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Efficiency of Inpatient Installation in South Kalimantan Using Data Envelopment and Tobit Regression Analysis

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Abstract- Hospital competition is getting tight nowadays in Indonesia. As a result, hospitals should differentiate their efforts and strategy to sustain their businesses. This paper aims at examining the efficiency of inpatient installation of the 29 hospitals located in South Kalimantan province. The efficiency is measured using Data Envelopment Analysis (DEA) and the Tobit Regression Model. The Tobit regression is used to find out the factors that affect the technical efficiency or determinants of technical efficiency. The study found inter alia that the BPJS cooperation and the number of nosocomial infections have partial significant influenced on the technical efficiency value of the hospital inpatient installation. Whilst the ownership of hospital and hospital accreditation are insignificant in explaining the value of technical efficiency of the hospitals in South Kalimantan. Therefore, hospital cooperation with BPJS and the number of nosocomial infections should be given a great attention to maintain and improve the technical efficiency of the hospital in South Kalimantan under survey.

Index terms- Inpatient installation, technical efficiency, Data Envelopment Analysis (DEA), Tobit Regression analysis, hospital accreditation, hospital ownership, BPJS cooperation, nosocomial infection.

I. INTRODUCTION

Views of whether health services should be efficient or not have been responded differently by some experts (Jacobs, 2010). Health services are argued to be unnecessarily efficient as they cover universally. Some studies, however, showed that technical efficiency has a positive relationship with quality. Thus, the assumption that quality problems will arise in line with the efficiency is not proven. Clement et. al. (2016) and Nayar and Ozcan (2014) suggests that technical efficiency is associated with the outcome of patient health. Their research showed that hospitals that are capable of improving technical efficiency are also able to improve the outcome of patient service quality at the same time.

Jacobs (2006), further, states that efficiency is the ratio between the amount of output generated by the number of inputs used to produce the output. In the province of South Kalimantan, the use of government hospitals is very good. This is shown from the Bed Occupancy Rate (BOR) which averages around 65 - 85%, especially after the enactment of the National Health Protection program (JKN), even though patient satisfaction is decreased due to over capacity. One way to improve the productivity of a hospital is by increasing the efficiency of inpatient installation.

To measure the efficiency in the health sector is indeed complicated. This is due to the complexity of the production process, the process of health services, and the unique characteristics of health services which are uncertain, have asymmetry of information and externality (Evans, 2014). Uncertain is because the need for health care cannot be ascertained, whether in terms of time, place, or cost.

Due to these facts, Data Envelopment Analysis (DEA) is the most appropriate measurement technique as it has ability to adapt to unique characteristics of the health industry and to external factors affecting efficiency (Hollingsworth 2003, 2004, 2008; Worthington, 2004; Gueglimo et al., 2016). The DEA has been used widely in measuring the efficiency of hospitals than SFA (Stochastic Frontier Analysis). Several studies advance in the literature on the efficiency of hospitals that implement DEA, among others are Ersoy et al. (1997) in Turkey; Kirigia et al. (2004) in Kenya; Staat & Rene (2006) in Germany; Clement et al. (2007) in the United States; Valdmanis et al. (2008) in the United States; Puentatom and Rosenmmen (2008) in Thailand; Pham (2011) in Vietnam; Mogha et al. (2014) in India; Gholami et al. (2015) in the United States; Rezaee & Karimdadi (2015) in Iran; Sommersguter-Reichmann & Stepan (2015) in Austria.

In Indonesia, research to examine hospital efficiency is generally performed on the basis of hospital performance measures only. The common measures used for this include the Bed Occupancy Rate (BOR), Length of Stay (LOS), Turn Over Interval

(TOI), and several other measures (Dewi & Ningsih 2012; Dwianto & Lestari, 2013). These measures, however, are unable to describe the inputs needed to produce output. Studies using DEA methods advanced in the literature are very few, including Chalidyanto (2010), Cahyani et al. (2012) ; Hardiana et al. (2014); Alchusna & Susilaningrum (2012); Son (2012).

In this study Full Time Equivalent (FTE) of doctors is used as input variable. Full Time Equivalent of doctor is a unit that indicates the workload of a doctor. Full time equivalent is defined by the US Federal Government as the number of hours a doctor needs to treat a patient. In addition to that input variable, there are other input variables used in this study. These input variables were the number of nurses, the number of non-nurses, and the number of beds. Whilst the output variables used are the number of days of hospitalization and the number of re-admissions.

Empirically, the determinants of variation in hospital efficiency differ among researchers. Among them are the ownership of hospital (government or private), ward capacity utilization, and medical equipment (Hu & Huang, 2004), size of hospital (Lobo et al., 2014), market share of all hospitals within the province, manager's perception toward the degree of competition between hospitals, population density, the percentage of uninsured population, the number of doctors per 1000 population, ownership, location (Narci et al., 2015), Index concentration, number of beds, location, outpatient (Tiemann & Schreyögg, 2008). This study aims to examine the influence of the hospital ownership, hospital size, hospital accreditation, BPJS cooperation, and the number of nosocomial infections on hospital efficiency. From the results of previous research, it was found that in Indonesia private hospitals are more efficient than government hospitals (Chalidyanto, 2010). However, before the above variables are examined, the following section deals with review literatures as the background analysis.

II. LITERATURE REVIEW

Production Concepts

According to Beattie (1994), production is a process of combining and coordinating materials and power (i.e. inputs, factors, resources or production services) in producing goods or services. The production function is an abstraction that depicting a production process. This can be written in mathematical or quantitative forms to describe the various technical production possibilities faced by an enterprise. Thus, the production function provides maximum output produced from inputs in the physical sense.

As a fundamental function within an organization or business entity, production includes activities that are responsible to produce output that has added value to the consumers. This suggests that the production system is an integral system that has structural and functional components. According to Gazperz (2001), however, production system has several characteristics. It has components or elements that are related to each other and it is an integrated form. This is related to the structural components that build the production system. It has an underlying purpose in existence in the form of producing quality products (goods and / or services) that can be sold at competitive prices in the market. It has activity to transform the inputs into output effectively and efficiently. Also, it has a mechanism that controls the operation, in the form of optimal resource allocation.

Furthermore, Sukirno (2010) states that to see the flow activities of an organization or business entity in producing and offering goods, it is necessary to analyze various aspects of production activities. First, it should be analyzed to what extent production factors will be used to produce the goods to be produced. After that, it needs to see the cost of production to produce the goods. Finally it needs to be analyzed how an entrepreneur will compare the results of his production sales with the production costs incurred, to determine the level of production that will provide maximum benefits.

The Concept of Efficiency

Producers' performance to respond the economic conditions is an important indication for policy goals, and the concept of efficiency provides theoretical basis as a measure. Many references to efficiency are based directly or indirectly to Farrell (1957), which states that efficiency can be measured relative to producer best practices against producer groups. Farrell (1957) also introduced the distinction between technical efficiency and allocation efficiency.

The technical efficiency shows firms' ability to achieve maximum output from certain input combinations and technologies (Bravo-Ureta and Pinheiro, 1993; Sadoulet and de Janvry 1995; Coelli 1995; Kumbakar and Lovell, 2000). Allocation efficiency reflects the use of inputs that generate maximum returns for producers at specific input prices. Therefore, allocation efficiency shows firms' ability to use the optimum inputs as defined in Coelli (1995). The firm's success in choosing the optimum input combination will occur if the marginal product ratio of each input is equal to the input market price ratio as stated by Bravo-Ureta and Pinheiro (1993).

Hospital Efficiency Measures

Over the last two decades, efficiency measurement has been one of the most explored areas of healthcare research. See, for instance, Sherman (1984), Grosskopf and Valdmanis (1987), Sahin and Ozcan (2000), Moshiri et al. (2010), and Basaskar & Saxena (2016). To measure the efficiency of the hospital, the output of the hospital should be identified. There are many potential measurements for hospital input and output. Review the literature that has been done on 362 pieces of research on hospital efficiency that have been published showed that the number of beds, the number of medical staff and the average length of stay is the most widely used as input variables. Meanwhile, the number of cases, the number of inpatients, the number of outpatients, the

number of procedures performed, the number of patient days, and the numbers of visits were most often used as the output variables. The output or combination of outputs to be used depends on the purpose of the organization and on the level of measurement activity (e.g. department and institutional level), and the purpose of the study. The problem with previous research is that the selection of output used has not been able to measure the actual output of a health service (Hollingsworth, 2016).

Determinant Factors of Hospital Efficiency

There have been numerous previous studies examining the effect of ownership on the efficiency of hospitals in some countries. See, for example, White & Ozcan (1996), Grosskopf et al. (2001), Burgess & Wilson (1998), Hofmarcher et al. (2002), Helmig & Lapsley (2001), Ramanathan (2005), Gannon (2005). Other studies that focus on health insurance include Chang et al. (2004) and Narci (2015)]. In this study, variables such as hospital ownership, hospital accreditation, cooperation BPJS, and the number of nosocomial infections are used. The ownership of the hospital is used as it can affect the efficiency of inpatient installation. Chalidyanto (2010) found that the private hospitals are more efficient than government hospitals.

Hospital accreditation is an acknowledgment given to the hospital by the government through an authorized body that is the Hospital Accreditation Committee (KARS). The legal basis for the implementation of hospital accreditation is Law no. 36 of 2009 on health, Law No. 4 of 2009 on hospitals, and Health Ministry Rule no 1144 / Menkes / Per / VIII / 2010 on the organization and working procedures of the Ministry of Health. Hospital accreditation prioritizes quality or quality improvement. To improve the quality, it usually required a lot of inputs, because it can reduce the efficiency of hospitalization. According to Pribakti (2016), accreditation can improve efficiency due to the improvement of quality.

Government Health programs (BPJS) is assumed to affect the efficiency of the hospital. This is because this program encourages people to seek treatment at hospitals at low tariff and the poor people are paid by the government. This causes the hospital output to increase. Based on Nurani and Rivany (2016) research, it was found that before National Health Protection Program (JKN) runs, hospital utilization in Bogor is still low. However, since JKN began, as of January 2014, the ratio of health care claims increase significantly. According to the Director of Legal Communication and Inter-Agency Relations of BPJS program, Purnawarman Basundoro, the health care claim ratio is estimated to be above 90% and almost 101% throughout 2014, while ideally it is only 90% .

Hospital Efficiency Measurement Method

There are two approaches that have been widely used by the Researchers to obtain a measure of efficiency. These methods are Stochastic Frontier Analysis (SFA) and the Data Envelopment Analysis (DEA). SFA is a parametric approach in which its application requires the assumption of the distribution of error terms. Therefore, the efficiency value based on this approach tends to be sensitive to the assumption of the distribution of errors used. In addition, the implementation of SFA also requires assumption of the form of production function. In contrast, DEA is a non-parametric approach, so its application does not require the assumption of the distribution of error and the assumption of the form of a production function.

In the literature, DEA has been widely used to measure the efficiency of health and hospital care centers (Field and Emrouznejad, 2003, Kirigia, et. al. , 2008, Hollingsworth, 2008. Although in practice some researchers use output-oriented DEA to analyze the efficiency of hospitals. See, for examples, Biqrn et al. (2003), Hu & Huang (2004). However, most of the earlier studies suggest the use of input- oriented DEA (see, Ferrier & Valdmanis, 2004; Lynch & Ozcan ,1994; O'neill & Dexter, 2004). The reason is that the input variables chosen in most studies are more controlled than the output.

The Data Envelopment Analysis is the most appropriate measurement technique because of its ability to adapt to the unique characteristics of the health industry and to the external factors affecting efficiency (Hollingsworth 2003, 2004, 2008; Worthington, 2004; Gueglimo et al., 2016). The application of DEA to estimate the technical efficiency stage does not require the assumption of the functional form of the relationship between input and output. This is because DEA is a non-parametric approach. As a non-parametric approach, the estimation results do not require statistical testing. In addition, all deviations from the frontier are considered inefficiencies. DEA enables efficiency measurement for production units, using multiple inputs to generate many outputs. Empirically, DEA has been used in various applications in both the public and private sectors [Emrouznejad & De Witte (2010), Lin et al. (2009), De Nicola et al. (2012)].

However, the application of DEA only results in hospital efficiency scores and improvements from the point of view of hospital management (e.g. through slack variable analysis), but it cannot explain the different levels of efficiency among the hospitals studied. In this context, a two-stage data analysis with two-stage procedure (DEA) is another alternative to the approach to researching the determinants of variation in skill. The procedure of this approach is to estimate the frontier production function with DEA to obtain an efficiency value in the first stage, and to raise the efficiency score with hospital-specific factors in the second stage. This is because the efficiency scores are limited in intervals 0 and 1, so that limited dependent variable regression techniques such as Tobit are more widely used in this stage.

III. CONCEPTUAL FRAMEWORK AND HYPOTHESES

This research uses two analytical models, where each model uses a different approach. The first model of analysis is intended to estimate the value of technical efficiency by using the DEA method. In patient inputs include persons works in the hospital such as medical personnel, nursing staff, medical support personnel, non-medical personnel, funds / budget from government sources, grants, and tariffs, raw materials (including medicines, medical consumables, printed materials, stationery, food and beverage), Infrastructure, Equipment and Facilities (e.g. Land, Building, Medical Device, Patient Bed, Non-Medical Equipment, Supporting Equipment, Furniture, Electricity and Water). While for the output, it includes the number of patients served, the number of outgoing patients (living and / or dead), the amount of income, the total cost, and the number of actions (Chalidyanto, 2010; Narci et al, 2015), Adhani, 2016, Aditama, 2008 , Paschal, Asbu, Jumoy, 2016, Giancotti, Pipitone, Mauro, Guglielmo, 2016).

The result of the first model of analysis is expected to estimate the technical efficiency value of each hospital in South Kalimantan, whether it is efficient or inefficient. The results of the first model analysis is then used to build the second model analysis. The second model of analysis is intended to determine factors that affect technical efficiency by using the Tobit method. The dependent variable in the second analysis model is the value of technical efficiency, while the independent variable consists of hospital ownership, Hospital Accreditation, Cooperation BPJS and Nosocomial Infection.

In terms of the hypothesis, there are two hypotheses. First, hospital ownership, hospital accreditation, BPJS cooperation, and the number of nosocomial infections simultaneously have a significant effect on the efficiency of inpatient installation in South Kalimantan. Second, hospital ownership, hospital accreditation, BPJS cooperation, and number of nosocomial infections, have partial significant effect on the efficiency of inpatient installation of the hospitals examined in South Kalimantan.

IV. RESEARCH METHOD

The Efficiency Model

As mentioned that the approach used is input-oriented DEA with the assumption of Return to Scale Variables (VRS) as modeled by Fare, Grosskopt and Logan (1983) and Banker, Charnes, and Cooper (1984). This approach is selected since the inpatient installation in South Kalimantan hospitals have not yet operated at optimal scale due to hospital competition and government policy.

The result of the technical efficiency measure will produce value with two conditions that is efficient and inefficient. This is indicated from the score or from the DMU efficiency value. The technical efficiency score generated by the DEA method ranges from 0-1. If the efficiency score is less than one, this means that the DMU is relatively inefficient compared to other units in using inputs or generating output. If the efficiency score of DMU is equal to 1, this means that the DMU is relatively efficient compared to the other units in using the input as well as producing the output.

Model Specification

Model Variable Return to Scale (VRS) in measuring technical efficiency toward Input (Input Oriented) is as follows :

Min Θ s.t.

$$-y_i + Y\lambda \geq 0$$

$$\Theta x_i - X\lambda \geq 0$$

$$1T\lambda = 1$$

Θ free, $\lambda \geq 0$

Where:

Θ = efficiency score; λ = constant vector or constraint vector; yi= output vector output i; xi = input vector i; Y = output matrix for the whole output i; X = input matrix for the whole i.

The above model is a VRS model with an input-oriented approach where variables Θ refer to technical efficiency calculations (Coelli et al., 2005) with values Θ between 1 and ∞ (infinity), and Θ - 1 is the minimum input required by the DMU with quantity Output. Λ is the vector x1 of the constant and $1T\lambda = 1$ is a convexity constraint, with I1 being the Ix1 vector of one. The convexity constraint shows that the return-to-scale (VRS) variable which ensures inefficient firms will only be compared to firms that have the same scale. There is a note that 1 / Θ denotes the value of technical efficiency that assumes a value at the interval level of 0 to 1. The efficiency in this study was measured using the Program Data Envelopment Analysis (DEAP) version 2.1. This computer program was written by Coelli (1996).

Tobit's regression

The second analytical model used in this analysis is the Tobit regression. This method is used to determine the factors that affect the technical efficiency or determinants of technical efficiency. The mathematical form of this model can be written as follows:

$$TEi = \beta 0 + + \beta 1\ Kepi + \beta 2Akredi + \beta 3BPJSi + \beta 4INOSi$$

TE i = technical efficiency value of the hospital i
Kep i = Ownership status of hospital i
Klas i = Hospital class of hospital i
BPJSi = BPJS participation of hospital i
INOSi = Number of nosocomial infection of hospital i

The computer software used to estimate the model is Stata 13. Tobit method is selected since the dependent variable in the model is technical efficiency (censored data). Specifically, the dependent variable on the analysis model has left and right censored which has range value between 0.1 and 0.9. According to Greene (2008: 277), censored data is data which have limitation to a certain range with uniform values at a particular point / value and this must be estimated by using the Tobit method.

Variables and Number of Samples

As stated above, the model was constructed using two variable components namely the output and input variables. The output variables used in this analysis are the number of days of care and the number of readmissions. While the input variables used are Full Time Equivalent doctors, the number of nurses, Full Time Equivalent other personnel, the number of beds. In the second analysis, the research model consists of dependent and independent variables. Dependent variable used is technical efficiency score (TE), while independent variable used is the hospital ownership, hospital accreditation, cooperation of BPJS, and the number of nosocomial infection. The number of samples included in the analysis was 29 units of inpatient installation of hospitals. This number was considered qualified as it fulfills the minimum amount of data requirement. See, Boussofiana et al (1991), Golany and Roll (1989), Bowlin (1998), Dyason et al (2001) and Long (2007).

V. RESULTS AND DISCUSSION

The hospital is an industry that has specific characteristics such as capital-intensive (including buildings and land), labor using, technological intensive, with highly variable output. In the analysis of the hospital's production function, external factors cannot be avoided, because it greatly affects the number and types of production services that must be generated by the hospital. To see the correlation of external factor with hospital's technical efficiency, correlation test was done with the following result. The estimation result of determinant model of technical efficiency is done by using Tobit method.

The results show that Chi Square test indicate that this model is significant to explain the technical efficiency of hospital ($p < 0,05$). This explains that hospital ownership, hospital accreditation, BPJS cooperation, and number of nosocomial infections simultaneously have a significant effect on the value of technical efficiency. Then Wald test is conducted to determine partially the level of significance of independent variables affecting the dependent variable. The regression coefficient has two insignificant independent variables since the p value is greater than 0.05 ($p > 0,05$) that is hospital ownership and hospital accreditation. However, variables of BPJS collaboration and number of nosocomial infections proved to be significant since the p values is less than 0.05 ($p < 0.05$). In terms of Lagrange Multiplier test (LM), it was found that the LM value test is 3.11. As the value of LM test is less than the critical value, then Null Hypothesis is not rejected so it can be concluded that the efficiency determinant model fitted with Tobit regression method. This means that the distribution has normal error and homoscedasticity. Therefore, the estimation result of Tobit parameter is consistent and efficient (Table 1).

Table 1
Estimation Results of Tobit Regression Analysis on *Latent Variable*

	Tobit Regression		Marginal Effects	
Variable	Coefficients	p	Coefficients	p
Hospital Ownership	0,0289	0,397	0,0134	0,136
Hospital Accreditation	0,060	0,513	0,0532	0,478
BPJS cooperation	0,148	<0,001	0,1021	<0,001
Nosocomial Infections	-0,453	<0,001	-0,3295	<0,001
Constanta	0,093	<0,001	-	-

LMtest = 3,11 ; LM(α=5%) = 3,84; Number of Observation = 29; Prob(Chi Square) = 0,000; Left censor observation number = 1; Right censor observation number = 1; Non censor observation number = 27

Furthermore, the coefficient of BPJS cooperation to the value of technical efficiency is 0,148. This indicates that hospitals that have cooperation with BPJS, has a value of technical efficiency higher than the hospital that does not have any cooperation with

BPJS. The marginal effect on the type of firms has a coefficient of 0.1021. This suggests that hospitals that have cooperation with BPJS has a technical efficiency value of 0.1021 higher than the technical efficiency of hospitals that do not have cooperation with BPJS. In terms of the number of nosocomial infections, it was found the company's technical efficiency value is -0.453. This indicates that an increase of 1 percent of nosocomial infections would decrease the company's technical efficiency value by -0.453. The coefficient of the marginal effect on this variable was -0.3295. This suggests that an average increase of nosocomial infections by 1 percent will reduce the technical efficiency of the hospital by 0.3295.

From the above estimation results, it can be said that healthcare is an intervention done to improve a person's health status. In this context, the efficiency of health services refers to how well the health resources are used to improve health (Groft et al, 2007). Measurement of efficiency is the first step in evaluating the overall health care system and the audit mechanism for the rational distribution of human resources and economic resources (Chalidyanto, 2010). Based on the results of Data Envelopment Analysis (DEA), it was found that the average value of technical efficiency at the inpatient installation at South Kalimantan hospital was 0.934. The efficiency rating indicates that the average inpatient installation of hospitals in South Kalimantan operates in efficient conditions. The condition is caused by the use of minimal input.

The measurement toward accurate production output of inpatient installations of the hospitals has not yet been determined (Groff et al., 2007; Biorn and Magnussen, 2002). However, a large number of options is available for both input and output variables (Magnussen, 2006). Defining output in the health sector is somewhat difficult, as the healthcare industry is seldom desirable if there is no problem. Conversely, demand comes from the belief that healthcare contributes positively to health status. Therefore, the output of health services should be defined within the limits of the outcomes produced (Groff et al, 2007). But the problem is that it is very rarely a health organization collects routine data about health outcome in production. The literature review shows that most studies use the quantity and type of activity performed.

In most literatures, researchers connect the length of day care to hospital efficiency. The longer the patient is admitted to the hospital, the more efficient the hospital will be, as hospital admissions are increasing (Mujasi, Asbu, Junoy, 2016, Valdmanis et al, 2004), Asandului et al, 2014). This assumption is correct according to economic theory, the more quantity produced, the more efficient it will be.

In recent years, there has been a paradigm shift, that the shorter the number of days of care, the more efficient the hospital will be (Groft et al., 2007, Morand Jacob, 2013). This is closely related to the quality of the hospital. In addition to the views of medical quality, in terms of economy, the shorter the day of inpatient installation, the more profitable also for the hospital. The cause of such benefits is due to changes in the payment system from fee for service, to a package system. The shorter the maintenance time, the more profitable it will be for the hospital. If long maintenance time, then automatically all hospital expenses increased, while paid by the insurer (Groft et al, 2007).

The average reduction in hospitalized days has been investigated by Cheng et al, 2012 in Taiwan, since the introduction of a package-based health insurance system. Louis et al (1999) also found the same thing about this insurance effect in Italy. But Roenberg and Browne (2001) rejected the results of this study by suggesting that the reduction in inpatient days is consistent with the overall trend, not because of the introduction of the insurance system.

The most expected outcome or outcome of hospital services is cure and comfort, so that the efficiency and effectiveness of hospitalization are important factors that determine customer satisfaction. This aspect ensures the patient is discharged from the hospital and is not expected to readmission or to reenter the hospital. The recovered patient (readmission) is an inpatient who had previously been admitted to the hospital, but the patient was re-treated before 30 days of his prior treatment (Iskandar 2014).

One way that can reduce the rate of readmission is by having a good discharge planning. This planning is a process in preparing patients for continuity of care both in the healing process and in maintaining the patient's health status (Hardivianty, 2017). Numerous studies have highlighted that effective discharge planning is crucial to improving patient health and significantly reducing patient readmission (Philips et al., 2004). In Indonesia there is still no regulation on patient readmission. BPJS health still pays the patient's readmission provided that the patient's readmission is not intentional. In this study, the readmission number is used as an output variable that serves to measure the quality of medical inpatient services.

Labor input is often measured by the amount of labor. But the measurement of the number of doctors and other personnel based on the number of personnel have not yet describe his workload. This is because workers of inpatient installation consists of a combination of full time, part time, and casual workers. The amount of labor time is the option taken as the unit of measurement in this study, where work time is not available, then the full-time equivalent staff is the best way to measure labor (Peacock, 2001).

The measure of hospital efficiency is often associated with the number of beds owned by the hospital. This is because the number of beds has a very strong correlation with the number of medical personnel, nurses, other personnel and the amount of equipment owned by the hospital. Because of this, the regulation of the number of beds becomes very important in the management of the hospital. In this study, there are some hospitals that have not met the requirements of the ideal number of beds.

BPJS health programs have a significant effect on the efficiency of the hospital. This is because this program encourages people to seek treatment at hospitals as the contribution fee of program is relatively low and it is directed to the underprivileged community. Nurani and Rivany (2016) in their study found that hospital utilization in Bogor is low before the government health protection programs (JKN) introduced, while it increased significantly after JKN was introduced as previously explained.

The average of Nosocomial infection number in South Kalimantan hospital was 7%. This figure is above the number of nosocomial infections that are allowed in the minimum service standards of hospital admissions. From Tobit regression analysis, it was found that the number of nosocomial infections had a significant effect on the efficiency of hospital inpatient installation in South Kalimantan. Nosocomial infection is associated with length of stay and the longer the patient is admitted to the hospital. The higher the rate of nosocomial infection, the longer will be the patient in hospital, vice versa.

The ownership of the hospital has no significant effect on the efficiency of inpatient installation. This finding is different to the study undertaken by Chalidyanto (2010) in that he found that hospital ownership affects efficiency especially for private hospital.

Finally, hospital accreditation has no significant effect on hospital efficiency. This is not surprising since the public has not yet selected hospital based on its accreditation level. This is partly due to the asymmetry information toward the quality of hospital.

VI. CONCLUSIONS

Using the Data Envelopment Analysis (DEA), this study found that the average value of technical efficiency at the hospital inpatient installation in South Kalimantan was 0.977. This indicates that inpatient installation in South Kalimantan hospitals under survey is in an efficient condition. The result of Tobit regression analysis found that hospital ownership, hospital accreditation, BPJS cooperation, and number of nosokomial infections jointly have an effect on the technical efficiency value of inpatient in the hospital. Both hospital cooperation with BPJS and the number of nosocomial infections partially have significant effect on the technical efficiency value of hospital inpatient, while hospital ownership and hospital accreditation do not partially affect the technical efficiency of hospital inpatient installation in South Kalimantan. Therefore, hospital cooperation with BPJS and the number of nosocomial infections should be given a great attention to maintain and improve the technical efficiency of the hospital in South Kalimantan under survey.

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