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GENERAL MANAGEMENT

An Analysis On Inequality, Economic Growth, And Unemployment In Sumatera Island

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Abstract

This study analyzed the relationship between inequality, economic growth, unemployment (endogenous variables), and other exogenous variables affecting the relationship. The panel data included 154 cities and regencies in Sumatera Island of Indonesia for ten consecutive years (2011-2020). Data were analyzed using simultaneous equations models for econometrics. Our findings confirmed (1) a negatively correlated, significant, and simultaneous two-way relationship between inequality and growth and (2) a negatively correlated and significant two-way causality between economic growth and unemployment. However, the relationship between inequality and unemployment was not significant. The limitation of the study was that it only used a simultaneous approach using three equations (inequality, growth, and unemployment); hence, other models may be developed using the other endogenous variables. Our findings will be helpful to make better policies to reduce inequality and unemployment and encourage economic growth, especially for the local governments in Sumatera Island.

Keywords: *inequality, economic growth, unemployment rate, Sumatera Island*

Introduction

Economic development has primary goals of highest growth, eradicating poverty, and reducing income inequality and unemployment (Todaro and Smith, 2006). Economic growth is the foundation to increase national income, yet it does not always reduce poverty. Thus, policies focusing on growth only solve some development problems (Klasen, 2005).

The income inequality between regions is a universal problem—inequality is always present in all classes of society—due to the different potentials of regions. Although regional and distributional inequality is natural, universal, and unavoidable, these can be changed through proper development and policies (Kuncoro, 2004). Shankar and Shah (2003) mention that regional inequality exists in many countries, especially countries with geographically and juridically vast areas.

Previous studies suggest that development inequality between regions in Indonesia is higher than that of developed countries. Inequality is even higher than in other developing countries (Akita, 1988). Williams et al. (2003) mention that regional disparity is one leading cause of income distribution inequality. Indonesia has 34 provinces with high differences in economic structures due to varied endowment factors. This has led to a disparity in the regional economic performance caused by different economic growth—rich provinces with abundant endowment factors will have better growth compared to those with low endowment factors.

Indonesia's Gross Domestic Product (GDP) reached IDR 10,722 trillion in 2020, while Indonesia's GDP per capita was IDR 39,557 million. The Gross Regional Domestic Product (GRDP) per capita value between islands in Indonesia is different (see Table 1). Between 2016-2020, only two islands with GRDP per capita above GDP, namely Kalimantan and Java. Meanwhile, other islands have GRDP per capita below GDP per capita. Kalimantan Island has the highest GRDP per capita, IDR 53,560 million in 2020, while Bali and Nusa Tenggara have the smallest GRDP per capita of IDR 20.576 million.

Aspect	Island						Indonesia
	Sumatera	Jawa	Bali and Nusa Tenggara	Kalimantan	Sulawesi	Maluku and Papua	
Economic Growth (%)							
2016	4.28	5.60	5.91	2.00	7.41	7.41	5.03
2017	4.28	5.62	3.69	4.34	6.95	4.89	5.07
2018	4.52	5.70	2.67	3.84	8.95	6.98	5.17
2019	4.55	5.48	5.03	4.99	6.96	-7.44	5.02
2020	-1.19	-2.51	-5.01	-2.27	0.23	1.44	-2.07

GDP/GRDP (IDR Billion)							
2016	2,044,984	5,545,720	291,499	807,896	563,958	244,777	9,434,613
2017	2,132,579	5,857,508	302,267	842,972	603,147	256,751	9,912,928
2018	2,229,071	6,191,172	310,351	875,369	657,105	274,669	10,425,852
2019	2,330,579	6,530,684	325,950	919,007	702,810	254,246	10,949,038
2020	2,302,731	6,367,054	309,626	898,174	704,423	257,903	10,722,443
GDP/GRDP per Capita (IDR Thousand)							
2016	36,440	37,809	20,385	51,672	29,724	34,957	36,469
2017	37,446	39,531	20,861	52,937	31,383	35,987	37,851
2018	38,589	41,375	21,145	54,002	33,764	37,800	39,341
2019	39,798	43,232	21,930	55,725	35,676	34,369	40,843
2020	38,808	41,765	20,576	53,560	35,338	34,260	39,557
Unemployment Rate (%)							
2016	5.43	6.16	3.02	5.51	4.21	4.78	5.61
2017	5.20	6.00	2.69	5.04	4.94	5.41	5.50
2018	5.11	5.86	2.59	4.70	4.45	4.54	5.30
2019	5.04	5.77	2.68	4.61	4.24	4.77	5.23
2020	6.14	8.09	4.69	5.52	5.45	5.50	7.07

Table 1: Economic Growth, GRDP, GRDP per Capita, and Unemployment Rate of Islands in Indonesia from 2016 to 2020
Source: Gross Regional Domestic Product of Provinces in Indonesia according to Business Fields 2016-2020, 2021, and the Workforce of Indonesia August 2020, 2020 (data analyzed)

The different GRDP per capita between islands indicates inequality or disparity between regions. The economic growth level and unemployment rate between regions also vary. Güçlü (2017) confirms that unemployment is the essential indicator for the economy at the macro level. Sumatera Island is one of the islands with GRDP per capita lower than GDP per capita from 2016 to 2020. The island's economic growth was relatively under the national average rate in those years. The island also had a high average unemployment rate of 4.38%, and the figure is close to the average unemployment rate of Indonesia of 5.74%. These confirm that Sumatera Island has experienced a slowdown in its economic growth and faced unemployment problems.

Inequality not only happens between islands in Indonesia but also between provinces in Sumatera Island. Economic growth and unemployment rates between provinces in Sumatera Island tend to vary from 2016 to 2020—there were regions with prolonged growth (on average 1%), while some regions showed growth by 6%. The same situation applied to unemployment—some regions showed an unemployment rate under 3%, while others showed a figure of more than 10% from 2016 to 2020. The data are presented in Table 2.

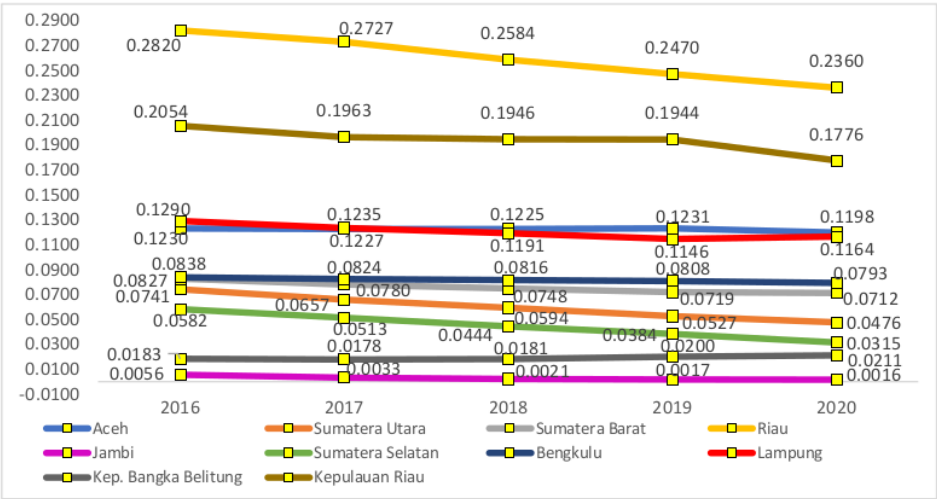
No.	Province	Economic Growth (%)					Unemployment Rate (%)				
		2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
1	Aceh	3.29	4.18	4.61	4.14	-0.37	7.57	6.57	6.34	6.17	6,59
2	Sumatera Utara	5.18	5.12	5.18	5.22	-1.07	5.84	5.60	5.55	5.39	6,91
3	Sumatera Barat	5.27	5.30	5.14	5.01	-1.60	5.09	5.58	5.66	5.38	6,88
4	Riau	2.18	2.66	2.35	2.81	-1.12	7.43	6.22	5.98	5.76	6,32
5	Jambi	4.37	4.60	4.69	4.37	-0.46	4.00	3.87	3.73	4.06	5,13
6	Sumatera Selatan	5.04	5.51	6.01	5.69	-0.11	4.31	4.39	4.27	4.53	5,51
7	Bengkulu	5.28	4.98	4.97	4.94	-0.02	3.30	3.74	3.35	3.26	4,07
8	Lampung	5.14	5.16	5.23	5.26	-1.67	4.62	4.33	4.04	4.03	4,67
9	Bangka Belitung	4.10	4.47	4.45	3.32	-2.30	2.60	3.78	3.61	3.58	5,25

10	Kepulauan Riau	4.98	1.98	4.47	4.84	-3.80	7.69	7.16	8.04	7.50	10,34
Sumatera		4,28	4.28	4.52	4.55	-1.19	5.43	5.20	5.11	5.04	6.14
Indonesia		5,03	5.07	5.17	5.02	-2.07	5.61	5.50	5.30	5.23	7.07

Table 2: Economic Growth and Unemployment per Province in Sumatera Island from 2016 to 2020
Source: Gross Regional Domestic Product of Provinces in Indonesia according to Business Fields 2016-2020, 2021, and the Workforce of Indonesia August 2020, 2020 (data analyzed)

Inequality can be written using Williamson Index—the regional inequality is high if the value of the index is getting closer to 1, and the regional inequality is low if the value of the index is getting closer to 0. The regional gap of provinces in Sumatera Island was relatively high. Some provinces like Riau and Kepulauan Riau have a high index (more than 0.2). In contrast, other provinces have a low index, like Jambi (on average 0.001) and Kepulauan Bangka Belitung (approximately 0.02), as presented in Figure 1.

The geographic and demographic situation of each region determines the regional inequality, ultimately affecting economic growth. The population of each province in Sumatera Island also varies. Some regions have a big population, like Sumatera Utara Province with 14,798 million people, while some regions have a small population, like Kepulauan Riau with only 1,469 million people. Each province also has a different GRDP per capita. Kepulauan Riau became the province with the highest GRDP per capita from 2016 to 2020 with an average value of IDR 80.471 million, while Bengkulu had the lowest GRDP per capita with only IDR 22.999 million. Only three provinces in Sumatera Island had an average GRDP per capita higher than Sumatera Island's average GRDP per capita. The three provinces were Kepulauan Riau, Riua, and Jambi. The significant difference in the economy among regions in Sumatera Island indicates inequality in regional development.



Source: From Indonesia in Statistics 2017-2021, 2017-2021 (data analyzed)
Figure 1: Williamson Index of Provinces in Sumatera Island 2016-2020

Inequality has always been an interesting topic (Stiglitz, 2012), even for world leaders, including the United Nations (UN), the World Bank, and the United States of America (USA). Reducing inequality has become one of the Sustainable Development Goals (SDGs) after the development agenda of the UN in 2015, and now the focus has shifted from fighting poverty to fighting inequality (Wei, 2017). In line with the global consensus, the government of Indonesia has committed to realizing SDGs by stipulating Presidential Regulation Number 59 of 2017 on the Implementation of Achieving Sustainable Development Goals. One of the 17 goals in SDGs is to reduce inequality (Goal 10). The commitment shows that the government of Indonesia has put effort and attention into inequality.

Regional inequality will continue and even increase if the government takes no real action to reduce inequality from fiscal and income distribution perspectives (Wardhana et al., 2013). Inequality will negatively impact economic growth and social welfare (Alesina and Rodrik, 1994). Some empirical studies on the effect of economic growth and unemployment on inequality reveal the strong relationship between the three variables. Lundberg and Squire (2003) and Huang et al. (2009) prove that simultaneously inequality and growth negatively affect each other. Chemli and Smida (2013) have found that economic growth and inequality go in different directions. Easterly (2007) also confirms the significant and negative relationship between economic growth and inequality in the long term.

Lessmann (2009) also reveals that the high unemployment rate leads to higher regional inequality. Tamai (2009) confirms that inequality and unemployment are positively correlated. Thayaparan (2014) reveals a two-way causality between economic growth and unemployment. Similar findings have been confirmed by Kizys and Pierdzioch (2009) and Ahmed and Wahid (2011). Martin and Rogers (2000) report the negative and significant effect of unemployment on economic growth in industrial countries in Europe.

Unemployment and economic growth are both crucial in formulating economic and social policies. Economic growth is the most critical indicator in achieving macroeconomic targets for developed and developing countries. Unemployment is a critical social indicator. Those variables are crucial because they have considerable power to affect the economy and social life (Soylu, 2018). Thus, economic growth and unemployment must be considered in reducing inequality, not excluding the same efforts in Sumatera Island.

Based on the explanation above, this paper aims to:

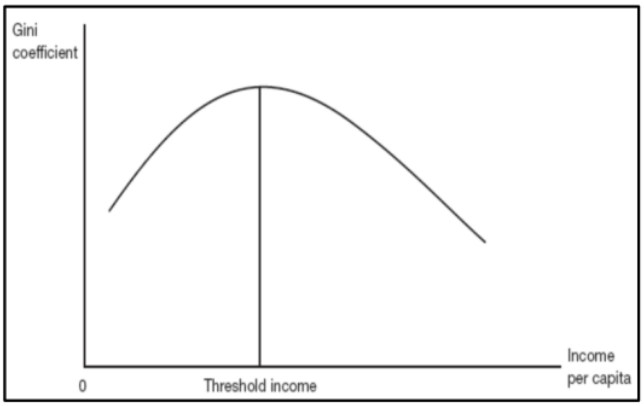
Analyze and empirically prove the effect of economic growth, unemployment rates, fiscal decentralization, population, trade, primary sectors, natural resources, and regional expansion on the inequality of cities and regencies in Sumatera Island.

Analyze and empirically prove the effect of inequality, unemployment, workforce, and investment on the economic growth of cities and regencies in Sumatera Island.

Analyze and empirically prove the effect of inequality, economic growth, education, and inflation on unemployment rates of cities and regencies in Sumatera Island.

Literature Review And Hypothesis Development

The foundation for regional inequality analysis is the neo-classic hypothesis. The hypothesis states that at the initial development stage of a country, regional inequality tends to be high, and this will happen until inequality achieves the divergence point (Todaro and Smith, 2006). This theory first appeared in 1995 from observing regional disparity as a relationship between economic growth and per capita income depicted in a U-shaped relationship curve. At the initial development stage, household income tends to be distributed unequally, yet after a certain point, the distribution will be more even (Kuncoro, 2006).



Source: Hossain, 2013
Figure 2: Kuznets Curve

Figure 2 depicts that further economic growth tends to create more considerable inequality at low-income levels before the development reaches a certain threshold of income levels. When this threshold is achieved (peak of the curve), income inequality decrease along with economic growth. In other words, at the initial development stage, poor countries may expect reduced inequality after they reach the threshold of income levels (Hossain, 2013).

Williamson (1965) reveals results similar to the hypothesis proposed by Simon Kuznets that analyzes income inequality within a spatial dimension or income inequality among regions at the per capita income level. Using the weight coefficient of variance of the Williamson Index, he reveals the systematic relationship between economic growth and regional disparity. Adelman and Morris (1973) confirm a similar finding using cross-section data. They conclude that a negative relationship exists between economic growth and social welfare. It is further stated that social welfare tends to be inequal at the initial development stage, yet inequality will decrease along with further development.

Improvement in income distribution along with further development is closely related to conditions of fundamental changes that are structural in nature. The Lewis Model explains that initial growth will center in modern industrial sectors with limited employment yet high wages and productivity. The Kuznets Curve can result from sustainable development stemming from the expansion of the modern sectors along with the development of the country's economy from the traditional to the modern economy. The underdeveloped economy consists of two sectors, namely:

The traditional sector is the rural subsistence sector, which is overpopulated and characterized by the marginal productivity of labor equal to zero. This is a condition of surplus labor. If some workforces are withdrawn from the agricultural sector, the sector will not lose its output.

The industrial sector is the modern urban sector with high productivity and homes to workforces transferred little by little from the sub-system sector.

The main focus of this mod[5] is on shifting workforces, output growth, and increasing employment in the modern sector. Workforce shifting and increasing employment are possible with the expansion of output in the modern sector (Todaro and Smith, 2006).

Myrdal (1957) explains regional inequality by building a theory of underdevelopment and economic development around regional inequa[2] at the national and international levels. As an illustration, the spread effect and backwash effect are used as propagation influences from the growth center to the surrounding area. The spread effect is defined as a favorable effect, which includes the flow of investment from growth centers to surrounding areas. The backwash effect is defined as an infavorable effect, which includes the flow of people from the surrounding area, including the flow of capital to the center, resulting in reduced development capital for the surrounding areas that are actually needed to balance the development of the center. Furthermore, it is argued that regional inequality occurs due to the significant backwash effect compared to the spread effect in underdeveloped countries.

Three popular measures are generally used to measure regional inequality: the Coefficient of Variation (CV), the Gini Coefficient, and the Theil Index (Fan & Sun 2008; Li & Wei 2010). Statistically, the Williamson Index is a coefficient of variation originally used in Jeffrey G. Williamson's study to measure regional development inequality. The Williamson Index uses the value of Gross Regional Domestic Product (GRDP) per capita as the primary data because it compares the level of development between regions and not the level of income distribution between groups of people.

[3]Theories linking growth and inequality assume that inequality impacts growth directly and indirectly through investment and physical and human capital accumulation. Inequality reduces growth when credit markets are imperfect, or high inequality creates barriers to productive investment in human and physical capital, especially among the poor. Worsening inequality raises birth rates, reduces investment in human capital, and weakens [3]omestic demand; it also increases pressure to increase government redistributive tax policies (median voter model) and social tensions and leads to an unstable socio-political environment (Thomas, 2009). High inequality can slow down growth, leading to undesirable social and economic impacts (Birdsall, 2000; Cornia and Court, 2001). Conversely, lower inequality can accelerate growth, as the poor earn higher incomes and share more in total growth (Ravallion, 1997).

The Harris-Todaro Model can also explain inequality and unemployment. Harris and Todaro (1970) state that inequality will increase along with initial urbanization, but it will decrease. The urbanization process is related to increasing unemployment when the available employment is less than the available workforce, even if employment grows in urban areas. Urban unemployment eventually will result in higher urban inequality. In line with the Harris-Todaro Model, Castells-Quintana and Royuela (2012) confirm that unemployment tends to cause inequality. Thus, high unemployment negatively affects long-term growth.

Harris and Todaro (1970) predict that high levels of inequality will lead people to migrate and find work, which results in higher unemployment. Therefore, Nickell (1990) concludes that persistently high unemployment is associated with higher poverty rates and higher inequality, as the unemployed proportionately lose more than those employed.

Sjafrizal (2018) mentions some factors causing inequality. First, it deals with the natural resources each region has. Different natural resources lead to different production capacities. Regions with abundant natural resources will find it easier to increase production activities with relatively smaller costs than regions with little natural resources.

Second, it deals with geographical conditions of regions related to population growth and structure, health and education levels, available employment, behavior and custom, and work ethic of the people. Regions with better demographic conditions will surely excel in productivity, eventually leading to increasing investment. Increasing investment will improve employment and economic growth. On the other hand, Adelman and Morris (1973) state that one factor causing inequality in income distribution in developing countries is high population growth that decreases per capita income.

Third, it deals with poor mobility of goods and services, including inter-regional trade activities and migration, whether sponsored by the government (transmigration) or spontaneous migration. People find it hard to sell excess production in their region to other regions in need with poor mobility. As a result, economic inequality between regions will tend to be higher because regions cannot benefit each other. Thus, it is difficult for underdeveloped regions to encourage their economic activities. The Hecksher-Ohlin theory also mentions that factor price equalization will be disrupted if international and interregional trade activities do not run well. As a result, regional development processes will be hampered, and the development disparity between regions will be high. Meanwhile, the investment allocation between regions will affect development inequality between regions because investment is one of the main factors determining the regional development process.

Fourth, it deals with development funds and government systems. If the system is decentralization or autonomy, the government will allocate more investment to regions to reduce regional disparity. Oates (1972) mentions that fiscal decentralization can create effectiveness and efficiency to stimulate growth and changes of the economic structure and reduce regional inequality. Akai and Sakat (2005) reveal that fiscal decentralization can improve public sector efficiency and reduce regional inequality. Rodríguez-Pose et al. (2009) mention that fiscal decentralization leads to significant changes leading to equality and welfare because local governments are closer to the people and know the people better to make policies suitable for their region. Thus, local governments achieve a more efficient allocation function.

Fifth, it deals with higher economic activities in certain regions leading to higher inequality because development runs faster in regions with high economic activities. The economic activities can be measured using Location Quotient (LQ) or Industrial Concentration Index (ICI).

On the other hand, regional disparity and regional development delays can be triggered by regional expansion. Sjafrizal (2018) reveals that regional expansion causes economic and government activities in the new expansion areas to be delayed or cannot be carried out properly due to limited funding sources and the relatively low quality of human resources. On the other hand, the old areas have drastically

decreased their economic activities because most of their potential happen to be in the new expansion areas. However, this does not mean that regional expansion only has a negative impact—it indeed has many positive impacts on the development of the new autonomous region.

Kuznets (in Jhingan, 2004) defines economic growth as a long-term increase in the ability of a country to provide more types of economic goods to its population; this capability grows with advances in technology and the institutional and ideological adjustments it requires. Susanti et al. (2007) state that economic growth represents the extent to which economic activities will generate additional income for the community in a certain period. Economic activities refer to using production factors to produce output, resulting in recompense for the community's production factors. It is expected that the community, as the owner of the factors of production, can increase their income along with economic growth.

One growth model that contributes to neoclassical growth theory is the Solow Growth Model. The Solow Neoclassical Growth Model develops from the Harrod-Domar formulation by adding a second factor, namely labor, and introducing a third independent variable, namely technology, into the growth equation. However, unlike the Harrod-Domar model, which assumes constant returns to scale with standard coefficients, Solow's Neoclassical Growth Model adheres to the concept of diminishing returns to scale from labor and capital inputs if they are analyzed separately. Solow also uses the assumption of the fixed yield scale. Solow and other theorists assume that technological progress is determined as a residual factor to explain economic growth in the long run, and the high and low growth itself is exogenous or not influenced by other factors. Solow's Neoclassical Growth Model uses the standard aggregate production function, namely:

$$Y = K^{\alpha}(AL)^{1-\alpha} \qquad (1)$$

Y represents Gross Domestic Product, K represents physical and human capital stock, L is labor, and A is labor productivity, whose growth is determined exogenously. Since technological progress is determined exogenously, Solow's Neoclassical Model sometimes called the exogenous growth model. The symbol represents the elasticity of output to capital (or the percentage increase in GDP from a 1% increase in physical capital and human capital). It is usually calculated statistically as the share of capital in the calculation of a country's national income (Todaro and Smith, 2006).

The relationship between unemployment and economic growth in economic theory is known as Okun's law, introduced by Arthur Okun (1962). Okun's law states that there is a linear negative relationship between unemployment and economic growth, in which a 1% increase in the unemployment rate will cause a decrease in economic growth by 2% or more (Prachowny, 1993). In his study, Okun reveals that if GDP grows rapidly, there will be a decrease in the unemployment rate, and if growth is very low or negative, then the unemployment rate will increase, and if the growth is the same as potential, then the unemployment rate will remain unchanged (Makaringe and Khobai, 2018).

The main impact of unemployment on the economy is a loss of production and worsening income distribution. Unemployment indicates unused human resources; this is a form of wasting resources. Existing yet unused resources for the production process will result in economic output not being at its optimal valu (Dornbusch et al., 2011). Thomas (2009) writes that work is the most sustainable way to reduce poverty, and job creation is the key to inclusive growth. According to Castells-Quintana and Royuela (2012), persistently high unemployment rates, accompanied by increasing inequality, can be a negative determinant of economic growth.

Unemployment is one of the main subjects of macroeconomics (Romer, 2012). Unemployment is one of the components in the workforce, namely those who are not working, ready to work, and in an active effort to find work but have not found work for a specific time (International Labor Organization, 1982). Dornbusch et al. (2011) classify unemployment into two: short-term, related to the job search process, and long-term unemployment, indicating problems in the economy.

Keynesian viewed that the labor market is not always in equilibrium. Unemployment is a phenomenon of market imbalance, a condition when there is an excess labor supply. The imbalance is caused by wages determined by intervention from outside the market; this wage is called wage rigidity. The intervention usually causes the wage level to become above the market equilibrium wage. There are four forms of wage intervention: employment contracts, minimum wage regulations, labor unions, and Efficiency Wage Theory. The Efficiency Wage Theory says that a high wage level (above the market equilibrium) will increase labor productivity. It assumes that providing high wages is more profitable for the company when compared to the costs incurred (Romer, 2012).

The relationship between inflation and unemployment is a central theme of macroeconomics. A study by Philips (1958) on the British economy during 1861-1957 showed a negative and non-linear relationship between the increase in the wage rate or inflation and unemployment. Keynesian economists adopted the findings to explain the trade-off between inflation and unemployment. Reducing unemployment means increasing inflation (Rahardja and Manurung, 2008). In line with this, Dernburg and Muchtar (1992) suggest that the Philips Curve provides an idea of the trade-off between unemployment and inflation. If the desired inflation rate is low, there will be a very high unemployment rate. Conversely, if the desired inflation is high, there will be a relatively low unemployment rate.

Based on the Philips Curve, Philips (1958) described the relationship between unemployment and inflation based on the assumption that inflation reflects an increase in aggregate demand. Demand theory says that if demand increases, prices will also increase. With high prices (inflation), producers increase their production capacity by adding more labor (labor is the only input that can increase output). As a result of the increase in demand for labor, unemployment is reduced (McEachern, 2000).

Borjas (2013) argues that the higher a person's education level, the less likely they will become unemployed. Workers with higher education have specific skills; when there is a reduction in the workforce, companies tend to be reluctant to fire educated workers. In addition, if educated workers decide to change jobs, the risk of becoming unemployed is more negligible because they have broad access to job vacancies information.

Nevertheless, there are regions with high unemployment among the educated, with the following causes. First, the region is an urban area with high workforce growth due to high migration from rural to urban areas. Migration has caused a high proportion of unemployment among young educated people (Todaro and Smith, 2012). Nafziger (2006) mentions that high unemployment among the educated might be due to

their unrealistic expectation on the salary or jobs they think they deserve or the unflexible amount of salary paid to the educated. Second, the region has slow economic growth that it fails to open employment for the educated. If a region has more uneducated than educated unemployment, it means economic growth does not go hand in hand with workforce improvement. The problem is that uneducated workforces cannot fill available employment because of technological advancement—their qualification fails to meet market needs.

Based on the theoretical background, the research hypotheses are:

Economic growth, unemployment rates, fiscal decentralization, population, trade, primary sectors, natural resources, and regional expansion significantly affect inequality.

Inequality, unemployment, workforce, and investment significantly affect economic growth.

Inequality, economic growth, education, and inflation significantly affect unemployment rates.

Research Method

We used secondary data from the Central Bureau of Statistics of Indonesia, including data on GRDP per capita, population growth, population number, economic growth, open unemployment, regional expenditure, GRDP based on business fields, formation of autonomous regions, number of people employed, Gross Fixed Capital Formation (GFCF), the average time of schooling, inflation rates, and export and import values of 154 cities and regencies in Sumatera Island from 2011 to 2020. Data were analyzed quantitatively using a panel data regression method that combined cross-sectional and time-series data from 154 regencies and cities in Sumatera Island within ten years.

We used simultaneous equations models for econometrics with inequality (proxied with the Williamson Index), economic growth, and unemployment as the endogenous variables. The exogenous variables were fiscal decentralization (proxied with the ratio of regional expenditure against GRDP), population growth, trade (proxied by the export and import values against GRDP), a dummy variable of the primary sectors (classified into two: regions with non-agriculture as their basis coded 1, and regions with agriculture as their basis coded 0), a dummy variable of natural resources (classified into two: regions with oil and gas potential coded 1, and regions with non-oil and gas potential coded 2), workforce (proxied by the number of employed people), investment (proxied by the ratio of GFCF against GRDP), education (proxied by the average time of schooling), and inflation. The structural equations in this model are as follows:

The model to know the effect of economic growth, unemployment rates, fiscal decentralization, population, trade, primary sectors, natural resources, and regional expansion on inequality is as follows.

$$INEQ = f(GROWTH, UNEMP, FD, POP, TRD, BS, RS, RE) \quad (2)$$

in which

$INEQ$: inequality

$GROWTH$: economic growth

$UNEMP$: open unemployment rate

FD : ratio of regional expenditure against GRDP

POP : population growth

TRD : export and import values against GRDP

BS : primary sector (dummy variable)

RS : natural resources (dummy variable)

RE : regional expansion (dummy variable)

The model to know the effect of inequality, unemployment, workforce, and investment on economic growth is as follows:

$$GROWTH = f(INEQ, UNEMP, LF, INV) \quad (3)$$

in which:

$GROWTH$: economic growth

$INEQ$: inequality

$UNEMP$: open unemployment rate

LF : number of employed people

INV : ratio of GFCF against GRDP

The model to know the effect of inequality, economic growth, education, and inflation on unemployment rates is as follows:

$$UNEMP = f(INEQ, GROWTH, MYS, INF) \quad (4)$$

in which:

$UNEMP$: open unemployment rate

$INEQ$: inequality

$GROWTH$: economic growth

MYS : average time of schooling

INF: inflation

Based on the identification with order condition on the structural equations, $INEQ$, $GROWTH$, and $UNEMP$ equations show $K - k > g - 1$. This means the three equations are overidentified. Table 3 presents the identification results.

Structural Equations	$(K-k)$	$(g-1)$	Identification
$INEQ$	10 - 6	3 - 1	Overidentified
$GROWTH$	10 - 2	3 - 1	Overidentified
$UNEMP$	10 - 2	3 - 1	Overidentified

Table 3: Identification Results of Structural Equations using Order Condition
Source: Analyzed by the Authors, 2020

Note: K = number of exogenous variables in the system

k = number of exogenous variables in certain equations

g = number of endogenous variables in certain equations

In a system consisting of G equations, an equation is "identified" if it has at least one determinant not equal to zero. The determinant has a dimension of $(G-1)$ coefficients from variables not included in the equation, but they are included in other equations within the same model.

Functions	Coefficients of Variables											
	Endogenous Variables			Exogenous Variables								
	INEQ	GROWTH	UNEMP	FD	POP	TRD	BS	RS	RE	LF	INV	MYS	INF
INEQ	1	$-\alpha_1$	$-\alpha_2$	$-\alpha_3$	$-\alpha_4$	$-\alpha_5$	$-\alpha_6$	$-\alpha_7$	$-\alpha_8$	0	0	0	0
GROWTH	$-\beta_1$	1	$-\beta_2$	0	0	0	0	0	0	$-\beta_3$	$-\beta_4$	0	0
UNEMP	$-\gamma_1$	$-\gamma_2$	1	0	0	0	0	0	0	0	0	$-\gamma_3$	$-\gamma_4$

Table 4: Identification Results of Structural Equations using Rank Condition
Source: Analyzed by the Authors, 2020

Table 4 shows that the $INEQ$, $GROWTH$, and $UNEMP$ equations are overidentified. The matrices of the endogenous variables are elaborated as follows.

Matrix $|INEQ| = \begin{vmatrix} -\beta_3 & -\beta_4 & 0 & 0 \\ 0 & 0 & -\gamma_3 & -\gamma_4 \end{vmatrix}$

$= [(-\beta_3.0) + (-\beta_4.-\gamma_3) + (0.-\gamma_4)] - [(0.-\beta_4) + (0.0) + (-\gamma_3.0)]$

$= [0 + (-\beta_4.-\gamma_3) + 0] - [0 + 0 + 0]$

$= (-\beta_4.-\gamma_3) - 0$

$\neq 0 \rightarrow Identified$

Matrix $|GROWTH| = \begin{vmatrix} -\alpha_3 & -\alpha_4 & -\alpha_5 & -\alpha_6 & -\alpha_7 & -\alpha_8 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\gamma_3 & -\gamma_4 \end{vmatrix}$

$= [(-\alpha_3.0) + (-\alpha_4.0) + (-\alpha_5.0) + (-\alpha_6.0) + (-\alpha_7.0) + (-\alpha_8.-\gamma_3) + (0.-\gamma_4)] - [(0.-\alpha_4) + (0.-\alpha_5) + (0.-\alpha_6) + (0.-\alpha_7) + (0.-\alpha_8) + (0.0) + (-\gamma_3.0)]$

$= [0 + 0 + 0 + 0 + 0 + (-\alpha_8.-\gamma_3) + 0] - [0 + 0 + 0 + 0 + 0 + 0 + 0]$

$= (-\alpha_8.-\gamma_3) - 0$

$\neq 0 \rightarrow Identified$

Matrix $|UNEMP| = \begin{vmatrix} -\alpha_3 & -\alpha_4 & -\alpha_5 & -\alpha_6 & -\alpha_7 & -\alpha_8 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\beta_3 & -\beta_4 \end{vmatrix}$

$= [(-\alpha_3.0) + (-\alpha_4.0) + (-\alpha_5.0) + (-\alpha_6.0) + (-\alpha_7.0) + (-\alpha_8.-\beta_3) + (0.-\beta_4)] - [(0.-\alpha_4) + (0.-\alpha_5) + (0.-\alpha_6) + (0.-\alpha_7) + (0.-\alpha_8) + (0.0) + (-\beta_3.0)]$

$= [0 + 0 + 0 + 0 + 0 + 0 + (-\alpha_8.-\beta_3) + 0] - [0 + 0 + 0 + 0 + 0 + 0 + 0]$

$= (-\alpha_8.-\beta_3) - 0$

$\neq 0 \rightarrow Identified$

The three structural equations have three endogenous variables ($INEQ, GROWTH,$ and $UNEMP$) and ten exogenous variables ($FD, POP, TRD, BS, RS, RE, LF, INV, MYS,$ dan INF). Through the substitution process of the three equations, a reduced-form equation is resulted, in which the exogenous variables influence the endogenous variable of each equation with stochastic error terms (Gujarati, 2015). The reduced-form equations of the initial structural equations are as follows:

$$INEQ_{it} = \Pi_{10} + \Pi_{11}GROWTH_{it} + \Pi_{12}UNEMP_{it} + \Pi_{13}FD_{it} + \Pi_{14}POP_{it} + \Pi_{15}TRD_{it} + \Pi_{16}BS_{it} + \Pi_{17}RS_{it} + \Pi_{18}RE_{it} + \varepsilon_{it} \quad (5)$$

$$GROWTH_{it} = \Pi_{20} + \Pi_{21}INEQ_{it} + \Pi_{22}UNEMP_{it} + \Pi_{23}LF_{it} + \Pi_{24}INV_{it} + \varepsilon_{it} \quad (6)$$

$$UNEMP_{it} = \Pi_{30} + \Pi_{31}, INEQ_{it} + \Pi_{32}GROWTH_{it} + \Pi_{33}MYS_{it} + \Pi_{34}INF_{it} + \varepsilon_{it} \quad (7)$$

Because (5), (6), and(7) are reduced-form equations, the Ordinary Least Square (OLS) method can be applied to each reduced-form equation to find the estimate of each endogenous variable. Parameters in the reduced-form equations are multipliers representing the response of endogenous variables on changes of some exogenous variables. The reduced-form multiplier shows the combination of structural parameters in the simultaneous equation system. The reduced-form equation allows us to use OLS to get the estimated value of each endogenous variable in the simultaneous equation system. Estimation of function parameters in the overidentified equation uses Two-Stage

Least Squares (2SLS). 2SLS is an estimate carried out in two stages using OLS.

Statistical results from data analysis were used to test hypotheses. Hypothesis testing aims to check whether the obtained regression coefficient is significant (significantly different), meaning that a regression coefficient value is not statistically equal to zero. If the slope coefficient equals zero, there is insufficient evidence that the independent variable influences the dependent variable (Nachrowi, 2006).

Results And Discussion

The Effect of Economic Growth, Unemployment, Fiscal Decentralization, Population, Trade, Primary Sectors, Natural Resources, and Regional Expansion on Inequality

Estimation results on inequality parameter (INEQ) with 2SLS and fixed-effect model show six exogenous variables significantly affected inequality, while two variables (unemployment and a dummy variable of primary sectors) did not significantly affect inequality, as shown in Table 5. Our findings support previous studies and existing theories or models. Tests on the estimation of the INEQ model equation resulted in the F-statistic probability smaller than 0.1%, meaning that the regression model used was significant. In other words, the independent variables together had a significant effect on the dependent variable (inequality). The R-squared (R2) is 0.1823, indicating that the model can explain the variation of inequality by 18.23%.

Economic growth had a negative and significant effect on inequality in Sumatera Island with a coefficient of -0.03, meaning that the variable could reduce inequality. Economic development in a region indicates improvement in infrastructure, public services, and income. This ultimately reduces inequality due to the fulfillment of service standards and equitable development. Unemployment had a negative but not significant effect on inequality. This indicates that an increase or decrease in unemployment will not affect inequality.

Variable	Coef.	Std. Err.	t	P>|t|
GROWTH	-.030661	.0102038	-3.00	0.003 (**)
UNEMP	-.016467	.0104716	-1.57	0.116
FD	.015392	.0035837	4.29	0.000 (***)
ln_POP	.6249769	.0451205	13.85	0.000 (***)
TRD	.0038281	.0013786	2.78	0.006 (**)
BS	-.0428118	.0611634	-0.70	0.484
RS	.3027361	.0666702	4.54	0.000 (***)
RE	.2973186	.0545863	5.45	0.000 (***)
C	-11.85495	.6149402	-19.28	0.000 (***)
R-squared	0.1823			
Prob > F	0.0000			
Observation Numbers	1,540			

Table 5: Estimation Results of Inequality Model
Source: Analyzed from Stata 15

Note: * p<0.05; ** p<0.01; *** p<0.001

Fiscal decentralization had a positive and significant effect on inequality in Sumatra Island with a coefficient of 0.02, meaning that the variable increased inequality. An increase in regional expenditure signs the fiscal independence of a region. Our findings confirmed that increasing regional expenditure did not guarantee equitable development. In other words, development only occurs in certain areas and is enjoyed by a portion of the population.

Population growth has a positive and significant effect on inequality with a coefficient of 0.63, meaning that the variable increased inequality. Regional demography indeed determines the quality of the existing population—one of the reflections is the work productivity of the population. Large population and high population growth, accompanied by poor demographic quality, will decrease income per capita. Finally, development is hampered because the existing population becomes a burden and cannot increase production capacity that inequality increase.

Trade has a positive and significant effect on inequality in Sumatera Island with a coefficient of 0.004, meaning that the variable increased inequality. The increase in inequality was caused by poor trade mobility amidst increasing net export. Thus, a proportional increase in net exports to GRDP must be made to reduce inequality. This means that each region must show good trade mobility following its economic concentration. Thus, export and import can be distributed evenly despite increasing net exports.

The dummy variable of primary sectors had no significant effect on inequality, with a coefficient value of -0.04. This means that regions with a non-agricultural primary sector have a lower inequality of 0.04% than regions with a primary agricultural sector.

The dummy variable of natural resources has a significant effect on inequality. The coefficient was 0.30. This means that regions with oil and gas natural resources had higher inequality of 0.30% than those without oil and gas natural resources. This finding indicates that oil and gas regions had relatively better economic progress because oil and gas can impact a region's income. However, the economic level of the oil and gas regions can become unequal if the development is uneven. In other words, although regions with oil and gas resources are relatively wealthy compared to non-oil and gas regions, the development and welfare distribution may not be entirely equitable.

The dummy variable of regional expansion significantly

affected inequality, with a coefficient of 0.30. This means that the new region had a higher inequality of 0.30% than the parent region. Our finding indicates that development progress and distribution in the new region are relatively lower than expected to accelerate public services access. This may happen due to weak economic activities and limited resources, such as development funds, human resources, natural resources, and existing social aspects, such as social conflicts. Therefore, regional expansion needs careful planning that the new region can be better developed.

The Effect of Inequality, Unemployment, Workforce, and Investment on Economic Growth

Estimation results on economic growth parameter (GROWTH) with 2SLS and fixed-effect model show that all exogenous variables significantly affected economic growth, as shown in Table 6. Our findings support previous studies and existing theories or models. Tests on the estimation of the GROWTH model equation resulted in the F-statistic probability smaller than 0.1%, meaning that the regression model used was significant. In other words, the independent variables together had a significant effect on the dependent variable (economic growth). The R-squared (R2) is 0.0391, indicating that the model can explain the variation of economic growth by 18.23%.

Variable	Coef.	Std. Err.	t	P>ltl
ln_INEQ	-.3190764	.0633502	-5.04	0.000 (***)
UNEMP	-.1359687	.0234142	-5.81	0.000 (***)
ln_LF	.2318398	.0888917	2.61	0.009 (**)
INV	.0163168	.0056424	2.89	0.004 (**)
C	.7407843	1.183066	0.63	0.531
R-squared	0.0391			
Prob > F	0.0000			
Observation Numbers	1.540			

Table 6: Estimation Results of Economic Growth Model
Source: Analyzed from Stata 15

Note: * p<0.05; ** p<0.01; *** p<0.001

Inequality had a negative and significant effect on economic growth in Sumatera Island, with a coefficient of -0.32, meaning that the variable could reduce economic growth. These findings support the results on the INEQ model on the relationship between inequality economic growth, which was also negative and significant. In other words, two-way causality or reciprocal relationships exist between the two variables. Therefore, regional governments in Sumatera Island must focus on reducing inequality to optimize economic growth and equitable development.

Unemployment had a negative and significant effect on economic growth in Sumatera Island, with a coefficient of -0.14, meaning that the variable could reduce economic growth. Efforts must be made to reduce unemployment by increasing job opportunities for the productive population to pursue more significant economic growth. On the other hand, the high absorption of labor will increase economic capacity and increase production; finally, the population's purchasing power will also increase due to increasing job opportunities.

The workforce had a positive and significant effect on economic growth in Sumatera Island, with a coefficient of 0.23, meaning that the variable could increase economic growth. Efforts must be made to increase job opportunities for the productive population to pursue more significant economic growth. The workforce is an essential factor that influences and is considered the main determinant of economic growth other than capital (investment). An increase in the number of workers involved in productive economic activities will boost production capacity, thereby increasing the supply of goods and services. In addition, an increase in the number of people employed will increase the population's income and purchasing power, which will finally increase the demand for goods and services. An increase in the supply of goods and services due to increased production capacity, offset by increased demand due to an increase in people's purchasing power, will encourage economic growth.

Investment had a positive and significant effect on economic growth in Sumatera Island, with a coefficient of 0.02, meaning that the variable could increase economic growth. A commitment must be made to invite investment for optimal economic growth. Bigger investment chances will benefit the region to further develop due to increased production and optimal utilization of regional resources. Finally, the production capacity will increase, reflecting economic growth and increased income.

The Effect of Inequality, Economic Growth, Education, and Inflation on Unemployment

Estimation results on unemployment parameter (UNEMP) with 2SLS and fixed-effect model show that three exogenous variables significantly affected inequality, while one variable (inequality) did not significantly affect unemployment, as shown in Table 7. Our findings support previous studies and existing theories or models. Tests on the estimation of the UNEMP model equation resulted in the F-statistic probability smaller than 0.1%, meaning that the regression model used was significant. In other words, the independent variables together had a significant effect on the dependent variable (unemployment). The R-squared (R2) is 0.1986, indicating that the model can explain the variation of economic growth by 19.86%.

Inequality had no significant effect on unemployment, indicating that an increase or decrease in inequality does not affect or change unemployment. This result supported the finding on the effect of unemployment on inequality in the INEQ model, showing the insignificant effect of unemployment on inequality. Meanwhile, economic growth had a negative and significant effect on unemployment, with a coefficient of -0.13, meaning that economic growth can reduce unemployment. This result supported the relationship between unemployment and economic growth in the GROWTH model, showing a significant and negative relationship. In other words, two-way causality or reciprocal relationships exist between the two variables. Therefore, regional governments in Sumatera Island must optimize economic growth to increase production capacity and create new jobs.

Variable	Coef.	Std. Err.	t	P>|t|
ln_INEQ	.056164	.0596529	0.94	0,346
GROWTH	-.1341349	.0265101	-5.06	0.000 (***)
MYS	.8292129	.0450376	18.41	0.000 (***)
INF	.0681793	.0234984	2.90	0.004 (**)
C	-.9665596	.4343895	-2.23	0.026 (*)
R-squared	0.1986			
Prob > F	0.0000			
Observation Numbers	1,540			

Table 7: Estimation Results of Unemployment Model
Source: Analyzed from Stata 15

Note: * p<0.05; ** p<0.01; *** p<0.001

Education had a positive and significant effect on unemployment in Sumatera Island, with a coefficient of 0.83, meaning that the variable increased unemployment. This finding indicates that the increasing average length of schooling cannot keep up with the actual labor demand. In other words, an imbalance between supply and demand for labor exists, primarily related to the required education levels for employment. A balance between the progress of the population's education level with the supply of available labor must be maintained to realize a relatively lower unemployment rate.

Inflation had a positive and significant effect on unemployment in Sumatera Island, with a coefficient of 0.07, meaning that the variable increased unemployment. Inflation is closely related to people's purchasing power—an increase in inflation will decrease purchasing power. It will be worse if the real income of the community is stagnant or low as people are unable to respond to fluctuations in prices. This situation then causes a decrease in aggregate demand, thus encouraging producers to reduce production by reducing production costs, one of which is labor—the final impact of reducing labor is an increase in unemployment.

Conclusion

Based on the findings and discussion above, the following conclusions are presented:

Economic growth, fiscal decentralization, population, trade, natural resources, and regional expansion significantly affected the inequality of regencies and cities in Sumatera Island from 2011 to 2020. Meanwhile, unemployment and the primary sector showed no significant effect on inequality during that period.

Inequality, unemployment, workforce, and investment significantly affected economic growth regencies and cities in Sumatera Island from 2011 to 2020.

Economic growth, education, and inflation significantly affected unemployment f regencies and cities in Sumatera Island from 2011 to 2020. Meanwhile, inequality did not significantly affect unemployment during that period.

Limitation And Further Studies

The followings are the limitation of the present study and suggestions for further studies:

This study used a simultaneous model approach with three equations (INEQ, GROWTH, UNEMP), resulting in relatively small R-squared values. This indicates there are other factors or variables outside the model that can also affect endogenous variables (inequality, economic growth, and unemployment). Therefore, further research is suggested to include other variables not included in this model to reveal other variables affecting the endogenous variables.

This study showed an insignificant relationship between endogenous variables of inequality and unemployment. Therefore, further research should develop a relationship model, either directly or indirectly, between other endogenous variables theoretically and empirically.

This study used data at the regency and city level of Sumatera Island. Further research is suggested to collect data on other regions or islands in Indonesia, or even all regencies and cities in Indonesia.

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