Between the years of 2001 and 2006, the mean outpatient visits, inpatient cases, and total number of surgeries rose 78%, 30% and 122%, respectively. Since our analysis found very large increases in the number of the outputs in only five years, it raises the question of whether the unnecessary demand has been induced because of an asymmetry of information on the actual needs and demands of patients. However, further studies are necessary to query this situation.

Second of all, the enormous increase in the quantity of the delivered activities brings to question the quality of care. As mentioned, the P4P system links the individual bonus payments of the health staff to the institutional performance criteria, including institutional productivity such as bed occupation rate, ALS, and inpatient rate in order to persuade qualified health care services. However, our results indicate that the quality indicators have not improved in the short-run between 2001 and 2006. The bed occupation rate almost stayed the same (about 55%). In addition, the mean hospital mortality rate slightly (but insignificantly) increased. According to Barnum and Kutzin [3], hospitals in developing countries operate most efficiently at 85-90% occupation rate. However, they point out that it is not unusual to find hospitals operating at less than half that level, either because of very low perceived quality of care or the nonexistence of enough people for the size of hospital in the area that hospital is settled (such misallocation of resources is likely to be politically driven). Even though, in our study, the mean number of inpatient care services and surgeries increased enormously, the same low occupancy rate is a possible signal of low quality in health care. Planning the location of the health care facilities according to the needs of the population has been started in Turkey with a noticed published on February 15, 2008 to prevent the uncontrollable and fast increase in the number of private health care facilities.

In our study, ALS is also considered as a quality indicator. We have found that the ALS decreased very slightly and insignificantly from 4.80 to 4.75 between the years of 2001 and 2006. Even though the decrease in ALS is insignificant due to the great increase in the number of inpatient care services, it can be an early signal that patients are not hospitalized for the medically required amount of time.

Conclusion

It appears that the expected benefits from the HTP reforms have been partially achieved in the short-run. First of all, this study concludes that the performance based supplementary payment system was successful in boosting the health staff productivity, providing widespread use of the latest technologies and providing an increased volume of health care services which were previously under-met. Furthermore, our analyses found that in the MoH hospitals that served in provincial markets, the average technical efficiency gains took place because of the improved scale efficiencies, but that the average pure technical efficiency was not improved. The lower pure technical efficiencies compared to scale efficiencies affirms the lack of adaptation of the hospital management to the renewed system in the short-run. Additionally, our analyses indicate that in the socio-economically most disadvantaged provinces (17 out of 81 provinces), productivity gains have not been achieved

because of the deterioration in the technical efficiency, even though there was an improvement in the technological progress.

Although the productivity of the doctors has been provided in general, how confident can one be that measured improvements in output are resulting in a genuine health gain? Unfortunately, the present study found that the quality indicators considered (the bed occupation rate, the hospital mortality rate, and ALS) have not improved in the short-run between the 2001 and 2006. Furthermore, since the P4P system applied in the MoH hospitals in Turkey is rewarding the production of previously under-provided health services, a quick progress from a static and inefficient system to an active system is observed in the short-run. The increase in the volume of the output was expected, but our analysis of productivity indicates that the health staff has much more control over the quantitative production of the hospitals than previously thought.

In the literature performance based supplementary payment systems and the health system reforms have been studied extensively for the developed countries. However, there are a few studies on developing countries. As it has been noted in the OECD health system review of Turkey [26]: "Turkey is closing the performance gap with other OECD countries and, on a number of measures including overall costs, performs well relative to other comparable upper middle-income countries. Indeed, there may be much that other countries can learn from the recent health reforms in Turkey, especially in the use of performance-related pay to raise staff productivity". Thus, this study contributes to the existing literature with a widespread analysis of the health system performance in Turkey.

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