Analyzing the Effect of Regional Economic Factors on Maternal Mortality Rate: Evidence of Indonesia

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The maternal mortality rate (MMR) is a barometer that used for measuring the pregnancy death rate. The MMR of Aceh is categorised as high compared to national MMR. Of these, the purpose of this study is to analyse the effect of regional economic factors (e.g. human development index, health budget and economic growth) on MMR. This panel data study was conducted for 23 districts in the year of 2010 to 2017 at Aceh province, Indonesia. It collected from the Central Bureau of Statistics, Aceh, Indonesia. By using the panel data regression analysis, this study found that the Fixed Effect Model is an appropriate or the best model chosen for this study. Also, the result of the analysis indicated that the variable of the Human Development Index has a significant negative effect on MMR. Meanwhile, the Gross Domestic Product and Health Budget do not significantly effect MMR. In conclusion, an increase in the Human Development Index means it will be decreasing the MMR.

Key words: *Maternal Mortality, Economic Growth, Human Development Index (HDI), Health Budget*

Introduction

Maternal Mortality Rate (MMR) is used to determine and monitor the pregnancy deaths rate. High and low MMR rates in a particular area are not only caused by the population growth but high and low levels of health in the regions. The indicator of death is useful for monitoring the performance of central and local governments in improving community welfare in health development. The MMR is one of the Sustainable Development Goals (SDGs), which guarantees a healthy life and promotes well-being for all people of all ages. The goal of SDGs is to reduce the MMR to ¾ from the figure in 1990, with the SDGs target as much as 70 per 100.000 live births by the end of 2030 (World Health Organization, 2015). By following the report of Central Bureau of Statistics (2016), the MMR in Aceh Province is 167 per 100.000 live births, and the figure is still very high compared to the national target achievement of 102/100.000 KH. The result of MMR trends in Aceh province in the year of 2010 to 2016, as seen in Figure 1 below.

**Figure 1.** A trend of Maternal Mortality in the Province of Aceh in 2010-2016
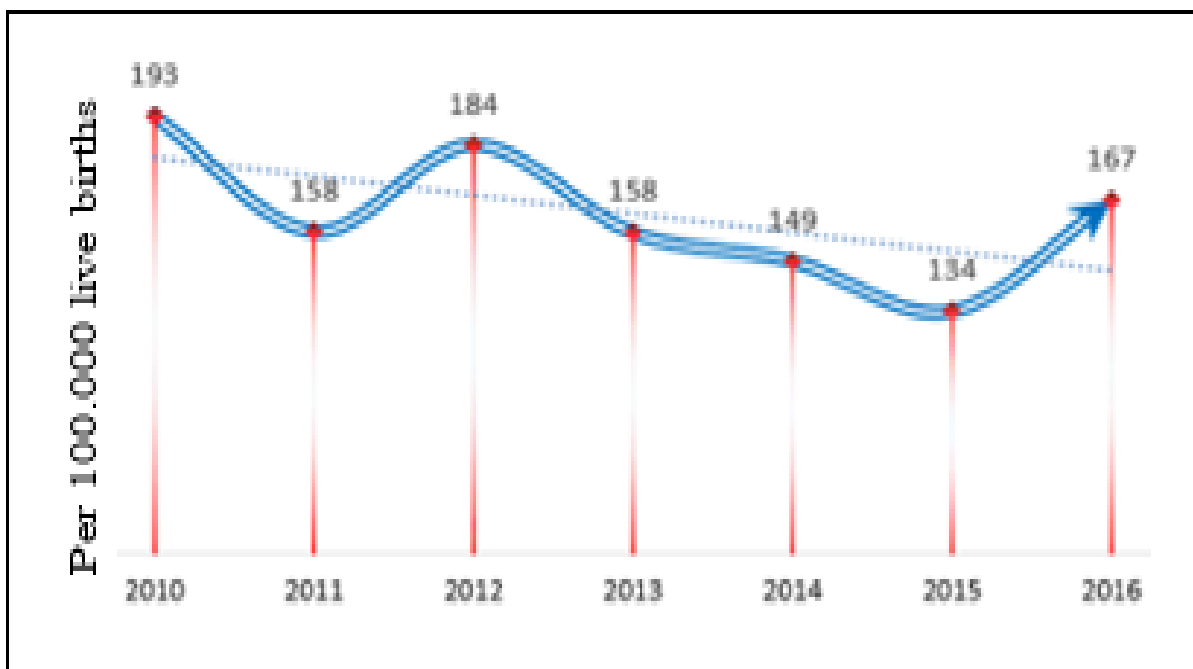
Source: Health Office (2016)

Figure 1 displayed that the MMR is showing a stable fluctuation trend (decline). It becomes a challenge for the Aceh Government to increase the commitment of the region in providing health services for pregnant women and postpartum mothers. A high MMR is caused by a lack of understanding of mothers regarding health responsibilities (Health Office, 2016), and low-income families economy (Ruth and Will, 2016), such as low economic growth (country or region), and low of awareness of government on public health. It is proved by the small

allocation of the health budget by the government. In line with that issue, Figure 2 depicted the development of Aceh's economic growth from 2010 to 2017.

Figure 2. The comparison of Economic Growth between Aceh and in the year of 2010-2017
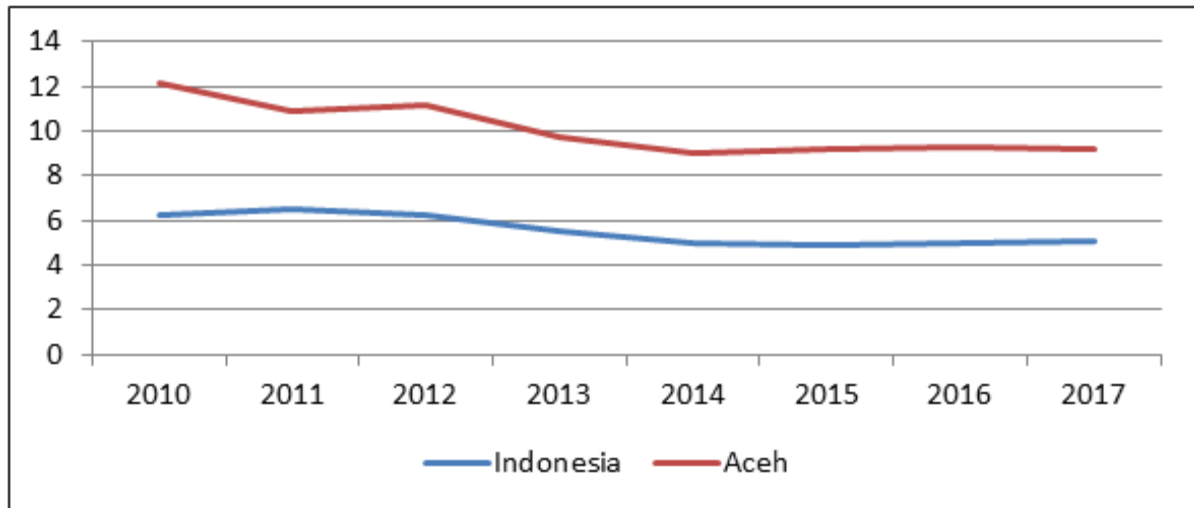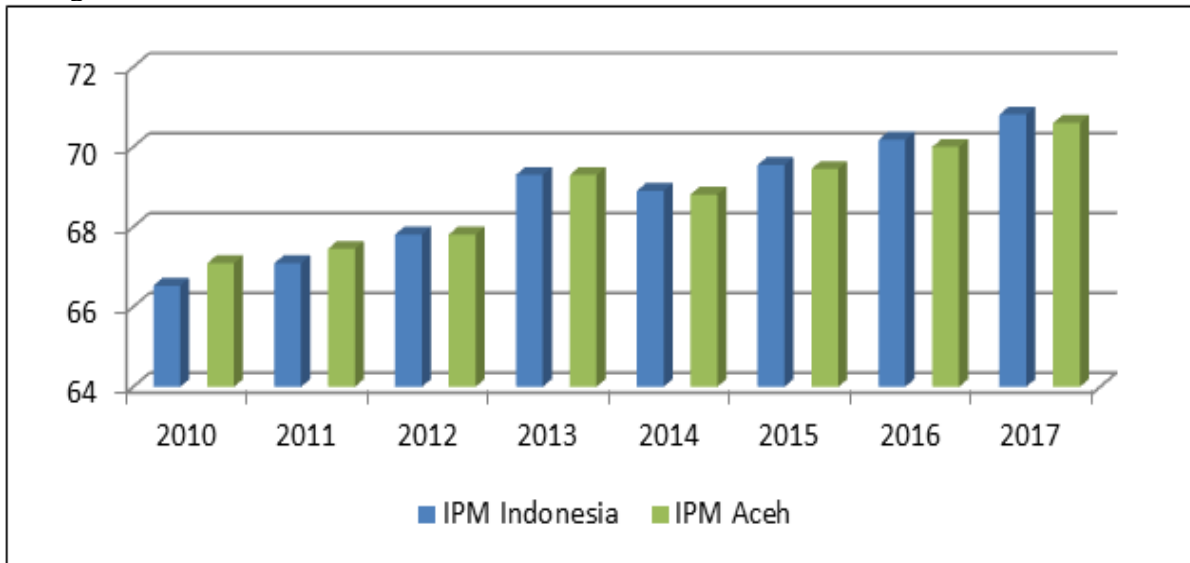

Source: Central Bureau of Statistics (2017)

The development of Aceh's economic growth has almost stagnated in the last five years, and there it is about 4 per cent lower than Indonesia's economic growth with a figure of around 5 percent. Generally, low economic growth in Aceh and Indonesia in recent years is caused by the impact of the global economic slowdown and the various problems faced globally and nationally. In this case, very low growth is thought to have relevance to the very low level of public health.

The Human Development Index (HDI) such as the composite index of life expectancy (UHH), literacy rate (AMH), Average School Length and economic indicators of public purchasing power (PPP) become the crucial indicators for measuring the level of physical and non-physical quality of the population. In terms of HDI, it continues to increase with an average increase of 0,6 points, indicating that there is an increase in the quality of life in Aceh Province (figure 3), where the HDI of Aceh Province is slightly below the Indonesian HDI of 70,6. In another case, government spending, as one of the sources of financing for development, has increased government activities to improve the welfare of the community (Todaro, 2011).

Figure 3. The comparison of Human Development Index (IPM) between Aceh and Indonesia during 2010-2017

Source: Central Bureau of Statistics (2016)

Figure 4. The Indonesia Health Budget in the year of 2010 until 2017
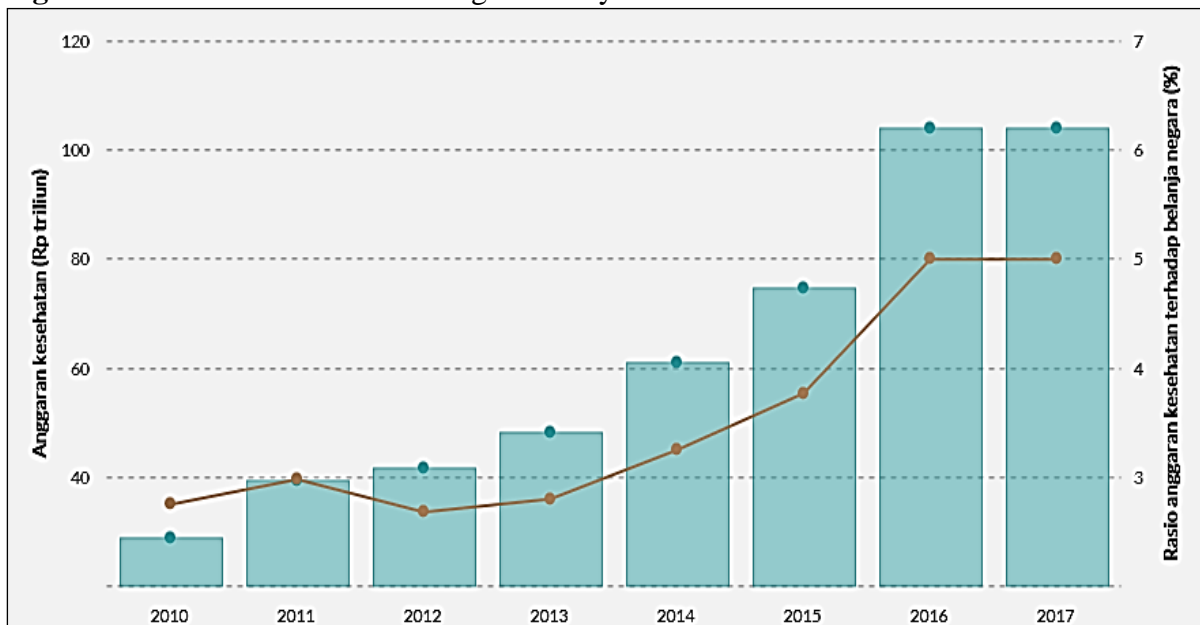
Source: Central Bureau of Statistics (2016)

Figure 4 shows Indonesia's Health Budget in the year of 2010 until 2017. The Figure indicated that the health budget of Indonesia is increasing from time to time. The state budget increased from IDR 28.83 trillion (in 2010) to IDR 104.02 trillion (in 2017). It means that the budget ratio health towards state spending in-country expenditure budgeting (APBN) in 2017 increased by 5 per cent (Ministry of Finance, 2017). Meanwhile, the health budget of Aceh province in 2016 is IDR 4.582 trillion and increased to IDR 8.901 trillion in 2017

(Department of Health, 2017). Despite the increase of the national health budget of Aceh, the MMR still hasn't reach the national target. In conjunction with that issue, this study aims to examine the effect of regional economic factors (e.g. economic growth, Human Development Index, health and regional budgets) on MMR.

Literature Review

The Relationship of Economic Growth and Maternal Mortality Rate

In this section, we elaborate on the relationship between maternal mortality and economic development and explain various mechanisms that affect the degree of maternal health. We discuss its relationships in several focus areas including the health and development, health and poverty, choosing interventions for better health, assessing the health status of the population, increasing health costs and removing barriers non-fees for health services.

A study was conducted by Hanson et al. (2015) about maternal mortality and distance-to-facility obstetric care in rural southern Tanzania. They stated that there is 75 per cent reduction in the maternal mortality rate between 1990 and 2015. Also, in the fifth Millennium Development Goal, maternal survival is considered as an essential measurement for increasing economic growth and reducing poverty. Worldwide, maternal mortality has declined by 45 per cent per year since 1990, with an estimated number in 2013 of 289,000. However, in sub-Saharan Africa alone, 179,000 women die each year during pregnancy and childbirth. It means that one woman in the world will die every minute.

In countries with better health levels, each individual has a longer average life, thus economically has the opportunity to get higher income. Families with longer life expectancies tend to invest their income in education and saving. Therefore, national savings and investment will increase, and in turn, will increase economic growth. Ramirez et al. (1998) conducted a study using cross-country data (1970-1992). They found that there is a significant positive relationship between human development and economic growth. Besides, government spending on the social and educational sectors also has an essential role as a link that determines the strength of the relationship between economic growth and human development. At the same time, the level of investment and income distribution is a reinforcement of the relationship between human development and economic growth. In conclusion, this study explained that government spending and investment contribute to strengthening human development and economic development.

In line with the study conducted by Barro et al. (2003), it was found that economic growth was influencing maternal mortality. It can be seen from the distance of the residence. With them, this is the most important factor affecting the use of health services in the southern

districts of Ghana. Also, they stated that inadequate access to health facilities drastically reduced the life expectancy of rural residents and then increased the maternal mortality rate. They further observed that rural people often did not take advantage of visiting the nearest health care centre available due to transportation facility issues.

The Relationship of Human Development Index towards Maternal Mortality Rate

For measuring the success of the Health Development program, the area can be used as a component in the human development index, namely life expectancy. The life expectancy is the average year of life that will still be lived by someone who has succeeded in reaching the age of x, in a given year. In the prevailing mortality situation in the community or life expectancy at birth is the average year of life a newborn baby will live in a given year (Saputra et al. 2017; Saputra et al. 2017).

A study by Syafii (2009) analysed the effect of the Human Development Index on Maternal Mortality in North Sulawesi. He used a table analysis and simple linear regression analysis. His study found that the Human Development Index has a positive and significant effect on maternal mortality. Also, the value of elasticity for the human development index is 0.127 per cent. It means that increase the Human Development Index as much as 1 per cent then the maternal mortality rate will decrease as much as 12.7 per cent. Also, he added that human development could spur growth in the local economy. Further, Oyedemi (2016) found that low access to health facilities, income level, purchasing power and educational status can have an effect on maternal mortality rates in rural communities. Therefore, an intensive, maternal health awareness is needed in the form of campaigns and efforts of modern health practices to decrease the maternal mortality rate.

The Relationship of Health Budget towards Maternal Mortality Rate

The Regional Revenue in Aceh Province is known as Aceh budget for income and expenditure (APBA). It is a regional government work plan that covers all revenues and expenditures of regional governments, both provinces and districts, in order to achieve target development within one year, expressed in units of money and approved by the DPRA (House of Representatives of Aceh). The functions and objectives of APBA preparation are the same as the functions and objectives of the APBN (State Budget), only in the APBA the scope is different, the APBN is on a national scale. At the same time, APBA is limited to regional areas, and its implementation is handed over to regional heads or Governors and Regents/Mayors, and following regional autonomy policies. Meanwhile, the APBD was prepared by the regional government, together with the regional House of Representatives (DPR) to run their respective regional administrations (Ismawanto, 2009).

Lembang (2015), indicates that Health budgets have a direct and significant positive effect on maternal mortality, in education levels, employment and poverty, and the human development index. According to some other research done by Winarti and Astri (2014), the allocation of capital expenditure budget in the APBD has a positive impact and has a significant effect on employment, also the budget allocation for capital expenditure in the APBD indirectly has a significant impact on social welfare, either through economic growth or employment

Regional policy on regional income and expenditure is planned in the budget. According to budget economists it can be interpreted as a process, from the preparation stage needed before the start of the preparation of the plan in gathering various data and information required. Further, Roma'n Rodrıguez-Aguilar (2018) stated that the efficiency of health spending occurs when sufficient funds can provide optimal health services so that they can achieve decent public health. Muoghalu, (2010), explains that there are other factors besides the medical causes of maternal mortality in Nigeria, including socio-economic and cultural factors, which non-medical impacts cause most cases of maternal mortality.

Methodology

This study used the secondary data obtained from the Central Bureau of Statistics with a total of 23 districts in the year of 2010 to 2017 at Aceh province, Indonesia. By using the panel data approach, Equation (1) shows the estimation parameters for different individual behaviours over a period of time. The common panel data regression model with individual-specific effects can be written as follow:

$$Y_{it} = a + \beta X_{it} + \varepsilon_{it} \tag{1}$$

Where Y_{it} and X_{it} is the dependent and independent variables for each individual i in a period of time t where $i = 1,2,\ldots,$ N and $t = 1,2,...,$ T. ε_{it} is an error term. In X_{it}, there are much of K slope (not including the intercept) which shows the number of independent variables used in the model. It is an individual effect that can be of constant value throughout the period t or even different for each individual i. By using the common panel data regression model in Equation 1, the specification of the econometric model can be written as seen as follows:

$$Log(MMR)_{it} = a + \beta_1 Log(GDP)_{it} + \beta_2 HDI_{it} + \beta_3 HB_{it} + u_{it} \tag{2}$$

Where MMR is the maternal mortality rate, GDP is economic growth, HDI is Human Development Index, HB is the government health expenditure, and α_o is intercept, α_1 α_2 α_3 α_4 is independent variable regression coefficients, u_{it} is error component at time t with cross-

section unit *i* is (23 district or cross-section data) in Aceh Province), t is time-series data (2010-2017).

Results and Discussion

In this section, we present the result of descriptive statistics. It aims to identify the important or current level among variables.

Table 1: The Result of Descriptive Statistics

Statistics	Maternal Mortality Rate	Gross Domestic Product	Human Development Index	Health Budget
Mean	6.611739	4.291988	67.43	67.45966
Median	5	4.24	66.92	55.57
Maximum	32	10.73	83.73	215.36
Minimum	0	0.56	58.97	3.28
Std. Dev.	5.149249	1.151717	4.921598	45.33358
Sum	1064.49	691.01	10856.23	10861
Sum Sq. Dev.	4242.363	212.2322	3875.54	328821.3

Table 1 shows the result of descriptive statistics. In the above table, we indicate that the average value of the maternal mortality rate is 6.611739. Further, the average value of the Gross Domestic Product is 4.291988. For Human Development Index, this study found that the average value of its variable is 67.43. Also, the average value of the Health Budget is 67.45966. Also, the maximum number of maternal mortality rate is 32 people with standard deviation is 5.149249. For gross domestic Product, the maximum value is 10.73 billion with the standard deviation is 1.151717. Interestingly, the maximum value for the Human Development Index is 83.73 with standard deviation as much as 4.921. Lastly, the maximum health budget is 215.36 billion, with standard deviation is 45.33358.

Table 2: The Result of Correlation Testing

Independent Variable(s)	Dependent Variable
	Log (Maternal Mortality Rate)
Log (Gross Domestic Product)	-0.063
Log (Human Development Index)	-0.109
Health Budget	-0.216

Table 2 displays that the Human Development Index and Health Budget has negatively significant correlated with Maternal Mortality Rate. Meanwhile, Gross Domestic Product does not significantly correlate with Maternal Mortality Rate. From the above table, we can

identify that the Health Budget has 21.6 per cent correlated with Maternal Mortality Rate and the Human Development Index has 10.9 per cent correlated with Maternal Mortality Rate. After testing the correlation among variables, we employ the panel data regression analysis for examining the determinant factors that affect the Maternal Mortality Rate. The result, as seen in Table 3 below:

Table 3: The Result of Hypotheses Testing

	Model 1 (POLS)	Model 2 (FE)	Model 3 (RE)
C	2.763 (0.797)	7.767 (2.508)	3.703(1.146)
	3.464***	3.096***	3.229***
Log (Gross Domestic Product)	-0.095 (0.180)	-0.099(0.155)	-0.094(0.150)
	-0.528	-0.638	-0.626
Human Development Index	-0.017 (0.011)	-0.088(0.036)	-0.029(0.016)
	-1.528	-2.381***	-1.737
Health Budget	0.003 (0.001)	-2.39E-05(2.508)	0.001 (0.001)
	2.799***	-0.022	0.873
R^2	0.063	0.540	0.024
F-test	3.423**	6.069***	1.245
Chow test		6.083***	
Breusch-Pagan RE LM test		52.982***	
Hausman test			16.892***
Dependent variable: Log (Maternal Mortality Rate)			

Table 2 displays the result of hypotheses testing. Before interpreting the result, we should be identifying the appropriate model. As a standard test for panel data regression, there are three models, namely Pool Least Square, Fixed Effect Model and Random Effect Model. Applying some test for comparing which one the model or appropriate, this study found that the Fixed Effect Model is the best model or suitable model in this study. The result of the analysis found that the variable GDP, HDI and HB explained its relationship on MMR is 54 per cent and the remaining about 46 explained by others variable which does not study in this research. Also, this study found that the variable of HB and GDP do not significantly effect on MMR. Only the HDI has a significant negative effect on MMR. The value of estimation regression for HDI is -0.088 with standard deviation is 0.036 and t-stat is -2.381 or significant at level 1 per cent. It means that, by assuming an increase in HDI as much as 1 per cent, it will be giving effect on reducing the number of MMR as many as 8.8 (round up is 9) people.

Table 4: The result of individual effect testing for cross-sectional (districts)

No	District	Individual Effect	No	District	Individual Effect
1	Simeulue	-0.214	13	Gayo Lues	-0.079
2	Aceh Singkil	0.007	14	Aceh Tamiang	0.465
3	Aceh Selatan	-0.485	15	Nagan Raya	-0.101
4	Aceh Tenggara	-0.159	16	Aceh Jaya	-0.368
5	Aceh Timur	0.477	17	Bener Meriah	-0.174
6	Aceh Tengah	0.021	18	Pidie Jaya	-0.310
7	Aceh Barat	-0.203	19	Kota Banda Aceh	0.053
8	Aceh Besar	0.084	20	Kota Sabang	-0.600
9	Pidie	0.576	21	Kota Langsa	0.342
10	Bireuen	0.427	22	Kota Lhokseumawe	0.423
11	Aceh Utara	0.701	23	Kota Subulussalam	-0.218
12	Aceh Barat Daya	-0.665			

In this study, the assumption of normality and heteroscedasticity was tested using the Jarque-Bera and Breusch-Pagan-Godfrey Test (BPG). The result as displayed in Table 5 below

Table 5: The results of Normality and Heteroscedasticity

Normality	Jarque-Bera	4.777
	Prob.	0.091
Heteroscedasticity	Breusch-Pagan LM	4.523
	Prob.	0.055
	Scaled magnitude LM	7.837
	Prob.	0.06

Table 5 shows that the value of Jarque-Bera is 4.777 and probability value is more than 0.05 (0.09). It means that the data normally distributed. Further, for checking the issue of heteroscedasticity, we use Pagan-Godfrey Breusch test, the result of the analysis found that the value of Pagan-Godfrey Breusch and Scaled magnitude LM are 4.523 and 7.837. Both probabilities are more than 0.05. It means that there is no issue heteroscedasticity. We can conclude that the data is homogeny. Having that, we test the existence of a perfect linear relationship among independent variables. It tested using the correlation matrix. The result as seen in table 6 below:

Table 6: The result of Multicollinearity

	Log(Gross Domestic Product)	Human Development Index	Health Budget
Log(Gross Domestic Product)	1.000	0.053	-0.069
Human Development Index	0.053	1.000	0.065
Health Budget	-0.069	0.065	1.000

Table 6 shows that all independent variable coefficients are smaller than 0.80. It indicates that there is no *multicollinearity* in the variables used.

Based on the results of data processing by testing the first hypothesis, it proves that the variable economic growth does not significantly effect on maternal mortality rate. It indicates that higher economic growth does not significantly reduce the maternal mortality rate in Aceh Province. This result contrasts with the previous studies by Barro, Robert J., May (1991), Rudy (2011), Muoghalu, C.O (2010), Hendarmin. (2012), Philip & Khemani (2003), which found that economic growth has an effect on decreasing maternal mortality rate. Further, the Human Development Index has a negative effect on MMR. Similar findings reported by Blum (2010), increasing the level of public health can be measured from population mortality and morbidity which is influenced by four determinants, namely: environmental factors (45 per cent), health behaviour (30 per cent), health services (20 per cent), and population/descent (5 per cent), this theory in line with Wahyudi (2011) which found that Human Development Index could be reducing the maternal mortality index by 0.003 per cent. Besides, the health budget has no significant effect on maternal mortality rate. The limit of the budget provided by the government caused the population to find it difficult to get health care, and these conditions have an enormous effect on the number of maternal mortality both in the present and future.

Conclusion

In conclusion, the economic growth (GDP), Human Development Index (HDI), health budgets have shared effects on maternal mortality rate as much as 50 per cent. Further, the economic growth and health budget do not affect maternal mortality. Interestingly, the Human Development Index has a significant effect on reducing the number of maternal mortality rate. The district/town variable does not have a significant effect on maternal mortality in Aceh Province, meaning that as long as the area has adequate health facilities, the maternal mortality rate can be overcome. The prediction results indicate that the location of the area does not determine maternal mortality, if the health budget is sufficient, the facilities and infrastructure in the district will be fulfilled so that the community does not need to look for health care to the city.

This research is limited to the influence of economic growth, HDI, health budget and district/town, and then it is expected that subsequent research can add to the poverty variable to find out how much the maternal mortality rate is caused by poverty. For improving the level of maternal and child health, the health budget is a crucial element for providing health services and developing the infrastructure facilities. Due to the variables of economic growth, the Human Development Index and health budget influence the maternal mortality rate, and it is expected that the government and the legislature need to examine in more detail the causes of maternal mortality in the districts/towns.

For reducing maternal mortality rate in Aceh, this study hoped that the district/town government can comply with the mandate of Law No. 36 of 2009 concerning health, in page 126-135, on 126 (1) Maternal health efforts must be aimed at maintaining maternal health. It aims to produce a generation of healthy and qualified people and reduce maternal mortality; (2) Maternal health efforts as referred to in paragraph (1a) including promotive, preventive, curative and rehabilitative efforts; (3) The Government guarantees the availability of personnel, facilities, tools, and medicines in the provision of safe, quality and affordable maternal health services; (4) Further provisions regarding maternal health services are regulated by Governmental Regulation. Local governments need to enhance the accessibility and quality of existing health facilities and provide health budgets for underprivileged people, especially for the cost of examining pregnancy and childbirth.

Acknowledgements

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