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MACROECONOMIC FACTORS ON THE NUMBER OF PULMONARY TUBERCULOSIS PATIENTS IN NORTH SUMATERA

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Abstract

Tuberculosis is an infectious disease that caused significant mordibity and mortality. TB identified by WHO as the 22 high burden nations especially in the low and middle income countries (LMIC). In Indonesia, especially in North Sumatera the number of the patient of pulmonary tuberculosis is growing every year. Various factors, suspected as the cause. Beside the advent of antibiotics, Its believe that economic conditions such as better nutrition, improve housing and working conditionare ther relativelyhave huge impact on the deadline of the incident of TB. Thus, this study analyzes macroeconomic factors that influence the number of patients with pulmonary tuberculosis in North Sumatera. Using quarterly data for the period of 2000-2015, the result of cointegration test shows that inflation, poverty and population positively and significantly affected the number of patients of pulmonary tuberculosis. While variable education and number of health facilities negatively and significantly affected the number of patients. Therefore, a more serious effort is needed from the government to tackle poverty and population growth in North Sumatera, this problem however, is not only the problem of the health sector.

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Keywords: Tuberculosis, cointegration, poverty.

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1. Introduction

Tuberculosis is an infectious disease caused by infection of Mycobacterium tuberculosis. Tuberculosis (TB) is an infectious disease that cause significant morbidityand mortality, especially in the low and middle income countries (LMIC). TB identified by the World Health Organization (WHO) 2010 as the 22 ‘‘high burden’’ nations in Indonesia, especially in North Sumatera.

The number of the patient of pulmonary tuberculosis is growing every year in North Sumatera. In 2010, North Sumatera ranks 7th highest number of patients of pulmonary tuberculosis in Indonesia. The number of patients were 104,992 in that year and increase to 123,790 patients in 2012. Various factors, suspected as the cause. Recentwork suggests that, on a national level, TB trends track moreclosely with social and economic indicators than with measures of TB control activities (Oxlade et al., 2009; Dye et al., 2009). Knowing the factors that significantly influence the increase of the number of patients is very important to make critical policies to reduce the number of tuberculosis patients. Thus, this study analyzes macroeconomic factors that influence the number of patients with pulmonary tuberculosis in North Sumatera.

2. Problem Statement

Knowing the factors that significantly influence the increase of the number of patients is very important to make critical policies to reduce the number of tuberculosis patients.

3. Research Question

What macroeconomic factors that influence the number of patients with pulmonary tuberculosis in North Sumatera?

4. Purpose of the Study

Thus, this study analyzes macroeconomic factors that influence the number of patients with pulmonary tuberculosis in North Sumatera.

5. Research Method

In accordance with the purposes of the study, this study is a survey study that uses secondary data. Secondary data used is the quarterly time series data. Observation period is from 2000 to 2015. The data source is from BPS (Central Bureau of Statistics). Lack of data from BPS tried to be fulfilled by visiting the office of Central Bureau of Statistics Medan, Medan City Health Department, Bank Indonesia in Medan, and various other institutions expected to help provide data. Methods of data analysis consists of a unit root test, cointegration test and test of model specification and method using ECM (Error Correction Mechanism) Engle Ganger

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6. Findings

6.1. The Unit Root Test

The results of the study begin with checking the stationarity of the data because the variables should be stationary before using the error correction method (ECM). The null hypothesis of the unit root test is generally defined as the presence of a unit root and the alternative hypothesis is stationary. The unit root test used in this study is the Phillips–Perron (PP) test. The result of this test in level shown by Table 1.

Table 01. The Result of Phillips–Perron (PP) Unit Root Test in Level

Variable	Level	Adj. T-Stat (PP)	Prob.	Decision
LnTB	Level	-1.139712	0.2179	Non-stationary
LnINF	Level	1.611420	0.9657	Non-stationary
LnEDU	Level	-1.563674	0.1075	Non-stationary
LnPOV	Level	1.357320	0.9468	Non-stationary
LnPOP	Level	-0.676426	0.4043	Non-stationary
LnHF	Level	2.946256	0.9972	Non-stationary

Table 1. shows that none of the variables stationary in level.This is means that it must be proceed with the next level such as the first difference or the second difference until the result of the unit root test shows that the variables stationary. The result of the unit root test in the first difference shown by Table 2

Table 02. The Result of Phillips–Perron (PP) Unit Root Test in First Difference.

Variable	Level	Adj. T-Stat (PP)	Prob.	Decision
D(LnTB)	First Difference	-6.361669	0.0000	Stasionary
D(LnINF)	First Difference	-3.035401	0.0058	Stasionary
D(LnEDU)	First Difference	-12.46708	0.0001	Stasionary
D(LnPOV)	First Difference	-3.311283	0.0033	Stasionary
D(LnPOP)	First Difference	-7.387815	0.0000	Stasionary
D(LnHF)	First Difference	-2.516025	0.0169	Stasionary

The result of Phillips-Perron unit root test in the first difference shown by Table 2 basically suggest that finally the variables stationary in the first difference. It is shown by the probability of t-statistics lower than the critical value 0.05. Based on these findings the next test, that is the cointegration test can be proceed because the requirement of stationary variables is fullfilled.

6.2. The Result of Cointegration Test

This study used a cointegration Engle-Granger (EG) test. The test conducted on the residual of the equation of multiple linear regression to decide their stationary. The decisions based on the comparison of the ADF statistic to the critical value $\alpha = 0.05$. If the statistics are greater than the critical value, it can be concluded the the variables observe are cointegrated or having a long-term relationship. If otherwise the statistics not greater than critical value, then the variables are not cointegrated. Judging from the estimated value of -5.613989 ADF statistic greater than critical value $\alpha = 5\%$ (-3.119910) and the

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probability 0.0008 <α = 0.05, so it is can be concluded that they are cointegrated. This result shown by Table 3

Table 03. The Result of Cointegration Test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.613989	0.0008
Test critical values:	1% level	-4.057910	
	5% level	-3.119910	
	10% level	-2.701103	

*MacKinnon (1996) one-sided p-values.

6.3. The Result of Estimation Model

The result of ECM model is:

dLnTBt= 1.2295+6.4689*dLnINFt–0.3053*dLnEDUt+ 0.4922*dLnPOVt+1.4269*dLnPOPt-20.1088*dLnHFt– 1.7612*ECT

The complete result of estimation model such as the F-statistics, R-squared, the coefficient of each variable, t-statistics and its probability shown by Table 4.

Table 04. The Result of Estimation Model of ECM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.229590	0.550884	2.232029	0.0671
D(LNINF)	6.468994	1.478917	4.374144	0.0047
D(LNEDU)	-0.305328	0.098958	-3.085444	0.0215
D(LNPOV)	0.492286	0.081700	6.025501	0.0009
D(LNPOP)	1.426944	0.324903	4.391902	0.0046
D(LNHF)	-20.10881	4.054033	-4.960197	0.0026
ECT(-1)	-1.761235	0.184528	-9.544526	0.0001
R-squared	0.971337	Mean dependent var		1.405057
Adjusted R-squared	0.942674	S.D. dependent var		6.268220
S.E. of regression	1.500786	Akaike info criterion		3.953589
Sum squared resid	13.51416	Schwarz criterion		4.257792
Log likelihood	-18.69833	Hannan-Quinn criter.		3.891061
F-statistic	33.88837	Durbin-Watson stat		1.947421
Prob(F-statistic)	0.000225			

The results of the estimation of the model shown by Table 4 indicates that all the variables studied in the short term affect significantly the number of tuberculosis patients in Medan. Inflation variable positively and significantly affected the number of patients of pulmonary tuberculosis. Variable education, negatively and significantly affected the number of patients. While variable poverty also found positively and significantly influence the number of patients of pulmonary tuberculosis. Similarly, the number of population has a significant effect on the number of patients with pulmonary tuberculosis, whereas the variable number of health facilities also significantly influence the number of patient but in a negative relationship.

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Inflation variables found to affect positively and significantly the number of tuberculosis patients in Medan. The term inflation in this study is a persistent, ongoing rise across a broad spectrum of prices, not just one or two goods but that increase is spreads to (or leads to escalating prices for) other goods. The measurement of inflation in Indonesia based on the consumer price index, especially food stuffs, housing, clothing and health. Inflation as macroeconomic indicators caused lower ability to fulfill the nutrition needs. Nutritional deficiencies will lead to susceptibility to tuberculosis as studid by Chandra (1997) and Cegielski and McMurray (2004). This means that the higher the rate of inflation will increase the number of tuberculosis patients in North Sumatera.

Variable education found affected negatively and significantly the number of patients with pulmonary tuberculosis. This means that the higher the educational level the less the number of patients with pulmonary tuberculosis. This can be explained by the study Ross and Wu Chia-ling (1995) which states that people who have higher education have a greater control to their ill-health and always promote health in all their analysis. This finding is consistent with studies Gupta, Das, Balamughesh, Aggarwal, & Jindal (2004), that education negatively affect the number of patients with pulmonary tuberculosis.

Number of health facilities in the current study found significantly and negatively affected the number of pulmonary TB patients in North Sumatera. This is means that the higher the number of health facilities the lower the number of TB patients. Adequate health facilities will facilitate the efforts of TB preventive and treatment efforts. Assessment of the WHO (2010), Golub et al. (2007) and Lin, Murray, Cohen, Colijn, & Ezzati (2008) showed problems of health systems and health facilities in dealing with pulmonary TB will increase the number of TB cases very quickly.

The results of this study also indicated that poverty is the most influential variables on the number of patients with pulmonary tuberculosis in North Sumatra. This is because poverty is a big barrier to get healthy food, to get the immune system that can prevent infection of pulmonary tuberculosis. Poverty is also a barrier to get a decent place to stay with normal ventilation system to maintain health. Poverty is also a barrier to getting health efforts if someone gets sick, and poverty can also be a cause of disease transmission. Studies on poor countries and poor people (Lönnroth, Jaramillo, Williams, Dye, & Raviglione, 2009 and Muniyandi et al., 2007) showed that they are more prone to this disease compared to people in middle income countries.

The number of population in this study found to be the second important variable that influence the number of pulmonary TB patient after variable the number of poverty. This is due to the explosion of the population will affect the availability of food, shelter and other health needs. High population tend to cause a shortage of the important things. High population means a high number of dependents for the heads of households, leading to work hard in a poor working environment. Transmission of TB will be higher in the family if there are higher number of family members. The results of this study is in line with previous studies such as the reviews by Dye and Williams (2010) or studied by Narasimhan, Wood, MacIntyre, & Mathai, (2013).

Finally, it can be said that the proposed macroeconomic variables studied in this paper found significantly influence and play a significant role in increasing or reducing the number of patients with pulmonary tuberculosis in North Sumatra. Other variables such as the level of air pollution, urbanization conditions that are common in big cities, followed by dense and bad settlements, that are not included in

this study is expected to also affect the number of TB patients in North Sumatra. All of the proposed factors in this study basically are not merely a health problem, but also economic, social inequality and poverty. This is the same as stated by van Helden (2003) in his study of TB disease, he states that tuberculosis is not just a medical problem, but also a problem of social inequality and poverty and it is always the result of gross defects in socialorganization and in thenmanagement of individual lives.It is truly a social sin which canand must be stamped out.

7. Conclusion

- Variable inflation, poverty and population positively and significantly affected the number of patients of pulmonary tuberculosis. While variable education and number of health facilities negatively and significantly affected the number of patients.
- Poverty and population found as the most influential variables on the number of patients with pulmonary tuberculosis in North Sumatra.

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