

## **Using Granger Causality to Examine the Relationship Between Economic Growth and Absorption of Labor In North Sumatera Province – Indonesia**

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**ABSTRACT :** *This study refers to Okun's Law on the economy in North Sumatera Province. Difference with previous studies, in this study the data used is not aggregate data but the data of each economic sector. In addition, the unemployment variable is proxy with the absorption of labor rate. The data analysis was tested by Granger Causality to determine the direction of the relationship between variables for growth of each economic sectors and absorption of labor. By using the Granger Causality Test analysis we concluded that the agricultural sector has a two-way direction relationship between economic growth and absorption of labor. Mining and Quarrying sector, construction sector, transport and communication sector and services sector only have one-way direction relationship from absorption of labor to economic growth. Electricity, gas and water supply have one-way direction relationship from economic growth to absorption of labor. Three other sectors are sectors manufacturing industry sector; trade, hotel and restaurant sector and finance, real estate and business service have no relationship at all between economic growth and absorption of labor.*

**KEYWORDS -** *Economic Growth, Absorption of Labor, Granger Causality*

### **I. INTRODUCTION**

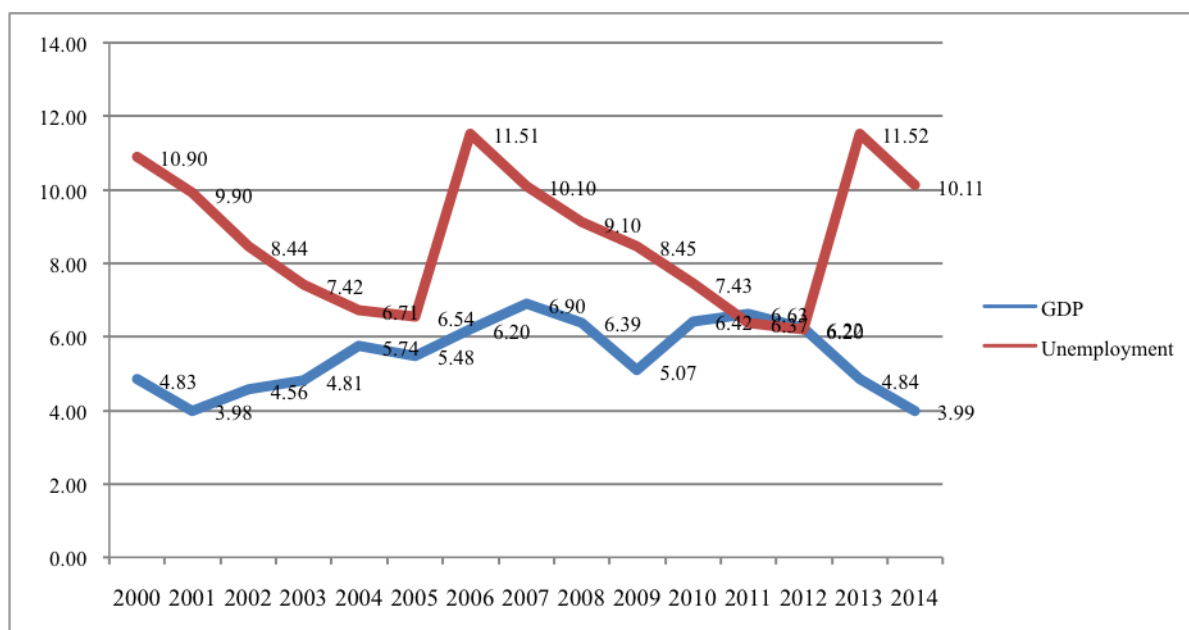
One indicator to observe of regional development is Gross Domestic Product that classified into nine sectors of the industry: (1) agricultural, livestock, forestry and fishery; (2) mining and quarrying; (3) manufacturing industry; (4) electricity, gas and water supply; (5) construction; (6) trade, hotel and restaurant; (7) transport and communications; (8) finance, real estate and business service, and (9) services. The aggregate of all sectors of the economy is representative of the economy from an area or region. Increase or decrease of the Economy will be shown from GDP in the area or region.

On the other hand, the GDP is expected to increase in the unemployment rate will decrease or increase absorption of labor level. Classical economists such as Adam Smith, David Ricardo and Thomas Robert Malthus argued that there is always a race between the rates of output growth with the rate of population growth eventually won by population growth. Because the population also identical as labor, there will be difficulties in the availability of jobs. If people can get a job, then it will be able to improve their welfare. But if it does not get a job, it means there will be unemployment, and eventually will depress living standards will be lower.

**Table 1. Economic Growth in North Sumatera Province By Economic Sectors 2006 to 2012**

Economic Sector's	2006	2007	2008	2009	2010	2011	2012
Agriculture, Livestock, Forestry and Fishery (AGR)	2.4	4.98	6.05	4.85	5.7	4.82	4.72
Mining and Quarrying (MNG)	4.17	9.78	6.13	1.43	5.87	6.73	2.04
Manufacturing Industry (IND)	5.47	5.09	2.92	2.76	4.16	2.05	3.63
Electricity, Gas & Water Supply (EGW)	3.08	0.22	4.46	5.57	6.88	8.21	3.43
Construction (CONS)	10.33	7.78	8.1	6.54	6.77	8.54	6.78
Trade, Hotel & Restaurants (THR)	6.95	7.55	6.14	5.43	6.53	8.09	7.23
Transport and Communication (TCOM)	11.91	9.9	8.89	7.56	9.44	10.02	8.26
Finance, Real Estate and Business Services (BANK)	9.87	12.43	11.3	6.14	10.78	13.61	11.2
Services (SERV)	7.09	8.25	9.48	6.62	6.77	8.3	7.54
Gross Domestic Regional Bruto (GDP)	6.2	6.9	6.39	5.07	6.42	6.63	6.22

In aggregate the achievement of the success of economic development as measured by GDP in line with the high labor absorption as measured from the open unemployment rate shows the direction in accordance with the pattern and development. When GDP increases, absorption of labor will also increase and vice versa if the GDP decreased the absorption labor will also fall. However, when we did the analysis partially between economic sectors with the level of absorption of labor in the North Sumatera province, the result will be different.



**Figure 1. Trend of Economic Growth and Unemployment  
North Sumatra – Indonesia 2000-2014**

This article will explain the causality between sectors of the economy with the absorption of labor rate in the province of North Sumatra. From the results of this study will be illustrated in detail which sectors are actually absorb most large workforce as well as any sectors which absorb very little labor in North Sumatra province by economic growth sectors.

## II. LITERATURE REVIEW

There are three important macroeconomic variables used by the economists to measure economic performance. These variables are the gross domestic product, the unemployment rate, and the consumer price index (CPI). In 1962, Arthur Okun, is specifically examining the relationship between two of the three variables in macroeconomics that economic growth in terms of output with the unemployment rate. Results of the study became known as Okun's Law. Based on Okun's Law, the number of unemployed is negatively related to the level of a country's economic growth. Growth in Gross Domestic Product (GDP) that is closer to 2 percent would reduce unemployment by 1 percent (Mankiw, 2007).

Some economists have followed Okun (1962) to examine the relationship between unemployment and output to get an estimate Okun coefficient. Economists include: Smith (1975), Gordon (1984), Prachowny (1993), Weber (1995), Moosa (1997a, 1999), Attfield and Silverstone (1998), Lee (2000), Harris and Silverstone (2001), and Silvapulle et al (2004). These studies generally support the empirical validity of the relationship of unemployment and output but Okun coefficient estimates vary substantially across countries and over time.

Moosa (1997) examined the Okun's Law in G7 countries (US, Japan, Germany, France, Britain, Italy and Canada). By using Harvey, Moosa extracting time series data before regressed using ordinary least squares (OLS), rolling OLS, and seemingly unrelated regression (SUR). Moosa find Okun coefficient differences in each country studied. Subsequently, Lee (2000) examined the relationship in Okun's Law of 16 OECD countries in post-war world. Lee using difference model and gap models as contained in Okun's Law. For gap models, Lee analyzing and building data by alternative methods, namely HP filter, BN decomposition method, and based on the Kalman filter NAIRU framework. Lee discovered that the labor market and industrial structure in developed countries have evolved in new ways, so that the relationship between output and unemployment feasible to re-examination.

Studies on Okun's law is also done by Knotek (2007), which examines the relationship between real GDP and unemployment in America. Knotek found that Okun's law is not a significant relationship. There are many exceptions in Okun's law, or instances where the decline in output growth does not always coincide with rising unemployment. This is true when looking for long term and short term. It is a reminder that Okun's law is contrary to the connotations of the word "law", only a rule of thumb, not a structural feature of the economy.

In the region of Southeast Asia, the research ever conducted by Noor et al. (2007), which examines the existence of Okun's Law in the Malaysian economy have negative relationship between unemployment and output (GDP). From these studies they found that there is a negative relationship between output and unemployment where the coefficients obtained are -1748 and it is known that unemployment is one of the factors affecting changes in output in Malaysia. Granger causality test also showed that there is a two-way direction relationship between unemployment and output variables (GDP).

Time series analysis model is then used by Petkov (2008) tested the Okun coefficient in the UK. Petkov using analytical tools autoregressive distributed lag model (ARDL) approach Hodrick-Prescott filter (HP filter). This approach is used to capture the phenomenon Petkov NAIRU and then followed up by applying the Error Correction Model (ECM) to get Okun coefficient. Petkov prove that there is a relationship between output growth and unemployment. But Okun found Petkov coefficient value is different from the original version of Okun coefficient. Then Arshad (2010) using the gap equation and techniques Hodrick-Prescott Filter (HP) found empirical evidence that there is a negative and significant correlation between GDP and unemployment in the short term strengthening Okun's Law (1962). For the long term, used Cointegration Test and Error Correction Model (ECM) shows that GDP and unemployment cointegrated with one another in the long term.

Sectoral studies and using proxy variables for unemployment ever undertaken by Hanusch (2012), which discusses the economic growth and unemployment using data from eight East Asian countries during 1997 to 2011 period to get the coefficient of Okun's Law that shows the relationship between economic growth and employment. The results show that the effect of economic growth in reducing unemployment, but there are variations in different countries. Economic growth affects employment, though not in the aggregate, but in its composition. There is evidence that employment in the agricultural sector move counter-cyclically, where the effect in a period of crisis, the agricultural sector can serve as a shock absorber to reduce the impact of layoffs in the industrial sector.

### III. RESEARCH METHODOLOGY

The analytical method used in this research is quantitative analysis. The data used are the growth of GDP and absorption of labor in North Sumatra province period 2000-2014. Because macroeconomic time-series data tend to be non-stationary, Unit Root Test using Augmented Dickey-Fuller Test (ADF) will used to determine the data is stationary or not. Second, using Granger Causality Test to determine the relationship of economic growth and absorption of labor, either one-way or two-way direction relationship.

### IV. FINDINGS AND DISCUSSION

#### Stationarity test

Testing unit root in this research model is based on Augmented Dickey Fuller (ADF) test to determine that a series has a unit root or not, there should be a comparison between the value of t-statistic with ADF table or probability with alpha (1%, 5% or 10%). If the absolute value of the t-statistic on the ADF Test is smaller than the critical value of the ADF in the table with a certain level of significance, the data time series is not stationary.

Based on the results of the unit root test on the level as shown in Table 1 below was found that the variables have a unit root, which means that the original data is not stationary research as well as on the level of the first difference.

**Tabel 1. Unit Root Testing**

No.	Variabel	ADF Test Statistic Level		ADF Test Statistic First Difference		ADF Test Statistic Second Difference	
		t – Stat	Probability	t – Stat	Probability	t – Stat	Probability
1	AGR	4.3337	1.0000	-1.1813	0.6448	-3.8660	0.0169
2	MNG	0.3934	0.9737	-3.3449	0.0361	-5.3931	0.0017
3	IND	0.1594	0.9575	-3.2422	0.0427	-3.1657	0.0536
4	EGW	0.2369	0.9637	-2.2298	0.2065	-3.4854	0.0307
5	CONS	3.9403	1.0000	-1.9478	0.3023	-3.5656	0.0271
6	THR	9.2432	1.0000	-0.3642	0.8868	-4.7390	0.0044
7	TCOM	6.1360	1.0000	-1.9409	0.3050	-3.6396	0.0293
8	BANK	3.7253	1.0000	0.1316	0.9504	-4.0530	0.0165

9	SERV	4.1011	1.0000	0.1831	0.9551	-3.4181	0.0400
10	UAGR	-0.2989	0.9006	-3.0461	0.0612	-3.2251	0.0491
11	UMNG	-1.9199	0.3140	-4.5130	0.0062	-4.2897	0.0119
12	UIND	-4.3383	0.0062	-5.1902	0.0023	-9.1797	0.0000
13	UEGW	-2.3143	0.1818	-0.6178	0.8243	-8.7646	0.0000
14	UCONS	1.4474	0.9972	-4.5097	0.0053	-5.0513	0.0035
15	UTHR	-1.0662	0.6948	-4.2605	0.0080	-1.9210	0.0098
16	UTCOM	-2.8065	0.0887	-2.5420	0.1305	-5.0344	0.0029
17	UBANK	-1.7690	0.3774	-4.9816	0.0026	-7.2121	0.0002
18	USERV	-0.7630	0.7958	-5.9540	0.0006	-3.9295	0.0195

Testing unit root at the second level difference indicates that all data has been stationary. This can be seen from the absolute value of the ADF statistic greater than Mc Kinon Critical Value on the critical value of 1%, 5% and 10%. Thus it can be explained that all the variables to be estimated in this study have been stationary at the same degree that the second difference.

### Grangers Causality Testing

On the Granger causality test carried out on a second difference data. This is considering the level data is not stationary, and will lead to spurious regression. Testing with the Grangers Causality is intended to examine the relationship between variables. Table 2 showed the result of Granger's Causality method using the second difference data.

The economic sector that has a two-way direction relationship between economic growth and absorption of labor is agriculture sector, this can be seen from the value of the F-statistic of variable absorption of labor for the agricultural sector with probability of 0.0267 and F-statistic = 6.73504, significant at  $\alpha = 5\%$ . While the F-statistic of economic growth for agricultural sector = 3.58247 with a probability = 0.0877 was significant at  $\alpha = 10\%$ .

Sectors which have a one-way direction relationship between the absorption of labor to economic growth are mining and quarrying sector, it can be seen from the F-statistic of absorption of labor = 0.37544 with probability = 0.5537 is not significant, while F-statistic of economic growth = 4.66321 with a probability = 0.0562 significant at  $\alpha=10\%$ . The absorption of labor and economic growth on construction sector is also related with one-way direction relationship, it can be seen from the F-statistic of absorption of labor = 0.53401 with a probability = 0.4817 is not significant. While a probability of economic growth = 0.0023 and F-statistic=16.4383 with a significant probability at  $\alpha=1\%$ . Absorption of labor to economic growth on transportation & communication sector also have a one-way direction relationship with F-statistic of absorption of labor = 0.46689 and probability = 0.5099 is not significant. While the F-statistic of economic growth = 3.81900 with probability = 0.0792 was significant at  $\alpha = 10\%$ . Services sector has a one-way direction relationship from absorption of labor to economic growth, this can be seen from F-statistic of absorption of labor = 0.06134 with a probability = 0.8094 is not significant, While the F-statistic of economic growth = 38.2922 with a probability = 0.0001 was significant at  $\alpha=1\%$ .

**Table 2. Results of Granger Causality Test the Second Difference Data**

Null Hypothesis	F-Statistic	Prob.	Description
UAGR does not Granger Cause AGR	6.73504	0.0267**	Rejected
AGR does not Granger Cause UAGR	3.58247	0.0877*	Rejected
UMNG does not Granger Cause MNG	0.37544	0.5537	Accepted
MNG does not Granger Cause UMNG	4.66321	0.0562*	Rejected
UIND does not Granger Cause IND	1.13040	0.3755	Accepted
IND does not Granger Cause UIND	2.48844	0.1526	Accepted
UEGW does not Granger Cause EGW	0.53401	0.4817	Accepted
EGW does not Granger Cause UEGW	16.4383	0.0023***	Rejected

UCONS does not Granger Cause CONS	4.50416	0.0598*	Rejected
CONS does not Granger Cause UCONS	1.12308	0.3142	Accepted
UTHR does not Granger Cause THR	0.05630	0.8172	Accepted
THR does not Granger Cause UTHR	0.34407	0.5705	Accepted
UTCOM does not Granger Cause COM	0.46689	0.5099	Accepted
TCOM does not Granger Cause UTCOM	3.81900	0.0792*	Rejected
UBANK does not Granger Cause BANK	0.31779	0.5854	Accepted
BANK does not Granger Cause UBANK	2.56246	0.1405	Accepted
USERV does not Granger Cause SERV	0.06134	0.8094	Accepted
SERV does not Granger Cause USERV	38.2922	0.0001***	Rejected

Note : \* = Signifikan at alpha 10%; \*\* = Signifikan at alpha 5%; \*\*\* = Signifikan at alpha 1%

Electricity, gas and water has a one-way direction relationship from economic growth to absorption of labor, it can be seen from the F-statistic of absorption of labor = 4.50416 with probability = 0.0598 was significant at  $\alpha=10\%$ . While the F-statistic of economic growth = 1.12308 with a probability = 0.3142 is not significant. Three other sectors have no relationship between economic growth and absorption of labor are manufacturing industry sector; trade, hotel and restaurant sector and finance, real estate and business service sector.

Knotek (2007) states that Okun's Law has the ability to be used as a practical application. However, based on the analysis and discussion in this study found that there are differences between the results with the original version of Okun's Law. Okun's Law phenomenon is not entirely the case in the economy of North Sumatera province. This could mean that Okun's Law cannot be used as a measuring tool that is valid in explaining the relationship of economic growth and absorption of labor by sectoral.

Although the research showed unsatisfactory results but Okun's Law may be implicated and play a role in the process of identifying the problems that are happening in the economy of North Sumatera province. The study found that the rates of absorption of labor in the economy of North Sumatera province are not responsive to changes in real output in almost all economic sectors. The cause is the existence of structural unemployment/frictional in the economy of North Sumatera province and the structural differences between the economies of developing countries such as Indonesia compared with developed countries. In the developing countries, labor-intensive still needed in the economy more dominant than skills labor.

Early identification of Okun's Law can be used as a reference by the government in formulating economic policy. In this case, the government needs to give attention to the sectors that can create jobs. Especially for agriculture and the informal sector, where the proportion of the ability to absorb labor is still higher than the other sector. This sector proved to be able to act as a shock absorber in a crisis situation in the economy.

Practically, Okun's Law is still worthy as one tool to determine the relationship of economic growth and unemployment, especially for developing countries. To understand this relationship more comprehensive manner, you can add variables such as the level of labor productivity and the number of hours worked in the industrial sector (Prachowny, 1993), as well as the need to consider the nature of the variables that are always changing (Knotek, 2007), the growth of labor force and labor productivity growth (Blanchard, 2009).

## V. CONCLUSION

Based on the results of research on the causality relationship between economic growth by sectors and absorption of labor, it can be concluded economic growth in agriculture sector and absorption of labor in the agricultural sector has two-way direction relationship. Sectors that have a one-way relationship between absorption of labor to economic growth are mining and quarrying sector, construction sector, transport and communication sector and services sector. Electricity, gas and water have a one-way relationship of economic growth to labor absorption. Three other sectors have no employment relationship between the sector and the GDP sectors are sectors of industry, trade and banking sector.

## VI. REKOMENDATIONS

The government should encourage the growth of productive and absorb a lot of labor, not growth that are capital intensive. The agricultural sector is still an important factor in the economy of North Sumatra province, so the government needs to pay special attention to this sector. The attention can be either policy or legislation to provide special incentives for farmers. In addition, to address structural unemployment / frictional required special training programs to improve the skills of the workforce according to the needs of sectors such as mining and quarrying, construction, transport and communication sector and services sector. The Government also needs to provide training and assistance in the field of entrepreneurship for workers who are not absorbed in that sector. Advanced testing can use the data to span a longer period. Given the economic structure in North Sumatera province in the industrial sector began to grow rapidly in the last twenty years period. As well as the need to be considered to include other variables to understand the relationship of economic growth and absorption of labor more comprehensively.

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