Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.13, No.14, 2022

Driving Factors of Regional Human Development Index (HDI) in Tomini Bay

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This research is funded by PNBP financial grant of Faculty of Economics Gorontalo State University (Sponsor Acknowledgement)

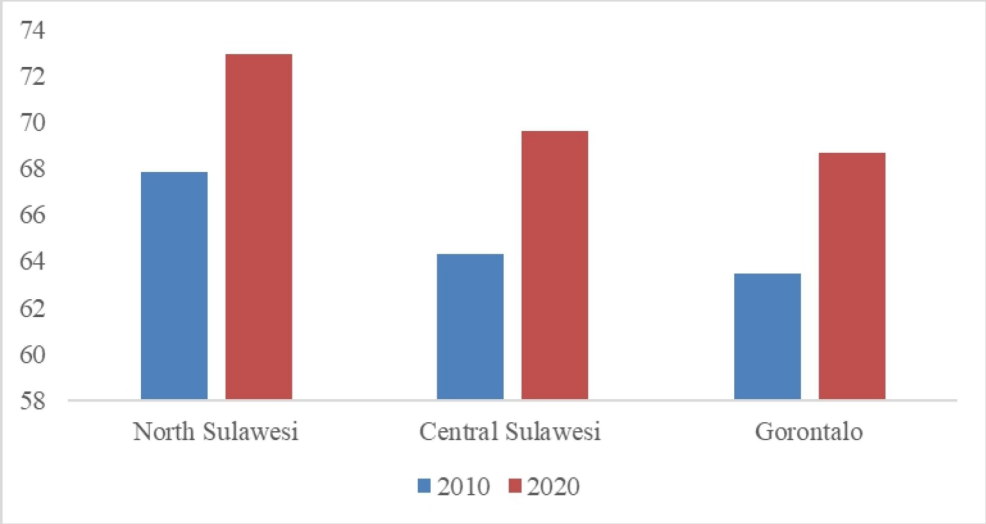
Abstract
Human Development Index (HDI) is one of the current measurements in identifying social welfare of a region. Tomini Bay is located in the world's heart coral triangle and due to its tourism potential, provinces in the surrounding of Tomini Bay is estimated to experience increasing social welfare, especially the HDI level. This study further aims to estimate the driving factors of human development index (HDI) of provinces located in the surrounding of Tomini Bay, which includes North Sulawesi, Central Sulawesi, and Gorontalo. This study uses regional level data of North Sulawesi, Central Sulawesi, and Gorontalo within the year of 2010-2020 sourced from Statistics Indonesia. Furthermore, this study develops life expectancy rate, mean years of schooling, average years of schooling, expenditure per capita, unemployment rate, and poverty rate as the independent variables. This study employs *fixed effect model (*FEM) panel data regression, specifically the Generalized Least Square (GLS) method. GLS estimates show that life expectancy rate, mean years of schooling, expenditure per capita, and poverty rate significantly increases HDI, while unemployment rate significantly decrease HDI of North Sulawesi, Central Sulawesi, and Gorontalo. Implications of the study recommends regional government to formulate policies which encourages the increase of economic growth, income level, and accessibility on education and health sectors to further increase regional HDI.
Keywords: HDI, mean years of schooling, expenditure per capita, unemployment rate, and poverty rate.
DOI: 10.7176/JESD/13-14-02
Publication date: July 31st 2022

1. Introduction

United Nation Development Program (UNDP) in Human Development Report 1990 primarily considered human development as both the input and output of economic development. It is undeniable that increasing human development portrays increasing productivity, which further results in the increase of standard of living, longevity, and social welfare. Such association further contemplate the classical measures which neglected the social-economic and human development factors on economic development (Anand & Sen, 1994; Hickel, 2020). Consequently, UNDP recommended human development index (HDI) measurement as crucial proxy to depict human development.

In compliance with the issue, Indonesia conducted human development index measures periodically since 2014 (Statistics Indonesia, 2020). Indonesia's HDI level increased from 66.53 in 2010 to 71.94 in 2020, despite its periodical fluctuations. However, the percentage of Indonesia's HDI level decreases continuously and only reached 0.3 percent in 2020. Indonesia is also categorized as medium-HDI-level country within ASEAN countries. Provincial HDI level in Indonesia also appears to be inequal. Thus, since Indonesia relies on provincial level data on HDI, it is important to analyse the current national HDI level from a regional point of view.

This study further focuses in analysing HDI attainment on provinces located near Tomini Bay, which includes North Sulawesi, Central Sulawesi, and Gorontalo. Tomini Bay is precisely located on the world's heart coral triangle and known as the largest bay in Indonesia, which encompasses 137.700 square kilometres with 1.350 kilometres coastline. Such potential arguably attracts tourists and further increases regional economy, through the increase of income per capita, employment reduction, and poverty reduction. This study further argues that the association between tourism economy and regional economy in Tomini Bay conclusively affect the HDI attainment in the area. Statistics Indonesia (2020) recorded significant increase on HDI attainment in North Sulawesi, Central Sulawesi, and Gorontalo within the year of 2010 and 2020 as seen in Graph 1. Therefore, this study would further analyse the factors contributing to the HDI attainment on provinces located in the extent territory of Tomini Bay, which includes includes North Sulawesi, Central Sulawesi, and Gorontalo.



Graph 1. HDI of North Sulawesi, Central Sulawesi, and Gorontalo in 2010 and 2020
Source: Statistics Indonesia (2020)

Driving factors of HDI attainment has been discussed heavily in recent literature. Humaira & Nugraha (2018) considered life expectancy, adjusted income per capita, average years of schooling, expected years of schooling, and Gross Regional Domestic Product (GRDP) as driving factors of HDI attainment. Arisman (2018) developed a model which estimated total population, per capita income growth, inflation, and unemployment as driving factors of HDI on ASEAN region. Fadillah & Setiartiti (2021) and Wijayanto et al. (2015) analysed the HDI attainment estimating Gross Domestic Regional Product (GRDP) and government expenditure on health sector and education sector.

Accordingly, this study will analyse the driving factors of HDI in North Sulawesi, Central Sulawesi, and Gorontalo. This study further focuses on estimating life expectancy, expected years of schooling, mean years of schooling, expenditure per capita, economic growth, unemployment, and poverty rate as main driving factors. The paper is structured as follows. Section two provides review on recent literature regarding HDI, section three describes research methodology, section four provides results and discussion, and last section derives conclusion regarding the study.

2. Literature Review

Human development index is measured by several indicators, such as education, health, and economic wealth. Recent studies have integrated various driving factors in estimating HDI. Schröder et al. (2020) reviewed the concept of HDI which includes several driving factors, such as longevity, health, access to education, and standard of living. On the other hand, Girum et al. (2018) analysed the association between life expectancy on mid and low HDI level countries within January to April 2015, which concluded that the increase in life expectancy level would increase the HDI level of a country. Arofah & Rohimah (2019) further confirmed that the increase in education level would increase the HDI level in East Nusa Tenggara. Masruroh & Subektik (2016) estimated that life expectancy, literacy rate, mean years of schooling, and purchasing power index indeed increase HDI in Yogyakarta. Dianaputra & Aswitara (2017) analysed the impact of education and health expenditure on HDI in Bali, which resulted in significant and positive association regarding the issue. Rohmah et al. (2021) analysed human development index in Central Java by considering life expectancy, mean years of schooling, and expenditure per capita as the driving factors. The study further found that the driving factors significantly increase the HDI level of Central Java.

3. Research Methods

This study analyses the driving factors of HDI on provinces located in the extent territory of Tomini Bay, which is North Sulawesi, Central Sulawesi, and Gorontalo. This study uses regional level panel dataset during 2010-2020 on secondary data sourced from Statistics Indonesia. This study further focuses on estimating life expectancy (LE), mean years of schooling (MYA), expenditure per capita (EXP), unemployment (UNEMP), and poverty rate (POV) as main driving factors of human development index (HDI). HDI is measured by an index ratio with the value between 1 and 100; life expectancy (LE) is measured by regional average life expectancy; mean years of schooling (MYS) is the regional average of individual years of schooling; expenditure per capita (EXP) is the total expenditure in Rupiah; unemployment (UNEMP) is the regional percentage of unemployed compared to the labour force; poverty rate (POV) is the percentage of people living below the poverty line.

Table 1. Descriptive Statistics of Variables

Varibel	Observasi	Mean	Dev	Min	Max
HDI	165	67.391	4.5953	58.87	77.41
LE	165	67.929	2.9582	61.62	72.53
MYS	165	8.0778	1.1991	5.91	10.37
EXP	165	9456.5	1488.4	6487	12720
UNEMP	165	5.0915	2.5445	1.31	13.18
POV	165	14.049	5.3597	5.45	22.43

This study further employs panel data regression in estimating the association between the driving factors and HDI on North Sulawesi, Central Sulawesi, and Gorontalo within the period of 2010-2020. To estimate the parameter, this study conducted the Ordinary Least Square (OLS) method first, then the fixed effect (FE) and random effect (RE) model on the data. The research also includes Chow Test and Hausman Test to further decide the appropriate econometric model of the study. The basic econometric model is as follows:

$$HDI_{it} = \alpha + \beta_1 lnLE_{it} + \beta_2 lnMYS_{it} + \beta_3 lnEXP_{it} + \beta_4 lnUNEMP_{it} + \beta_5 lnPOV_{it} + \varepsilon_{it} \quad (1)$$

where α is the constant; HDI_{it} is the HDI level of region *i* during period *t;* MYS_{it} is mean years of schooling of region *i* during period *t;* EXP_{it} is the expenditure per capita region *i* during period *t;* $UNEMP_{it}$ is the unemployment rate of region *i* during period *t;* POV_{it} is the poverty rate of region *i* during period *t;* and ε_{it} is the error term.

4. Research Results

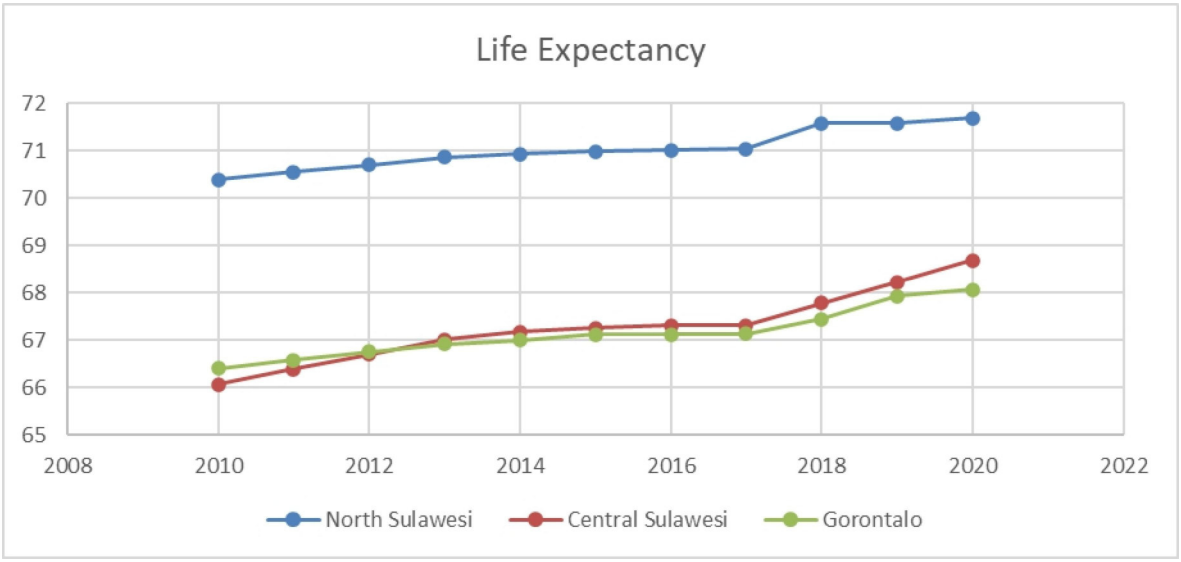
This study aims to analyse the driving factors of HDI in North Sulawesi. Central Sulawesi, and Gorontalo. Firstly, this study conducts Chow Test and Hausman Test to analyse the appropriate econometric model in the study. The result concludes that fixed effect model (FEM) is the appropriate econometric model in panel data regression. Secondly, we conduct multicollinearity and heteroskedasticity test, which indicates the problems of multicollinearity and heteroskedasticity in the data. To avoid estimation bias, this study develops *generalized least square* (GLS) method in estimating the driving factors of HDI. The GLS regression result is summarized in Table 2.

Table 2. General Least Square (GLS) Regression Results

Variable	Coefficient	Standard Error
LE	0.548***	0.027
MYS	0.171***	0.010
EXP	0.191***	0.007
UNEMP	-0.007***	0.001
POV	0.007***	0.002

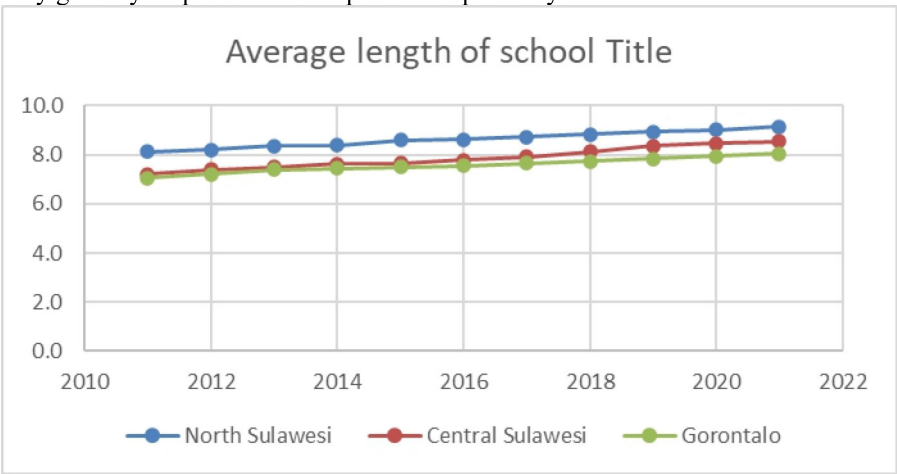
Note: the dependent variable is regional HDI data. *.**,***: significant at 1%, 5%, and 10%.

In general, Table 2 shows that all independent variables significantly associated with HDI. All else being equal, 100 percent increase of life expectancy rate in North Sulawesi, Central Sulawesi, and Gorontalo will significantly increase HDI level by 0.5 point. Increasing life expectancy rate portrays improved nutrition intake and overall health condition which arguably encourage the increase of HDI level. This result is in line with previous findings of Dinar et al. (2019), Girum et al. (2018), Masruroh & Subektik (2016), and Rohmah et al. (2021). Descriptively, life expectancy rate in North Sulawesi, Central Sulawesi, and Gorontalo is slowly increasing within the period of 2010-2020 as described in Graph 2. As described in Graph 2, the life expectancy rate is slightly higher in North Sulawesi compared to the other two regions. Life expectancy rate in North Sulawesi also grew by 4 percent within the period, while the life expectancy rate in Central Sulawesi and Gorontalo only grew by 2 percent within the period.



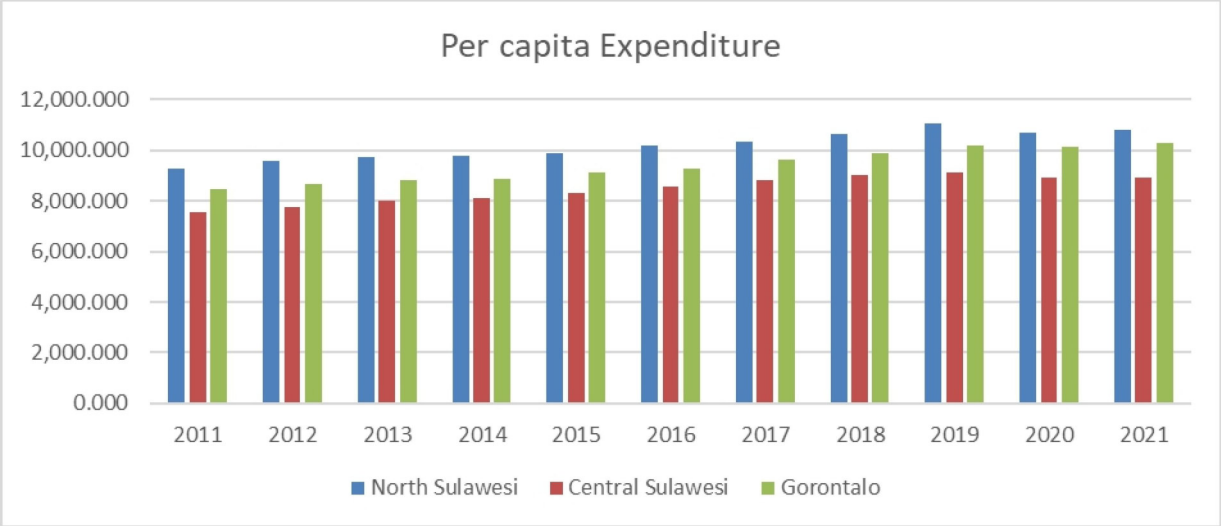
Graph 2. Life Expectancy Rate in North Sulawesi, Central Sulawesi, and Gorontalo 2010-2020
Source: Statistics Indonesia

Furthermore, mean years of schooling evidently has positive association with HDI. 100 percent increase on mean years of schooling will increase HDI level by 0.171 points. This result further supports the findings of Rohma et al. (2021) and Arofah & Rohimah (2019) which concluded the increase on years of schooling portrays the increase in educational attainment which further increase HDI. Veisani et al. (2018) found that increased mean years of schooling tend to result in increased job opportunities and broad knowledge on health issues which significantly related to the increase of HDI. Descriptively, the trend of mean years of schooling in North Sulawesi, Central Sulawesi, and Gorontalo gradually increases within the period 2010-2021. Additionally, the growth percentage is higher in Central Sulawesi which reaches 18 percent, while Gorontalo and North Sulawesi only grew by 14 percent and 13 percent respectively.



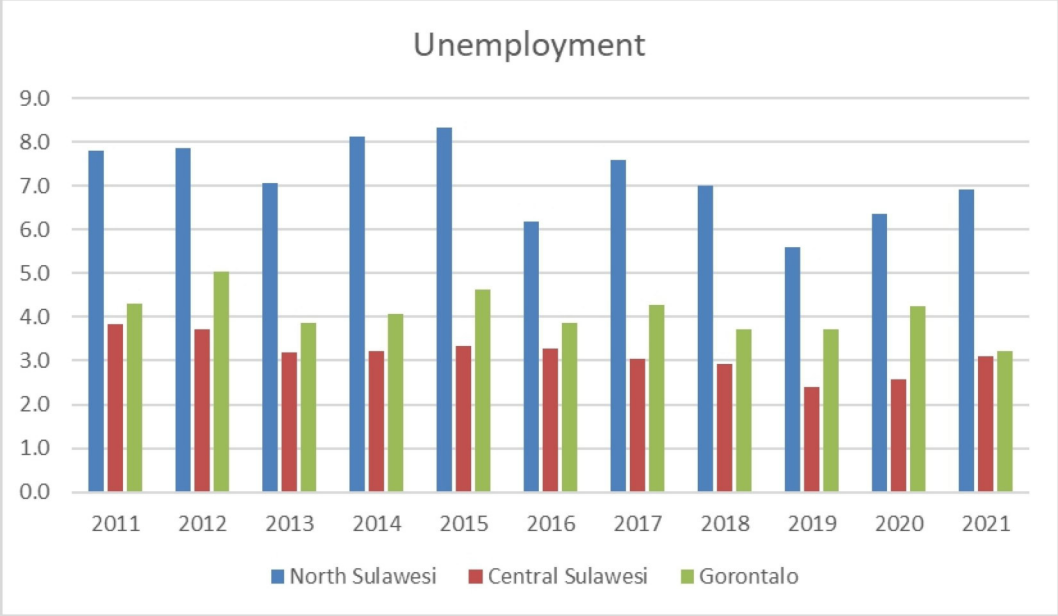
Graph 3. Mean Years of Schooling in North Sulawesi, Central Sulawesi, and Gorontalo 2010-2021
Source: Statistics Indonesia

As explained in the previous section, expenditure per capita portrays the regional income level. This study shows that the increase of expenditure per capita is associated with HDI level positively. This result is in accordance with the previous findings of Permana et al. (2016), Asmawani (2021), and Rohmah et al. (2021). Increasing expenditure per capita portrays the increasing purchasing power and ability in fulfilling basic necessities related to education and health, which results in the increase of HDI level (Martinez et al., 2019). However, contrarily, the findings of Manurung & Hutabarat (2021) found that the increase of expenditure per capita further decrease HDI level. Trend of expenditure per capita is summarized in Graph 4. North Sulawesi evidently has higher expenditure per capita with the 16 percent growth within the period of 2010-2021. Central Sulawesi and Gorontalo has slightly lower expenditure per capita rate, with18 percent and 21 percent total growth within 2010-2021.

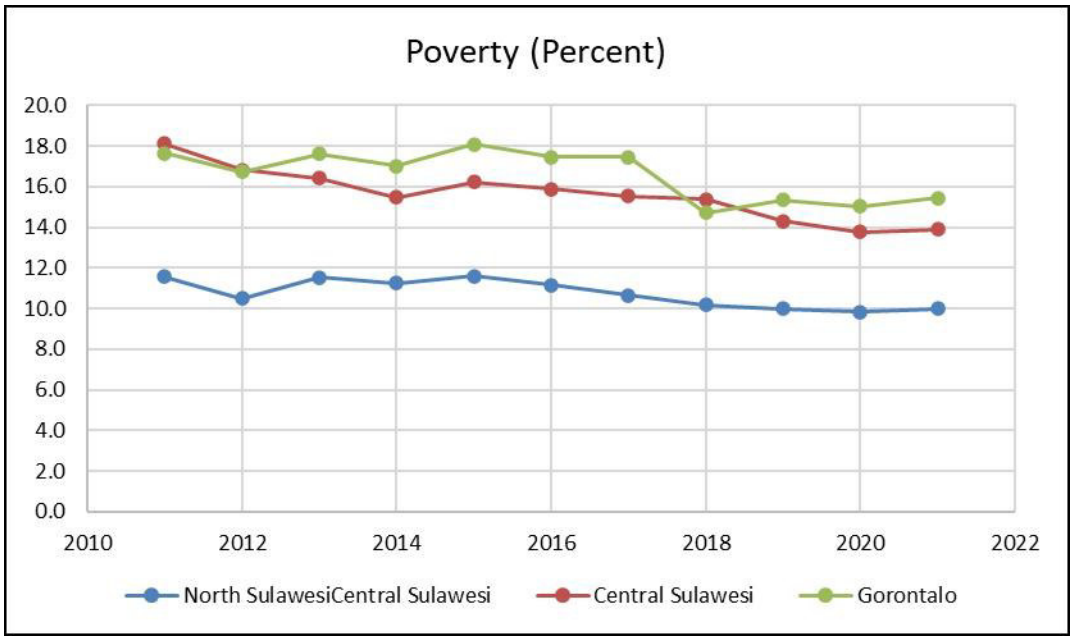


Graph 4. Expenditure per Capita in North Sulawesi, Central Sulawesi, and Gorontalo 2010-2021
Source: Statistics Indonesia

Furthermore, unemployment rate associated negatively with HDI in in North Sulawesi, Central Sulawesi, and Gorontalo. All else being equal, 100 percent increase on unemployment rate would decrease HDI level by 0.007 points. The result is debatable, since the increase of unemployment rate only affected the HDI level slightly. This result supports finding of Baeti (2013) which concluded the significance of unemployment rate on HDI. Increasing unemployment rates portrays the limited purchasing power in fulfilling education, health, (Ningrum et al., 2020) and other basic necessities (Meydiasari, 2017) which potentially limit the HDI level in the foreseeable future. However, this finding evidently argues with previous studies of Budirahayu (2017) which concluded insignificant association between unemployment rate and HDI. Descriptively, the trend of unemployment rate is lower in Gorontalo compared to North Sulawesi and Central Sulawesi within the period of 2010-2021.



Graph 5. Unemployment Rate in North Sulawesi, Central Sulawesi, and Gorontalo 2010-2021
Source: Statistics Indonesia



Graph 6. Poverty Rate in North Sulawesi, Central Sulawesi, and Gorontalo 2010-2021
Source: Statistics Indonesia

Lastly, poverty rate associated significantly and positively with HDI. All else being equal, 100 percent increase on poverty rate significantly increase HDI by 0.007 points. During 2010-2021, North Sulawesi, Central Sulawesi, and Gorontalo experienced the decreasing poverty rate as pictured in Graph 6. North Sulawesi evidently decreases the percentage of poverty rate by 13 percent since 2010. Gorontalo able to decrease poverty rate by 12 percent within the period of 2010-2021. While Central Sulawesi is able to suppress poverty rate by 23 percent within 2010-2021. This result is in line with Patta (2012) which concluded the significant association between poverty rate and the decreased HDI level. Poverty rate arguably has multiplier effect on driving factors which associated with HDI, such as limited access on education, health, and so on. It is arguably that the poor tend to preclude education and health compared to basic necessities, such as food, due to its limited purchasing power. This factors potentially affect HDI in the long term.

5. Conclusion

This study objects to analyse the driving factors of HDI on provinces located in the surrounding of Tomini Bay, which includes North Sulawesi, Central Sulawesi, and Gorontalo. Result of the study shows the significant and positive association of life expectancy, mean years of schooling, expenditure per capita, and poverty rate on HDI. While unemployment rate appears to be associated with HDI negatively. The improvement of life expectancy rate, mean years of schooling, and expenditure per capita which portrays income level would encourage accessible health and education capacity, as well as the increase on standard of living and further increase HDI in the long term. Unemployment would result in the decrease of standard of living and income which would limit the access towards basic necessities and further decrease HDI. Consequent to the estimates, this study would recommend the formulation of policy which encourage the improvement of purchasing power parity and employment to further increase HDI. The policy aims to increase overall income per capita and further increase HDI through accessible basic necessities.

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