



Mapping Out Health Expenditure Efficiency Associated with Health Sector Performance Development in Indonesia

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Abstract.

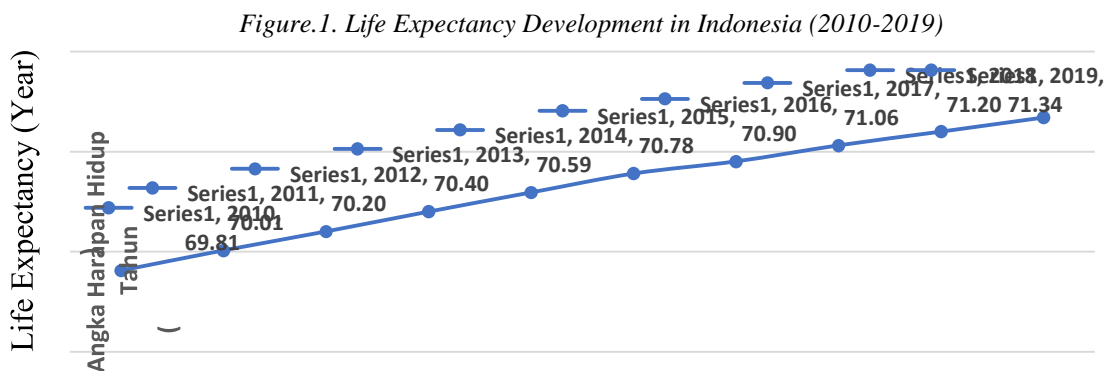
Health sector is one of principal development things. Health is reflection of country's wellbeing. In order to find out a level of country's soundness, there are some indicators analyzed, viz. i) Life Expectancy, ii) Mortality. In supporting health sector development, necessary for government expenditure led to improvement human resource quality in health, education, and income. Efficiency of health expenditure needs to be calculated to what extent its influence to the output. This research utilising *Data Envelopment Analysis* (DEA) and Tobit Model. DEA in analyzing efficiency level of health expenditure entire provinces in Indonesia with the output analysis are Life Expectancy, Infant Mortality, and Maternal Mortality. Environment Factors in Tobit Regression are population and poverty.

Result of this research according to DEA analysis indicated that all provinces in Indonesia fluctuated in leveraging expenditure to achieve efficiency and optimally health sector development. Eastern Indonesia possess high level of efficiency. Although health expenditure is relatively small, there has been allocated optimally. In the meantime, Tobit regression indicated that marginal effect of population is significant, by contrary marginal effect of poverty is insignificant to health expenditure. On the whole, health expenditure possesses positive and significant effect to health development performance in Indonesia.

Keywords: Health Sector, Expenditure, Data Envelopment Analysis, Tobit Model, Indonesia

1. Introduction

Education and Health are the important things of development (Todaro, 2012). Health is a basic of decent life, moreover education led to achieve beneficial and satisfying life. Education is a main key of developing countries, moreover sophisticated technology to achieve developed country. In addition, health condition necessary for increasing personal productivity. Life expectancy becomes the indicator that illustrate health condition for a country. According to Statistics Bureau (2019), life expectancy level in Indonesia constantly increasing time after time.

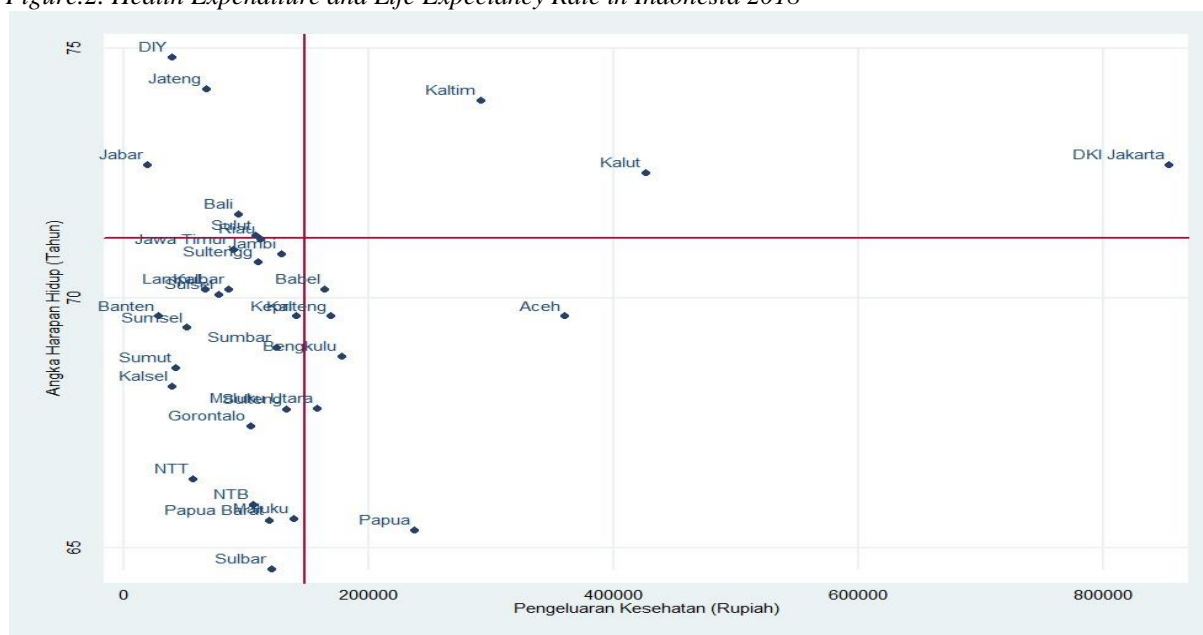


Source: Statistics Bureau, 2019.

Autonomous regions can be succeed if a regions are able increasing social welfare, good democracy, justice, equity, and consistent among central and local government (Amalia and Purbadharmaja, 2012). Mangkosoebroto (1994) stated role of government divided into 3 (three) sections, viz. 1) allocation, 2) distribution, 3) stabilization. Those roles can be applied, if there are policy instruments like spending allocation used for public facility, viz. education, health, irrigation, transportation, *etc* (Sasana, 2009).

Law Number 36 Year 2009 Clause 171 on Health. Explanatory notes that government must allocate minimum 5 (five) percent of state budget, subsequent local government allocates minimum 10 (ten) percent local government budget for health sector in which public service is prioritized approaching 2/3 of state or local government budget. Kindly find the picture of health expenditure per capita and life expectancy rate in Indonesia during 2018 below:

Figure.2. Health Expenditure and Life Expectancy Rate in Indonesia 2018



Source: Data Processed, 2020.



Enhancement of Life Expectancy Rate in Indonesia reflecting that there has to be an increasing life expectancy rate of each province. There are differences in health expenditure allocation of each region, due to the ability of local government budget of each province is different. Provinces in quadrant I are: Jakarta, East Kalimantan, and North Kalimantan. Provinces in quadrant II: West Java, Central Java, Yogyakarta, Bali, and North Sulawesi. Quadrant III: Aceh, Bengkulu, Bangka Belitung, Central Kalimantan, North Maluku, and Papua. Moreover, Provinces in Quadrant IV are: North Sumatera, West Sumatera, Riau, Jambi, South Sumatera, Lampung, Kepulauan Riau, East Java, Banten, Nusa Tenggara, West Kalimantan, South Kalimantan, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Gorontalo, West Sulawesi, Maluku, and West Papua. Distinction between each province caused by health expenditure is not fully maximized or health expenditure do not fully lead to better life expectancy.

In addition, health expenditure do not directly affect life expectancy for long term. Life expectancy will be maximized if government begins to pay serious attention to level of public health through infancy. As stated Halicioglu (2011) health was derivative of health production function. Health production function describes relation between input and output in a certain period. Output is health status analysis, as like life expectancy and mortality. Meanwhile, health protection, spending in health sector, environment, education, lifestyle, genetic factors, etc are inputs.

Government expenditure is a tool to increase human resource quality in health, education, and income aspect (Ouertani *et al*, 2018). As an input of health indicators, the level of efficiency of the health expenditure allocation must be measured to analyze what extent it affects health output (Mandl *et al.*, 2008). In addition, measuring the level of efficiency aims to provide advice and input for policy makers (Gupta & Verhoeven, 2001).

As mentioned above, there are some problems analyzed in this research: 1) which areas are efficient in allocating health expenditure, 2) what is the pattern of health expenditure efficiency among regions 3) how does environmental factor influence the efficiency value of health expenditure, 4) how is the relationship between health expenditure and health sector development performance.

2. Method

Secondary data is used in this research involving health expenditure, life expectancy rate, infant mortality, maternal mortality, number of population, and poverty rate during 2010-2018. These data compiled by statistics bureau of Indonesia and directorat general of financial balance. Data Envelopment Analysis (DEA) and Tobit Regression are used in analyzing some problems here. DEA is used to analyse efficiency level of health expenditure, moreover Tobit Regression is analysing environmental factors to efficiency value. According to SanchezGonzalez (2018) DEA model was:

$$\text{Max } \theta \dots\dots\dots (1)$$

Subject to:

$$\sum_{j=1}^n \lambda_j X_{ij} \leq X_{i0} \quad i = 1, 2, \dots, m \dots\dots\dots (2)$$

$$\sum_{j=1}^n \lambda_j Y_{rj} \leq \theta Y_{r0} \quad r = 1, 2, \dots, s \dots\dots\dots (3)$$

$$\sum_{j=1}^n \lambda_j = 1 \quad \lambda_j \geq 0 \quad j = 1, 2, \dots, n \dots\dots\dots (4)$$



Θ is efficiency value ; i is input ; r is output. In addition, Tobit model is:

$$\theta_{it} = \beta_0 + \beta_1 Pov_{it} + \beta_2 Pop_{it} + \mu_{it}$$

Pov is number of poor population; Pop is totally number of Indonesian population

3. Results and Discussion

3.1. Efficiency Value of Health Expenditure

DEA analysis shows that efficiency value of health expenditure varies during 2010 and 2018. Figure.3 shows there are 11 provinces are below the average efficiency value for the year. They are Aceh, Riau, South Sumatera, Jakarta, West Java, Central Java, West Nusa Tenggara, West Kalimantan, South Kalimantan, and South Sulawesi.

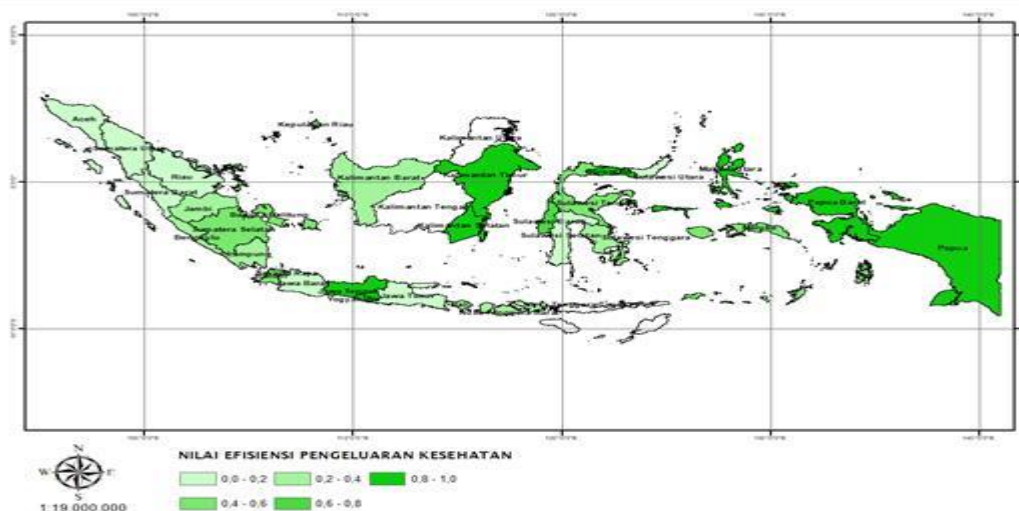
Figure.3. Efficiency Value of Health Expenditure 2010



Source: Data Processed.

In the meantime, in 2018 there were 9 (nine) provinces in scale 0.0 until 0.2 such as Aceh, North Sumatera, West Sumatera, Riau, Jakarta, West Java, East Java, North Sulawesi, and South Sulawesi.

Figure.4. Efficiency Value of Health Expenditure 2018



Source: Data Processed

There are 3 (three) provinces only whose efficiency values are stable. Province with efficiency value is 1 (one) can be indicated that the region is efficient. It means a number of budget input in health sector led to social welfare. Additional input used to finance health spending has resulted an additional output. If there are still provinces that have value less than 1 (one), these provinces classified into inefficient area in allocating health expenditure.

Figure.5. Efficiency Value of Health Expenditure 2010-2018

Province	Year								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Aceh	0,060	0,044	0,065	0,140	0,356	0,225	0,134	0,082	0,143
North Sumatera	1,000	1,000	0,167	0,219	0,268	1,000	0,284	0,273	0,199
West Sumatera	1,000	0,309	0,141	0,185	0,246	0,293	0,232	0,252	0,194
Riau	0,140	0,368	0,172	0,220	0,239	0,170	0,119	0,138	0,23
Jambi	0,270	0,271	0,381	0,341	0,348	0,524	0,321	0,163	0,300
South Sumatera	0,073	0,110	0,218	0,427	0,427	0,451	0,395	0,285	0,419
Bengkulu	0,210	0,205	0,227	0,298	0,477	0,536	0,523	0,354	0,311
Lampung	0,200	0,133	0,175	0,220	0,311	0,434	0,218	0,244	0,37
Bangka Belitung	0,421	0,208	0,935	1,000	0,930	0,988	0,740	0,557	0,57
Kepulauan Riau	0,272	0,280	0,644	0,601	0,484	0,565	0,579	0,539	0,47

**10th INTERNATIONAL CONFERENCE ON
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DKI Jakarta	0 ,040	0 ,020	0 ,030	0 ,028	0 ,025	0 ,030	0 ,027	0, 022	0,0 15
West Java	0 ,144	0 ,107	0 ,188	0 ,287	0 ,240	0 ,184	0 ,140	0, 118	0,1 20
Central Java	0 ,087	0 ,083	0 ,117	0 ,121	0 ,414	1 ,000	1 ,000	0, 069	1,0 00
DI Yogyakarta	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1, 000	1,0 00
East Java	1 ,000	1 ,000	0 ,039	0 ,044	0 ,054	0 ,060	0 ,057	0, 047	0,0 44
Banten	1 ,000	0 ,313	0 ,303	1 ,000	0 ,292	1 ,000	0 ,488	0, 278	0,5 49
Bali	0 ,435	0 ,341	0 ,192	0 ,158	0 ,153	0 ,173	0 ,249	0, 303	0,2 51
West Nusa Tenggara	0 ,153	0 ,129	0 ,152	0 ,242	0 ,217	0 ,403	0 ,370	0, 139	0,2 10
East Nusa Tenggara	0 ,311	0 ,185	0 ,181	0 ,620	0 ,566	0 ,548	0 ,329	0, 414	1,0 00
West Kalimantan	0 ,186	0 ,162	0 ,251	0 ,289	0 ,382	0 ,489	0 ,418	0, 291	0,2 86
South Kalimantan	0 ,126	0 ,070	0 ,062	0 ,239	1 ,000	0 ,205	0 ,155	0, 159	1,0 00
East Kalimantan	1 ,000	0 ,083	0 ,141	1 ,000	1 ,000	1 ,000	1 ,000	0, 140	1,0 00
North Sulawesi	0 ,696	0 ,635	0 ,896	1 ,000	0 ,739	0 ,888	0 ,774	0, 540	0,1 95
Central Sulawesi	0 ,343	0 ,189	0 ,181	0 ,307	0 ,512	0 ,646	0 ,444	0, 409	0,2 85
South Sulawesi	0 ,174	0 ,146	0 ,176	0 ,252	0 ,310	0 ,375	0 ,323	0, 236	0,1 92
South East Sulawesi	0 ,871	1 ,000	0 ,526	0 ,897	0 ,796	0 ,900	0 ,498	0, 554	0,4 39
Gorontalo	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1, 000	1,0 00
West Sulawesi	1 ,000	0 ,871	0 ,750	1 ,000	1 ,000	1 ,000	0 ,384	0, 675	0,6 52
Maluku	0 ,264	0 ,233	0 ,258	0 ,330	0 ,427	0 ,670	0 ,359	0, 620	0,5 61
North Maluku	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	1 ,000	0, 752	1,0 00
Papua	1 ,000	0 ,139	0 ,052	0 ,101	1 ,000	0 ,199	0 ,106	0, 170	1,0 00
West Papua								0, 778	1,0 00

Source: Data Processed



3.2. Regional Health Efficiency Pattern

Sumatera has an efficiency value of 0.293 in 2011 and increased 0.313 in 2012. In 2013 the efficiency value increased to 0.365, in 2014 approximately 0.408, in 2015 to 0.518. The lowest average efficiency value in Sumatra occurred in 2017, approximately 0.201. Meant, in 2017 most of the provinces did not use the health expenditure properly. In Java island, Yogyakarta possess DEA value was relatively stable. Efficiency value in Central Java constantly increasing time after time. By contrary, Banten, Jakarta, West Java, and East Java reflected inconsistency efficiency of health expenditure.

Bali and Nusa Tenggara, East Nusa Tenggara is more efficient and optimal in allocating health expenditure. For Kalimantan, East Kalimantan possess DEA value is 1 (one). It means East Kalimantan allocated health expenditure optimally. Subsequently, Gorontalo is one of provinces in Sulawesi possess DEA value is 1 (one). Similar with East Kalimantan, Gorontalo allocated health expenditure optimally. For Maluku and Papua, even though they have limited budget, but they succeed in allocating health expenditure optimally.

3.3. An Effect of Environmental Factor to Health Efficiency

Tobit regression is used for analyzing environmental factor on health expenditure in Indonesian provincials. For the most part developing countries trying to decline their population. Consequence of growth population becomes serious matter and impacted to their well-being (Todaro, 2012). Rapid population growth will be negative effect on health expenditure. If population growth is faster than health expenditure growth, per capita health expenditure will be lower. Government will cope difficultly health public services to people.

Poverty is often accompanied by malnutrition, low illiteracy, low health services, and low family planning.

Table.1. Tobit Regression Result Analysis

Variabel	Nilai Efisiensi
Populasi	-0.000020*** (0.000007)
% Kemiskinan	0.000099 (0.000064)
Constant	0.582763*** (0.031885)
Observations	281

Source: Data Processed

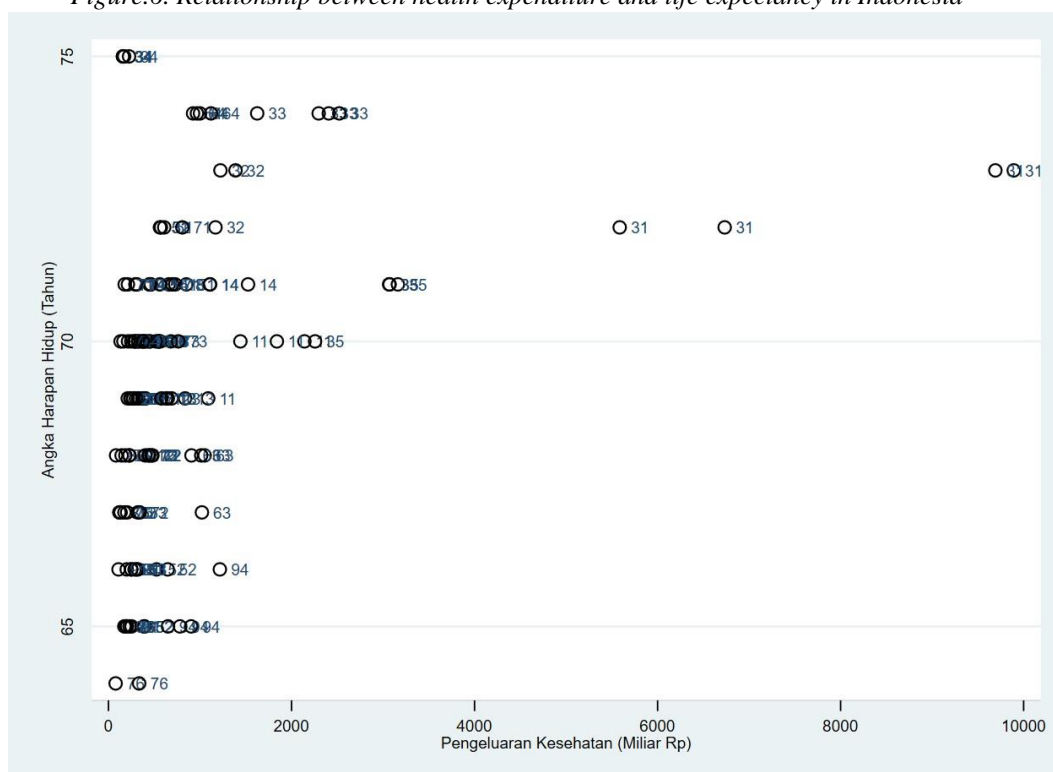
Table above states poverty has marginal effect 0,000103 on health expenditure efficiency. This table also proves that poverty has insignificant effect on health expenditure efficiency. If thousands of poor people increase, will increase efficiency value is 0.000103. This table shows that population possess marginal negative effect -0,000020. Enhancement thousands of people will reduce efficiency value 0.000020.



3.4. Relationship Between Health Expenditure and Health Sector Development Performance

Neo-classical growth model explained that human capital which consist of health and education has positive effect for long term per capita income (David, 1996). In achieving optimal health, a country requires investment in health sector. In fact, health sector investment has positive effect on economic (Anyanwu CJ & Erhijakpor EOA., 2007; Bloom, David et al., 2004). Kindly find the relationship between health expenditure and life expectancy in Indonesia below:

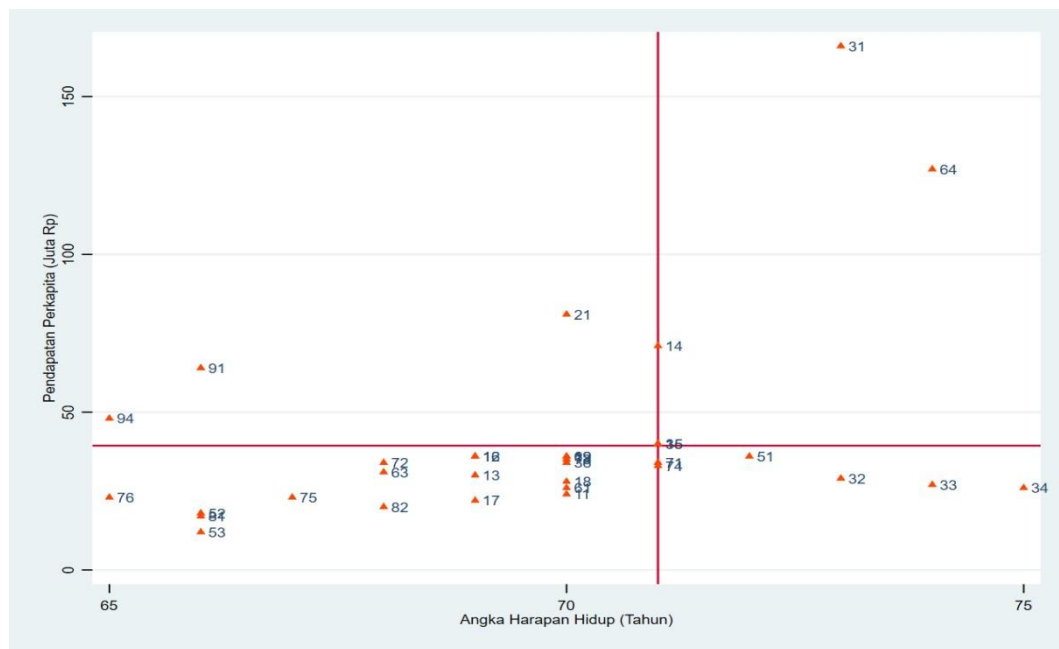
Figure.6. Relationship between health expenditure and life expectancy in Indonesia



Source: Data Processed

Based on the figure above, Jakarta is the province with the largest health expenditure, followed by change of significant life expectancy during 2014 until 2019. In the meantime, to analyze relationship between life expectancy and per capita income, quadrant analysis is used. According to the figure below, provinces in Quadrant.I are Jakarta, East Kalimantan, and Riau. It means, these provinces have per capita income optimally.

Figure.7. Relationship Between Life Expectancy and Per capita income



Source: Data Processed.

Quadrant.II consist of Kepulauan Riau, Papua, and West Papua. Subsequent, Quadrant.III there are Central Java, Yogyakarta, West Java, Bali, North Sulawesi, Southeast Sulawesi, and East Java. Provinces in Quadrant.II and Quadrant.III can be interpreted life expectancy indicator should be further developed to increase per capita income or leveraging their potency. Moreover, another province in Quadrant.IV in which these provinces has not optimally used resources yet.

4. Conclusion

DEA analysis indicated that all provinces in Indonesia fluctuated in leveraging expenditure to achieve efficiency and optimally health sector development. Eastern Indonesia possess high level of efficiency. Although health expenditure is relatively small, there has been allocated optimally. In the meantime, Tobit regression indicated that marginal effect of population is significant, by contrary marginal effect of poverty is insignificant to health expenditure. On the whole, health expenditure possesses positive and significant effect to health development performance in Indonesia.

Acknowledgment

This paper is an output of campus research project. Thanks to people who have been given tremendous support for reserachers.

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