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Technical Efficiency of Private Clinics Under Universal Coverage Scheme in Bangkok, Thailand

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ABSTRACT

This study aims to measure the technical efficiency of 88 private clinics under Universal Coverage Scheme (UCS) in Bangkok for the fiscal year 2017 and to identify the factors affecting their technical efficiency. This cross-sectional study uses secondary data collected in fiscal year 2017 (October 2016- November 2017), from the database of National Health Security Office (NHSO). The study is divided in to two parts. The first part measures technical efficiency with data envelopment analysis (DEA) and the second part identifies the factors affecting efficiency with regression analysis using a Tobit model.

The result of DEA under a variable return to scale assumption showed that 95.45 percent of the target study were operating on pure technical efficiency frontier (TEVRS), the mean pure technical efficiency score was equal to 0.98. Furthermore, the results of regression analysis revealed that only health supporting staff ratio was significantly affecting on pure technical efficiency (TEVRS) of private clinics under UCS.

Keywords: Technical efficiency, Data envelopment analysis, Private clinics

JEL classification: I180

1. Introduction

In Bangkok, Thailand private clinics have partnered with the Government to provide primary care service under UCS. Due to limited resources and lack of equity of access in health services, it is extremely challenging for private health agencies to manage their own available resources to achieve minimum cost and provide the best possible healthcare service at the same time. The term "efficiency" refers to the best use of resources in production. Data envelopment analysis (DEA) is one tool of measurement which focuses on technical efficiency which is producing the maximum amount of output from a given amount of input, or alternatively producing a given output with minimum quantities of inputs. Recently, it has been widely used in healthcare service studies. In Thailand, there are several previous studies about technical efficiency in hospitals and health centers under the Ministry of Public Health, but there is no study of private clinics under UCS.

This study aims to measure the technical efficiency of private clinics under UCS in Bangkok, Thailand for the fiscal year 2017 and to identify the factors affecting their level of technical efficiency. The result of this study is expected to provide mangers of private clinics participating in the UCS in Bangkok an understanding of their efficiency levels and to help them decide how to allocate their available resources to achieve greater efficiency.

2. Theoretical foundation of data envelopment analysis

The DEA is an efficiency measurement method proposed by Charnes, Cooper and Rhodes (1978) which is a non-parametric mathematical method for estimating production or cost frontier using linear programming to determine the efficiency index. This method can measure efficiency of units

which is called decision-making units (DMUs) that use multiple inputs and outputs. The inputs and outputs of each unit should be homogenous.

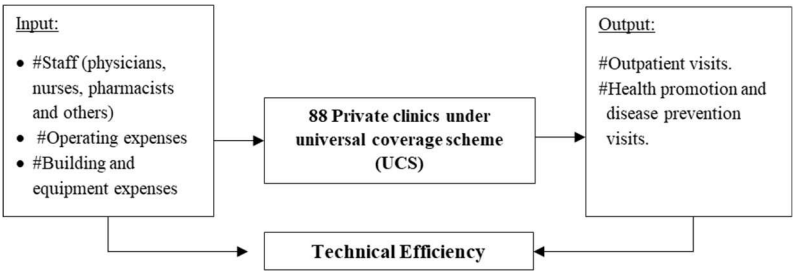
The efficiency index is calculated by measuring the ratio between weighted outputs and weighted inputs. Inputs and outputs should be weighted by assumed weight which is proper for linear programming. The DEA creates the efficiency frontier of DMUs, assuming that the value of DMUs which are on the efficient frontier is equal to 100% or 1, other DMUs which are below the frontier are less than 100% or 1 can calculated by the ration of distance of unit from its frontier. According to the concept, it is a relative efficiency measurement which compares between the DMUs; it may not be the best performance value.

There are 2 measurements: the first is the input-oriented measure explained by Farrell's (1957) conceptual framework, which considers the simple case of producing y using two inputs (x1, x2), assuming Constant Returns to Scale (CRS). The second measurement is an Output-oriented measurement, which aims to calculate the proportion of output that each DMU can produce with the same level of production. The advantages of this method are thatit can be used in mixed inputs and outputs without requiring weights. In addition, the analysis showed that poor performance values that is a guideline for development in term of increasing operational efficiency and reducing costs. In contrast, the disadvantages are the unit which in best practices may not be a real best performer because it cannot identify the relationship between outputs and inputs that indicates efficiency, and it cannot solve the problem of random error.

3. Concept and methodology for this study

This study is divided in to two parts. The first part measures the technical efficiency of private clinics under UCS with DEA using an input-orientated model. The inputs considered three variables: staff, operating expenses, and building and equipment expenses, while the outputs were the number of outpatient visits and the number of health promotion and disease prevention visits. The results of DEA show that the three associated efficiency scores consist of overall technical efficiency or technical efficiency under a constant return to scale assumption (TECRS) scores, pure technical efficiency or technical under a variable return to scale assumption (TEVRS) and scale efficiency (SE) scores. The DEA also shows the patterns of scale inefficiencies which are increasing return to scale (IRS) and decreasing return to scale (DRS). The concept can be seen in Figure 1.

Figure 1. Measuring technical efficiency with data envelopment analysis (DEA)



The second part identifies the factors affecting efficiency with regression analysis using Tobit model. The dependent variable was TEVRS which was the result of DEA analysis from the first part and the independent variables considered were seven expected factors based on previous studies and characteristics of private clinics under UCS. These

independent variables were defined as organizational characteristics and external environments. The organizational characteristics were ratio of staff and health service, the number of UCS members and type of clinics and the external environment as location. The identification of factors is shown in the following Figure 2 and the explanatory variables for Tobit regression analysis is showed in the following Table 1.

Figure 2. Identifying the factors affecting efficiency with regression analysis using Tobit model

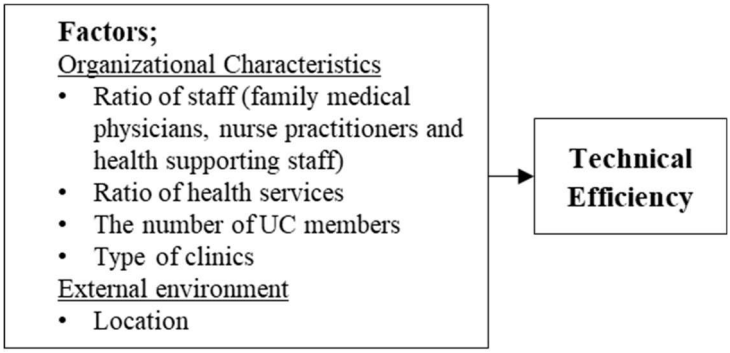


Table 1. Explanatory variables for Tobit regression analysis

Variables	Type	Sources	Description
Ratio of family medical physician	Quantitative	Public online data base (NHSO, 2018)	Ratio of family medical physician to other staff.
Ratio of nurse practitioner	Quantitative	Public online data base (NHSO, 2018)	Ratio of nurse practitioner to other staff.
Ratio of health supporting staff	Quantitative	Public online data base (NHSO, 2018)	Ratio of health supporting staff other staff.
Ratio of health promotion and disease	Quantitative	Non-public online data base (NHSO, 2018)	Ratio of health promotion and prevention visits to other visits.

Variables	Type	Sources	Description
prevention service			
The number of Universal Coverage (UC) member	Dummy	Non-public online data base (NHSO, 2018)	The number of Universal Coverage (UC) member; 1= it is under NHSO's condition 0= it is not under NHSO's condition
Type of clinics	Dummy	Public online data base (NHSO, 2018)	Type of clinics; 1= non-united clinic 0= united clinic
Location	Dummy	Public online data base (NHSO, 2018)	Location in Bangkok; 1=Outer area (urban fringe part and suburb part) 0=Inner area

Thus, the empirical regression model is:

$$\mathbf{TEVRS} = \beta_0 + \beta_1 \mathbf{RFM} + \beta_2 \mathbf{RPN} + \beta_3 \mathbf{RHS} + \beta_4 \mathbf{RPP} + \beta_5 \mathbf{UC} + \beta_6 \mathbf{TC} + \beta_7 \mathbf{LOC} + \varepsilon$$

Where:
TEVRS= Technical efficiency under a variable return to scale assumption
RFM = Ratio of family medical physician
RPN = Ratio of nurse practitioner
RHS = Ratio of health supporting staff
RPP = Ratio of health promotion and disease prevention service
UC = Number of Universal Coverage Scheme (UC) members
TC = Type of clinics
LOC= Outer area (urban fringe part and suburb part)
ε= Error term that captures other possible factors no specified

4. Results

4.1 Technical and scale efficiency scores

The DEA analysis with input-oriented assumption showed that the average technical efficiency score under a

constant return to scale assumption (TECRS) was equal to 0.82 (SD = 0.15). The pure technical efficiency score or technical efficiency score under a variable return to scale assumption (TEVRS) was equal to 0.98 (SD=0.03) and scale efficiency score (SE) was equal to 0.84 (SD=0.13). It can be observed that the result of TEVRS, the minimum number of efficient score was equal to 0.56 (the highest score=1) while TECRS was equal to 0.35 (the highest score=1).

Table 2. Descriptive statistics for TECRS, TEVRS and SE

TE	Mean	Median	Maximum	Minimum	S.D.
TECRS*	0.82	0.86	1.00	0.35	0.15
TEVRS**	0.98	1.00	1.00	0.56	0.03
SE***	0.84	0.87	1.00	0.35	0.13

* Technical efficiency score under a constant return to scale assumption
** Pure technical efficiency score or technical efficiency score under a variable return to scale assumption
*** Scale efficiency score

The TE scores from the input-oriented DEA model, from 88 private clinics, showed 84 private clinics were on technical efficiency under a constant return to scale assumption (TECRS) frontier while others were inefficient; it was 95.45 percent of the total units. There were 23 private clinics which were pure technical efficient or technical efficienct under a variable return to scale assumption (TEVRS) and scale efficiency frontier; it was 26.14 percent of the total units. It can be seen that the private clinics under UC can manage the healthcare service efficiently.

Table 3. Descriptive statistics of TE scores from Input oriented DEA model

TE	Private clinics on frontier (units)	Percentage (Total =88 units)
TECRS*	23	26.14
TEVRS**	84	95.45
SE***	23	26.14

* Technical efficiency score under a constant return to scale assumption
** Pure technical efficiency score or technical efficiency score under a variable return to scale assumption
*** Scale efficiency score

The private clinics under UC which showed CRS was equal to 23 units and IRS (increasing return to scale) was equal to 64 units while DRS was equal to 1 unit. Therefore, the results proved that increasing return to scale was higher than decreasing return to scale. It means that the percentage increases in outputs was more than percentage change in all inputs.

Table 4. Descriptive statistics of the patterns of scale inefficiencies

	CRS*	DRS**	IRS***
Private Clinics under UCS	23	1	64

*Constant return to scale (CRS)
**Decreasing return to scale (DRS)
***Increasing return to scale (IRS)

4.2 The result of regression

The results revealed coefficient standard error, z-Statistic and probability of seven explanatory variables: family medical physician ratio, nurse practitioner ratio, health supporting staff ratio, health promotion and disease prevention service ratio,

the number of UCS members, type of clinics and location. The results showed that only health supporting staff ratio had a significant effect on TEVRS of private clinics under UCS where probability was less than 0.05 while other explanatory variables had an insignificant effect on TEVRS of private clinics under UCS where probability was higher than 0.05.

Table 5. Tobit Regression results

Variables	Coefficient	Std. Error	z-Statistic	Prob.
1. Family Medical Physician Ratio	-0.0908383	0.1409311	-0.6445582	0.5192136
2. Nurse Practitioner Ratio	-0.1084353	0.1755673	-0.6176282	0.5368205
3. Health Supporting Staff Ratio	0.0564399	0.0218972	2.5774926	0.009952
4. Health Promotion and Disease Prevention Service Ratio	-0.0565734	0.0340754	-1.6602421	0.0968657
5. The Number of Universal Coverage (UC) Members (dummy)	0.0191022	0.0158423	1.2057768	0.2279036
6. Type of Clinics (dummy)	0.0041576	0.0196654	0.2114179	0.8325612
7. Location (dummy)	0.005992	0.0189911	0.3155185	0.752368

Number of observations = 88, Confidence Interval 95%, RSS =0.405149

5. Conclusion and Policy Implications

This study aimed to apply an accuracte tool of efficiency measurement for indicating the level of technical efficiency score of private clinics under UCS in Bangkok, Thailand and to investigate the factors that determine their technical efficiency scores.

The first part measured technical efficiency of private clinics under UCS by DEA using an input-orientated model. The results showed that the private clinics under UCS manage

their resources to provide healthcare services efficiently. The average TEVRS was 0.98 and there were 84 private clinics under UCS, calculated as 95.45 percent of the total number of target study operating at TEVRS frontier. Most private clinics under UCS showed increasing return to scale, meaning that output increases by a larger proportion than the increase in inputs during the operating process, so this group should expand their scale of operation. Moreover, the ratio of outputs to population showed that there was opportunity to increase healthcare services to cover the entire population. Private clinics under UCS which showed increasing return to scale should increase their healthcare services. In contrast, some private clinics under UCS which showed decreasing return to scale (DRS), meaning that output increases by less than proportional change in inputs, should reduce their scale of operation appropriately.

The second part identified the factors affecting efficiency of private clinics UCS using Tobit regression analysis. The number of observations was equal to 88, confidence interval at 95 percent, the residual sum of squares was equal to 0.40. The results revealed that only the health supporting staff ratio significantly affected the TEVRS of private clinics under UCS. The coefficient was equal to 0.06. It was proved that the health supporting staff ratio had a positive relation with private clinics under UCS's TEVRS score. In contrast, other explanatory variables such as family medical physician ratio, nurse practitioner ratio, health promotion and disease prevention service ratio, the number of UCS members, type of clinics and location had an insignificant effect on TEVRS of private clinics under UCS. It means these explanatory variables were not associated to increasing pure technical efficiency of private clinics under UCS.

According to the results, in order to achieve appropriate scale of operation, private clinics under UCS which showed

IRS should expand their scale of operation while some private clinics under UCS which showed DRS should reduce their scale of operation. Furthermore, increasing the health supporting staff ratio should be considered in private clinics under UCS in Bangkok. Private clinic mangers can use these as evidence base for allocating healthcare resources efficiently and designing operations suitable for private clinics under UCS in Bangkok.

6. Limitations

This study aimed to measure technical efficiency of private clinics which were registered in the UCS system in Bangkok in the fiscal year 2017. The total number of clinics was 165, but some data were not complete, especially the data of on the number of staff which need to be used for DEA analysis, so some private clinics were eliminated from this study.

Some data regarding input variables are assumed for calculation because the data were not available such as number of staff, salary of personnel, operating expenses and building and equipment expenses.

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