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ANALYSIS OF GOVERNMENT EXPENDITURE AND INVESTMENT IN REDUCING UNEMPLOYMENT BETWEEN REGIONS OF THE ISLAND OF SUMATRA WITH FD-GMM AND SYS-GMM METHODS

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ABSTRACT

Unemployment is an economic problem that has a direct impact on the welfare of society and the economic stability of a country, including Indonesia. The purpose of this study is to analyze what factors reduce unemployment in the Sumatra Island region using the FD-GMM and Sys-GMM methods, and test the application of Okun's Law in the Sumatra Island region, the variable used are Economic Growth Rate, Foreign Direct Investment, Domestic Investment, School Partcipation Rate, with dynamic data panel regression from 154 regencies/cities during the period 2017-2023 using stata 17 software. The result showed that economic growth had a significant negative effect on unemployment, supporting the application of Okun's Law. However, government capital expenditure shows a significant positive relationship with unwmployment, foreign direct investment (FDI) has a signifcant negative effect, while domestic investment and school participation rate have no significant effect. These findings highlight the need for more effective management of government spending and investment policies that support sustainable job creation in the Sumatra Island region.

INTRODUCTION

Unemployment is a condition where a person who is included in the labor force is looking for a job but has not managed to get one (Sukirno, 2010). Unemployment is one of the main problems in the economy, and is also a global phenomenon,

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esppecially in developing countries. Until now, unemployment is an economy problem that is stiil being researched (Ahmad et al., 2024; Akobi & Ogunmola, 2024; Dunga & Maloma, 2024; Misra et al., 2024), unemployment has a direct impact on the welfare of society and the economic stabilty of a country. A high unemployment rate indicates that a country has not optimally utilized its labor resources and several studies sow the most of the unemployed are young people (Ndlovu et al., 2024; Ndukwu et al., 2024; Uslu & Tatli, 2024; Vilakati et al., 2024).

Unemployment rates in Sumatra Island provinces - Indonesia show different fluctuations and variations, with mixed achievements when compared to the 2023 Regional Medium-Term Development Plan (RPJMD) target. Riau island has the highest unemployment rate at 6.8%, although it is stiil below the regional target of 7.76%. Furthermore, Aceh occupies the second position with and unemployment rate 6.03%, which is above the province's RPJMD target 5.48%. On the other hand, Bengkulu showed the lowest unemployment rate of 3.42%, slightly below the RPJMD target of 3.5%-3.6%. This difference in unemployment rates reflects the uneven employment conditions between provinces in Sumatra, and indicates that there are economic and social factors that affect the achievement of unemployment targets in each region. The fluctuations indicate the need for further research to understand the factors causing unemployment and its impact on welfare and development in each province.

Economic growth and unemployment have a close relationship and often in the opposite direction. As in research (Kamal, 2022; Mohamed, 2024). Which states that the relationship between unemployment and economic growth is not statistically significant, in the long run or short run. And a significant effect in research (Altunöz, 2024; Karadzic, 2021; Louail & Ben Haj Hamida, 2021) in economic theory, especially described in Okun's Law, there is a link between the level of unemployment and the rate of economic growth.

Efforts to reduce unemployment can be done through government spending, which serves as a toolto support economic growth and create jobs. Several studies have shown that government spending can contribute to reducing unemployment (Chukwuemeka, 2022; Falade & Babatunde, 2020). However, in the long run, if not managed efficiently, govern ment spending can actually trigger an increase in unemployment (Abouelfarag & Qutb, 2021). In addition, investment, both domestic and foreign (FDI), is proven to have a major influence in reducing unemployment, especially in developing Asian countries (Hilom-Polinon & Hakim, 2019; Nasution et al., 2020). (Gözen, 2022) Turkey, found and increase in public investment has a positive impact on reducng unemployment i the long run.

Education also plays a key role in addressing unemployment. Vocational secondary education and higher education have been shown to reduce youth unemployment (Mahesh & Hansraj, 2024; Olkeba et al., 2023), as found in Turkey (Bayir & Şahin kutlu, 2019). In additions, entrepreneurship education also has a significant impact on reducing unemployment among university graduates, as found in South Africa (Gamede & Ayodele, 2024).

Based on the background explanation above, this research has several research questions including: 1) is there a dynamic pattern of unemployment between regions on

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the island of Sumatra. 2) What is the effect government spending and investment on reducing unemployment between provinces on the island of Sumatra. 3) Does the Okun's Law theory apply in tne Sumatra region. Thus, this research aims to: First, to prove the dynamic pattern of unemployment rate. Second, to analyze the effect of government expenditure and investment on unemployment rate among regions in Sumatra Island. Third, to prove the occurrence of Okun's Law theory in Sumatra island.

This paper consist of several main sections. The firts section presents the theoretical basis as well as a brief review of previous research relevant to this topict. The second section describes the data used and the methodology applied in the analysis. Next, the third section presents the research results obtained and an analysis of the findings. Finally, the conclusion of the whole study outlines the policy implications that can be taken based on the findings in the Sumatra Island region.

LITERATURE REVIEW

Open Unemployment Level

Open unemployment level when a person does not have a job at all despite actively seeking work. (Alam, 2007) explains that this is often caused by a lack of jobs, a mismatch between educational background and the needs of the labor market, as well as an unwillingness to work. According to William Arthur Lewis'view, economic development in devoloping countries is usually characterized by an abundance of labor, while the demand for labor is limited. This imbalance can exacerbate unemployment, lower the skills of the workforce, and hamper productivity.

Economy Growth

Economic growth refers to the increase in total goods and services produced by an economy over a period of time. To measure the economic growth of a country, the calculation of gross domestic product (GDP) is used. If a country's economic growth increases, this is usually directly proportional to the improvement of people's welfare (Sari, 2021). Economic growth is closely related to the unemployment rate. When the economy grows, there is usually an increase in the production of good and services, which in turn creates more jobs. This relationship is known as Okun's Law, which was first introduced in 1962. According to this theory, an increase in gross domestic product (GDP) is usually followed by a decrease in the unemployment rate (Suparmoko & Bawana, 2007). Some studies support Okun's Law, such as those conducted by (Altunöz, 2024; Karadzic, 2021; Louail & Ben Haj Hamida, 2021). However, other studies, such a those conducted by (Kamal, 2022; Mohamed, 2024), show that Okun's Law does not alwasy apply in some regions. This inconsistency emphasizes the need for futher research to prove whether Okun's Law can be applied in the Sumatra Island region.

Government Expenditure

To reduce the unemployment rate and its impact, fiscal policy is needed that aims to achieve sustainable growth, price stability, and a reduction in unemployment. This approach is highly relevent fpr policymakers, especially in developing countries.

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In addition, the structure of government spanding plays an important role in determining the succes of a country's economic policy. government spanding is the main instrument of fiscal policy that can be used to influence aggregate demand, and this impacts include increased economic growth, job creation, increased national income, and income distribution (Abouelfarag & Qutb, 2021). One type of government spanding is capital expenditure, which is spending allocated to acqueryor improve long-term assets that are expected to provide benefits for more than one year. These capital expenditures are usually significant and include the purchase or construction of buildings, machinery, equipment, as well as the acquisition of land and patents. Some studies show that government spending can reduce the unemployment rate (C. Onuoha & Agbede, 2019; Soukaina, 2023). however, there also other studies that find the opposite, namely government spending actually increase unemployment (Abouelfarag & Qutb, 2021; Nepram et al., 2021). This difference in results suggests the need for further research to understand the conditions and factors that effect unemployment.

Investment

Investment is also a key factor in reducing unemployment. According to Suparmono (2022), investment is an expenditure made by company to support production activities, such as the purchase of machinery, land, and labor. Todaro (2006) adds that investment can increase prodution capacity, create new jobs, and increase national income (Qamariyah et al., 2022). Investment can come from foreign investment (FDI) of domestic investment. Several studies (Abdulai, 2022; Alalawneh & Nessa, 2020; Chike & Okeke, 2024; Hawariyuni & Andrasari, 2022; Nadia & Amri, 2023) show that investment can significantly reduce unemployment. However, the opposite result was also found (Hawariyuni & Andrasari, 2022; Putri & Ash Shidiqie, 2023; Warsame & Mohamed, 2023), which showed that neither FDI nor domestic investment always had an impact on reducing unemployment. This difference in results suggests the need for futher research to understand the conditions and factors that influance how effective government spending is in reducing unemployment.

Education

Education level plays an important role in determining one's employment status. Individuals with higher education usually have a greater chance of abtaining a quality job, thus enabling them to make ends meet better. In addition, higher aducation also helps to lower the unemployment rate. In contrast, those who have a low level of education or did not complete their aducation are more likely to face difficulties in getting a decent job, which in turn can exacerbate the unemployment problem (Nugroho & Arif, 2024), research in turkey by (Bayir & Şahin kutlu, 2019) showed the vocational secondary education can reduse youth unemployment in the long run because it produces job-ready graduates. However, contrary results by (Opuala-Charles & Oshilike, 2023) found that education actually increases unemployment. This finding confirms the importance of adjusting education to match the need of the world of work.

RESEARCH METHODS

The types and sources of data used in this study are quantitative secondary data.

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This study uses Dinamic panel regression analysis, namely regression using data in the form of cross section with 154 districts/cities in the province of Sumatra island region and time series from 2017-2023. The secondary data of this study comes from BPS, SIKD Data Portal-Ministry of Finance, One-Stop Investment and Integrated Services Office (DPMPTSP), Investment Coordinating Board (BKMP). And this research was conducted with Stata 17 software. The variables used in study are: Growth Rate (LPE), Capital Expenditure After Log (BM), Foreign Investment After Log (PMA), Domestic investment After Log (PMDN), School Participation Rate (APS).

Panel Data Regression

Data with panel characteristic are data that have a combination structure between time series and cross section. This type of data can be obtained, for example, by observing a number of individuals or objects (cross section) at several specific time periods in sequence (Ariefianto, 2012). Data were obtained from 154 districts/cities observed over a period of 7 years, resulting in 1.078 observations. There are two types of panel data residual modeling, namely:

Fixed Effect Model (FEM) is one of the panel data regression models that considers the differences in effects between fixed individuals. The difference is considered an unknown parameter but can be estimated using the least square dummy technique. The statistical equation for this model can be formulated as follows (Rusiadi et al., 2024):

$$y_{it} = \alpha + \beta_j X_{it} + \sum_{i=1}^{n} D_i^c \alpha_i + \varepsilon_{it}$$

The Random Effect Model (REM) has fundamental differences compared to the fixed effect model. One of the main differences is that the specific effect of each a_i is considered as part of the error component. This effect is random and uncorrelated with the observed explanatory variable, X_{it}. Therefore, the equation for the random effects model is expressed in a different form. (Rusiadi et al., 2024):

$$y_{it} = a_i + \beta_j x_{it} + E_{it}$$
$$E_{it} = (\mu_{it} + v_t + w_{it})$$

Notes: $\mu_i \sim N\left(0, \delta_\mu^2\right) =$ represents the cross-section error; $v_i \sim N\ (0, \delta_v^2)$ = represents the time series error; $w_{it} \sim N\ (0, \delta_w^2) =$ is the combanation of boath errors.

In choosing the best model, it is done through the Hausman test. If the probability value is less than 0,05, then the Fixed Effect Model (FEM) model is considered the most appropriate. However, if the probability value is greater than or equale to 0.05, then the Random Effect Model (REM) model is more appropriate (Rusiadi et al., 2024).

In economic reserch, dynamic panel models are often used because teh analysis of economic variables cannot rely solely on cross-section data. This kind of research requires observing the behavior of the research unit over various time periods. The dynamic relationship in the panel data model is indicated by adding a lag of the dependent variable between the independent variables (Zuhroh & Amir, 2021). In research (Roni & Hidayat, 2020; Rusiadi et al., 2024) the dynamic panel data regression model by Baltagi (2005) is as follow:

$$y_{it} = \delta y_{i,t-1} + \acute{x}_{it}\, \beta + \mu_{it}$$

where δ denotes a scalar, $\acute{x}_{it}$ donetes a $k \times 1$ matrix. In this case μ_{it} assumed to follow

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a *one way component error* model as follows:

$$\mu_{it} = \varepsilon_{it} + u_{it}$$

μ_{it} is the individual effect, while ε_{it} the error term. Both are assumed to be $\mu_i \sim IID\ (0, \sigma_\mu^2)$ and $\varepsilon_{it} \sim IID\ (0, \sigma_\varepsilon^2)$.

By combining the two components, the following dynamic panel equation is formed:

$$y_{it} = \delta y_{i,t-1} + \acute{x}_{it}\,\beta + \varepsilon_{it} + \mu_{it}$$

The application of the equation for model etimation in this study is as follows:

$$Y_{it} = \alpha + \beta_1 Lag\ Y_{it} + \beta_2 LPE_{it} + \beta_3 BM_{it} + \beta_4 PMA_{it} + \beta_5 PMDN_{it} + \beta_6 APS_{it} + u_{i,t}$$

In the book (Zuhroh & Amir, 2021) according to firdaus 2011, there the several criteria used to find the best dynamic model or GMM, namely:

The instrument is valid. The meaning of valid is if there is no correlation between the instrument and the error component. The Sargan test is test used to test the validity of the model. The null hypothesis of the Sargan test states that the instrument has no problem with validity (the instrument is valid). The instrument will be valid if the Sargan test cannot reject the null hypothesis.

Consistency. The autocorrelation tet in the GMM approach is used to determine the consistency of the estimation results. The estiamtion results will be consistent if m_1, indicates the null hypothesis is rejected and m_2 indicates the null hypothesis is not rejected.

Unbiased.Estimation result from PLS are biased upward and estimators from fixed effect (FE) are biasseddownwards. Unbiased estimation results are between PLS and FE.

RESULTS AND DISCUSSION

Tabel 1
Panel Model Static And Dynamic Result

Item	FEM	REM	FD-GMM	Sys-GMM
LPE	-.13513978***	-.13655756***	-.16220929***	-.16850664***
	(0. 0130)	(0.0131)	(0.0150)	(0.0164)
BM	-.05744016	.0852389	.45673084*	.61888214**
	(0. 2063)	(0.2017)	(0.2062)	(0.2231)
PMA	-.02595632*	-.02382874*	-.03866105**	-.03381356*
	(0. 0114)	(0. 0114)	(0.0135)	(0.0143)
PMDN	.02234509	.03459258	-.00647911	-.0167952
	(0. 0185)	(0.0182)	(0.0166)	(0.0190)
APS	-.00135514	.00551095	-.00223987	.00524757
	(0. 0069)	(0. 0066)	(0.0074)	(0.0069)
U_{t-1}	-	-	.25154311***	.48223828***
			(0.0684)	(0. 0366)
Uji Hausman	0.000			
Uji Sargan (Prob)	-	-	0.0038	0.0000
Prob m_1	-	-	0.0000	0.0000
Prob m_2	-	-	0.5716	0.7383

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R^2	0.0146	0.0352	-	-
N	1.078	1.078	1.078	1.078

*Notes: heteroskedasticity robust standard errors are shown in parentheses. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Source: Results of Data Processing (STATA 17)*

To prove the dynamic pattern of unemployment, it can be seen from the lag-Y variable (U_{t-1}) in the equation. Based on Table 1, this variable is significant at the 0.1% level for both analysis methods, namely FD-GMM and Sys-gmm, with coefficients of 0.2515 and 0.4822, respectively. This positive ceofficient indicates thst unemployment in the previous period affects unemployment in the next priod positively, meaning that if unemploymentin the past increases, then unemployment in the present tends to increase. This proves the existence of a dynamic pattern of unemployment, which indicates that unemployment conditions are interrelated between periods and requires policies tha focus on breaking this chain of effects.

Furthermore, the result of the static panel test, based on the Hausman test, there is a prob of 0.0000 < 0.05, which means that the best model chosen is the Fixed Effect Model (FEM). The results of the FEM model analysis show that economic growth has a coefficient of -.13351, which means that every 1% increase in economimc growth can reduce unemployment by 0.0135%, and has a significant negative effect at the 0.1% level statiscally. For government expenditure, the government capital expenditure section does not have a significant effect. Foreign Direct Investment (FDI) show a significant negative effect at the 5% level, where a 1% increase can reduce unemployment by 0.0259%. on the other hand, Domestic Investment has no significant effect on unemployment and School Participation Rate has no significant effect. Therefore, tha variabel of Capital Expenditure, School Participation Rate and Domestic Investment are not considered to contribute in reducing the unemployment rate.

Base on the Table 1, it can be seen the the Sargan test prob value of FD-GMM is 0.0038 < 0.05, so (reject H_0), and the prob value of Sys-GMM is 0.0000 < 0.05, so (reject H_0), thus, both models indicate that the instrument is invalid and there is correlation between the instrument and the error component. Before proceeding to the Arellano –Bond test, robust mode must be used firts. In the Arellano –Bond test, the probability of the firts derivative (m_1) must be smaller than 0.05, while the probability of the second derivative (m_2) must be greater than 0.05. in this case, the probability value of m_1 for FD-GMM is 0.0000 and for Sys –GMM is also 0.0000, which are both smaller than 0.05. Meanwhile, the probabilty value of m_2 for FD-GMM is 0.5716 and for Sys-GMM is 0.7383, both of which are greater than 0.05. This indicates that the estimators used are consistent. Therefore, the results of the robust model will be applied to analyze unemployment from dynamic perspective.

Tabel 2
Dynamic Panel Unbiasedness Test

Variable	FEM	FD-GMM	Sys-GMM	CEM
Tpt				
L1.	.29579146***	.25154311***	.48223828***	.87463482***

Source: Results of Data Processing (STATA 17)

Based on the analysis results, the lag 1 coefficient value of open unemployment

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rate in the FD-GMM model is smaller than that in the FEM model, so it does not meet the unbiasedness requirement because ideally the value is between the lag 1 coefficent values in the FEM and CEM models. In contrast, the lag 1 coefficent value in the Sys-GMM model is between the FEM adn CEM coefficient values, so it meets the unbiasedness requirement. Although the Sargan test show that the instrument is invalid, the Arellano-Bond test results remain consitent, thus supporting the reliability og the Sys-GMM model. The Sys-GMM model is considered more efficient and suitable to be used for analysis and discussion.

Furthermore, the Sys-GMM dynamic panel variable show taht the rate of economic growth has a negative effect with a parameter coefficient of -0,1685 and is significant reduction of unemployment, which means that every 1 percent increase in economic growth reduces the unemployment rate by 0,1685 percent. While proving Okun's law applies in the Sumtra Island region. Economic Growth has an inverse relationship with thw unemployment rate. When the economic growth rapidly, the number of unemployment tends to decrease. This happens because economic growth encourages activity in various sectors, increases production, and creates of unemployed people decreases (Baihawafi & Sebayang, 2023). The theory proposed by Arthur Okun, known as Okun's Law, states that the higher the economic growth. The lower the unemployment rate, and vice versa (Kuncoro, 2018). This significant effect at the 0.1 percent level confirms the important role of economic growth in creating jobs and reducing unemployment. This finding is in line with the reasearch of (Amidžić et al., 2022; Louail & Ben Haj Hamida, 2021) which show that the relationship between GDP growth and unemployment rate is negative and significant at the 1 percent level.

The government expenditure varible for Capital Expenditure has a positive effect with a coefficient of 0.6188 at the 1% significance level on the unemployment rate in the Sumatra Islan region. This means that the greater the government capital expenditure, the higher the unemployment rate. There is positive relationship between the unemployment rate and government spending inthe short term. This means that, i the short term, government spending can actually worsen the unemployment rate because it can reduce opportunities for the private sector to invest or create jobs (Saraireh, 2020). Capital Expenditures made in the current year are usually still in the procurement or devolopment stage. Therefore, the capital expenditures does not directly create new jobs in the same year, so it cannot directly reduce unemployment. However, in subsequent years, the impact begins to be felt, such as the creation of new jobs that help reduce unemployment. In other word, there is time lag between capital expenditure and its results in reducing unemployment (Yenie, 2023). This finding in line with research (Abouelfarag & Qutb, 2021; Nepram et al., 2021). However, this finding contradicts research that increased government spending contributes to lower unemployment (C. Onuoha & Agbede, 2019; Soukaina, 2023).

Furthermore, the varible of Foreign Direct Investment (FDI) negatively influences the unemployment in Sumatra Islan with the coefficient value -0,0338 at 5% significance level. This means that every 1% increase in FDI will reduce the unemployment rate 0.0338%. this show that FDI plays a role in creating jobs and encouraging economic growth, which in turn helps reduce unemployment. The Sumatra Island region has a good investment environment, which attracts investors to invest. As

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more investors invest, the number of industries built will increase. This can directly create more employment opportunities and absorb local labor (Putri & Ash Shidiqie, 2023), this finding is in line with reseasrch (Atilaw Woldetensaye et al., 2022; Chike & Okeke, 2024; Ikani, 2024).

Meanwhile, the Domestic Investment variable has a negative effect wth a coefficient -0.0167 but is not sicnificant, this show that there is no evidence that domestic investment can effect unemployment in the Sumatra Island region and is not one of the factors in reducing unemployment. In the research (Putri & Ash Shidiqie, 2023) Astrid & Soekapdjo said this is because most of the Domestic Investment is mostly directed to capital-intensive sectors, so its cotribution to labor absorption is veru limited. Capital-intensive sectors tend to allocate more investment in technology, resulting in less need for labor as most jobs are replaced by the use of technology, for example, the processing industry, Sumatra is famous for processing palm oil, rubber, and mining materials. This processing often uses modern technology and automation for afficiency, so it absorbs less labor (Anggraini, 2021). This finding is in line with research (Hawariyuni & Andrasari, 2022; Putri & Ash Shidiqie, 2023), however some studies (Nadia & Amri, 2023; Putri & Ash Shidiqie, 2023) contradicts that domestic investment is influential in reducing unemployment.

Likewise, the education variable in the School Participation Rate section in Sumatra Island has a positive effect on unemployment, with a coefficient value 0.0052, but the results are not significant. It can be concluded that an increases in the School Participation Rate. Open unemploymet is a condition where a person does not have a job, which generally occurs due to limited employment opportunities or a mismatch skill and indstry needs. The School Participation Rate does not have a significant impact on the unemployment rate because the education taht is taken is often not in accordance with thw skill needed in the world of work. When more people go to school , but the specialization of the work force is limited or not in accordance with their expertise, this can actually increase the unemployment rate (Selmin & suyanto, 2024). This finding is in line with (Opuala-Charles & Oshilike, 2023), who found that education has no impact on reducing unemployment. However, research (Bayir & Şahin kutlu, 2019) different results, where education has a significant effect on the unemployment rate in Turkey.

CONCLUSION

Based on results of this study, the Sys-GMM approach is proven to be superior to FD-GMM in modeling unemployment bet ween region og Sumatra Island. This study anliyzed the effect of government spending, investment on unemployment in Sumatra Island during 2017-2023. The finding show that economic growth has a significant negative effect in reducing unemployment, supporting Okun’s Law. However, inefficient government capital exenditure inreases unemployment, while Foreign Direct Investment (FDI) plays a significant role in reducing the unemployment rate. In contrast, domestic investment and school enrollment rate have significant impact.

This finding confirms the importance of effective public expenditure manageme nt and investment polices that focus on sustainable job creation. And suggest that policy makers pay more attention to efficiency in the use of capital expenditure in order to

create more effective employment. In addition, investment policies need to be more focused on sectors that have a direct impact on reducing unemployment education and aligning education with labor market nLeeds. Future researchers are advised to use variables that effect the unemployment rate, apart from the variables in this study.

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