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Determinant of the Labor Force, Electricity Consumption, and Clean Water on Economic Growth in Indonesia 2014-2019

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Abstract. *This research was conducted to determine the extent of the impact of the workforce, electricity consumption, and clean water consumption on economic growth in Indonesia. The data in this study is secondary data obtained from the publications of the Central Bureau of Statistics Indonesia for the years 2014-2019. This research uses the Ordinary Least Square (*OLS*). From the results of this Ordinary least Square analysis, it was found that the labor force variable does not affect economic growth. Meanwhile, the variables of electricity consumption and clean water consumption do affect economic growth. From the F-statistic probability result of 0.000000 < the significance level of 0.05, it can be concluded that together, these three variables affect economic growth. The three variables in this study simultaneously influence economic growth by 99.51%.*

Keywords: *Labor Force, Electricity Consuumption, Clean Water Consumption, Economic Growth, Panel Data.*

1. INTRODUCTION

Every country basically exists to carry out the same goal, namely to improve the welfare of its population. This welfare can be reflected in a quality social and economic life. Likewise with economic growth, an area is closely related to the welfare of its people, so that it becomes a benchmark for a region to be in a good economic condition or not (Mu'minin, 2020). Achieving the highest rate of economic growth is the primary objective of economic development. This is followed by eliminating poverty, lowering income disparity, creating job opportunities, increasing education, raising standards of health and nutrition, and improving the environment, and equalizing opportunities. and refreshment of cultural life (Sugiharto, 2019).

On the other hand, regional governments with their regional autonomy also contribute to developing all existing economic potentials so that they can accelerate the increase in regional economic activity which in turn improves the national economy (Pujiati, 2008).

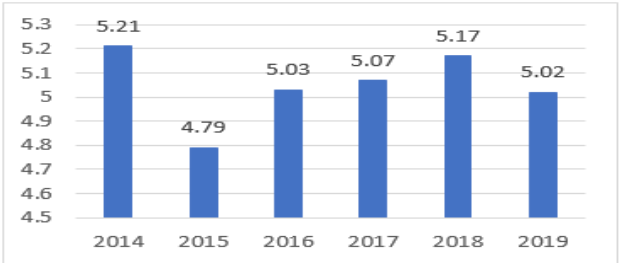

Figure 1
Indonesia's Economic Growth in 2014-2019

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Source: Central Bureau of Statistics 2019

For six years from 2014 to 2019 Indonesia's highest economic growth rate was 5.21%, namely in 2014 and the lowest in 2019 was 4.79%. Each achievement of this growth rate is accompanied by an increase in economic activity in Indonesia, including an increase in the labor force, electricity consumption and clean water in Indonesia which in turn affects economic growth and vice versa. According to Todaro and Smith in Mu'minin, Better economic activity is derived from the GDP growth rate at constant prices in regions with stronger economic growth (Mu'minin, 2020).

John Maynard Keynes contends in his 1936 book The General Theory of Employment, Interest, and Money that the primary determinant of a nation's economic standing is aggregate expenditure, namely public spending on goods and services. (Lo et al., 2019).

The development of economic growth certainly cannot be separated from the role of society in economic activities. According to Adam Smith in Hayati, population is one of the factors that influence economic growth in addition to other factors, namely the amount of stock of capital goods, land area and natural wealth and the level of technology used (Hayati, 2019). Labor is also a factor that affects the output of a region. A large workforce will be formed from a large population. According to Todaro, rapid population growth encourages the problem of underdevelopment and makes development prospects distant (Mutiah, 2019).

In addition, one of the factors that influence economic growth is the human resources contained in an area (Brown et al., 2015). The number of people who are increasing every year can make the labor force also increase. An increase in the workforce that is not balanced with an increase in job opportunities will have a bad effect on economic growthnomi (Mutiah, 2019).

According to Todaro and Stephen C. Smith (2006) in Karim, One of the favorable elements that can promote economic growth is labor growth, according to conventional wisdom. More workers translate into more output and a larger population growth. Then it can also be called a positive or negative effect of population growth based on the region's economic system's capacity to employ workers and make effective use of extra energy at work (Karim, 2018).

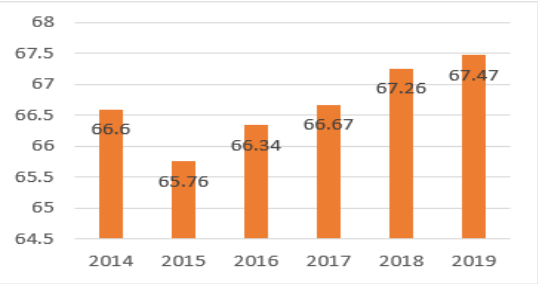

Figure 2
Indonesian Labor Force 2014-2019 (percent)
Source: Statistic of Indonesian 2018 & 2019

The workforce from year to year has increased. The availability of this abundant workforce can be an opportunity for Indonesia to absorb as much as possible in order to increase economic growth and people's welfare (Mutiah, 2019).

The Ministry of Manpower (Kemnaker) recorded that during 2015-2019 the total job creation reached 11,196,270 (BPS, 2019). In addition, until 2019 the number of labor force that has been absorbed is 133.56 million people (RI, 2020). But on the other hand, Growth may be negatively impacted if the labor force grows without the expansion of employment possibilities (Mutiah, 2019).

Consumption of goods and services is an important factor in an economy because the more consumptive an economy is, the more rapid its development in consumption will be. A commodity is a measure of how people's ability to spend their income. The government's fiscal policy in responding to slowing economic growth often increases personnel expenditure with the assumption that an increase in personnel expenditure will have a direct effect on the economy.

N. Gregory Mankiw in his book *Macroeconomics* argues That households must spend and preserve the money they earn from their work and capital. Additionally, Mankiw contends that government spending, investment, and consumption all contribute to the economy's output (Mankiw, 2007).

J. M. Keynes Contends that the primary driver of economic growth is aggregate expenditure, or public spending that encompasses both goods and services (Churchill & Ivanovski, 2020).

While the theory of Franco Modligiani assumes that the amount of consumption does not have to depend on the income you have, but also wealth such as savings, investment, income allowance, and inheritance (Apriliana, 2011).

Electricity consumption is also a factor that affects the output of an area. Electricity consumption in Indonesia has increased in general. This is an indicator of how the

community has increased in terms of increasing ownership of electronic goods. If energy consumption such as electricity and clean water increases, it will also increase the economic growth of a region (Lawal et al., 2020). The consumption of electrical energy consumed by the community shows how much electricity is used which can assist in moving the regional economy to increase economic productivity. The use of electricity is very important in increasing the gross regional product, which will influence economic expansion, because electricity is the main factor in supporting production process activities in the manufacturing sector (Hutauruk, 2020). Without electrical energy, activities related to the production process will be hindered, which will ultimately result in a drop in production volume and income.

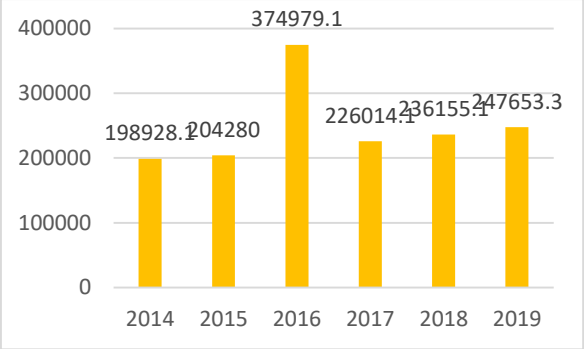

Figure 3
Electricity Consumption Distributed to Customers (GWh) 2014-2019
Source: Central Bureau of Statistics 2018 & 2019

The Director General of Electricity at the Ministry of Energy and Mineral Resources (ESDM) explained that the national electricity consumption per capita was at the level of 1,084 kWh/capita in 2019. This amount is equivalent to 95% of the target set by the government of 1,142 kWh/capita. This is in line with the electrification ratio which has also increased. In 2014 with a ratio of 84.35% to 98.89% in 2019. This electricity access almost covers all parts of Indonesia, only East Nusa Tenggara which is still 85% and Maluku 92%. Then there is Central Kalimantan, Southeast Sulawesi and Papua which are still 94% (ESDM, 2019).

In addition, Indonesia has a wealth of abundant springs in all corners of the archipelago. Clean water investment, theoretically and empirically, has been proven to encourage economic growth (Mungkasa, 2006). If many people use clean water obtained from the Regional Drinking Water Company (PDAM), the Gross Domestic Product (GDP) will increase.

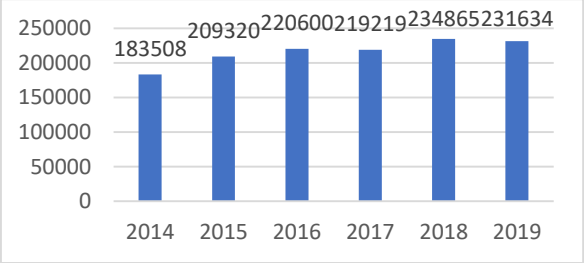

Figure 4
Clean Water Consumption (liter/second) 2014-2019
Source: Central Bureau of Statistics 2019

Water is the most important basic need for the continuity of daily activities. There are many functions of water in daily life, in addition to the needs of all Indonesian people, water is also useful for public facilities in the form of cleaning roads and watering parks, cleaning markets, for the livestock sector, the trade sector in the form of hotels and restaurants, and others. However, rural communities still find it difficult to get clean water just for drinking. The need for water is not only for eating, drinking and sanitation. Data from the PUPR Ministry stated that until the end of 2018 the realization of access to clean water and sanitation reached 73.60 percent and 69 percent, respectively. Based on these figures, before the 2020–2024 RPJMN era concludes, it is envisaged that Indonesia will have achieved the goal of providing all Indonesians with 100% access to safe drinking water.

2. LITERATURE REVIEW

The analysis of the activities the most crucial aspect of macroeconomic research is what an economy has accomplished. This research demonstrates how an economy's activities are determined by its total demand and total expenditure in a certain period and how national income or national production can be created.

According to Adam Smith (1729-1790), the efficient allocation of human resources is the starting point of economic growth. After the economy grows, the formation of new (physical) capital is necessary to sustain economic growth. The efficient allocation of human resources is an important condition for economic growth. (Prasetyo & Huda, 2019).

According to Todaro and Stephen C. Smith (2006) in Karim, it is possible to view traditional labor force increase as one of the favorable elements that can promote economic expansion. More workers translate into more output and a greater population growth.. It can also be referred to as a positive or negative effect of population growth

depending on the capacity of the economic system in the labor absorption area and the efficient use of additional energy in the work. (Karim, 2018).

People believe that consumption and expenditure are the main driving factors of economic growth. This can be explained through the analogy that if someone engages in consumption activities such as shopping for daily necessities, both goods and services, it will encourage the circulation of money and can boost economic growth. Households receive income from labor and capital they possess, which is used, among other things, to pay taxes to the government. Then, some of the income is used for consumption and some for saving. N. Gregory Mankiw argues that Y is the household income received, which is equal to the output of the economy. Then the government collects a tax from households amounting to T. Subsequently, post-tax income (Y-T) is defined, which we know as disposable income. The amount of money that can be spent is known as disposable income. Households themselves divide the disposable income into two parts, namely for consumption and for saving. (Mankiw, 2007).

Consumption will rise in response to an increase in disposable income, which is known as the marginal propensity to consume (MPC). Disposable income (Y-T) and consumption (C) are linked by the consumption function. The MPC is the amount of consumption growth that occurs when disposable income rises by one dollar.

Mankiw also argues that the output of according to the formula Y=C+I+G, the economy is driven by government spending, investment, and consumption. Government expenditure and taxes are exogenous factors determined by fiscal planners, while investment is dependent on the real interest rate and consumption on disposable income. (Mankiw, 2007).

John Maynard Keynes has an absolute consumption theory known as the Keynesian Consumption Theory (absolute income hypothesis). Keynes maintained that household consumption is a function of income (Churchill & Ivanovski, 2020). A framework for calculating income and consumption using the Consumption Theory and the Absolute Income Hypothesis is required in order to explain Keynes's Theory. According to this theory, the amount of consumption expenditure is directly correlated with national income, which will impact the fluctuations of the national economy. This relationship can be measured using constant prices. The Keynes Consumption Function is C = Co + cYd, where Co is Autonomous Consumption and Yd is disposable income available for consumption. The formula Yd = Y – TX + Tr, where tax is taxable and there is subsidy or a transfer. From that formula, the average consumer or Average Propensity

to Consume (APC) is obtained, which is the ratio of consumption to income. Then, if there is a change, such as an increase in income leading to an increase in consumption, it can be calculated with the Marginal Propensity to Consume, This is the shift in spending brought on by an increase in income.

According to Franco Modigliani's consumption theory in Apriliana 2011, since people's earnings differ, consumption levels do not necessarily have to be correlated with income levels. Modigliani's consumption theory is called the Life Cycle Hypothesis, which explains that the level of consumption depends not only on income but also on wealth, which can be generated through savings, investments, income allocation, inheritance, and so on. (Apriliana, 2011).

3. METHODS

The scope of this study is to focus on the determinant of the labor force, electricity consumption, and clean water consumption in Indonesia in 2014-2019. The type of research conducted in this research is descriptive research with a quantitative approach. The Central Bureau Statistics of Indonesia provided the panel data used in this study, which consists of time series data from 2014 to 2019 and cross-sectional data from 34 provinces. The method of data collection in scientific research is intended to obtain material for data collection carried out by the library method. Quantitative analysis in this study uses the Ordinary Least Square regression tool with the help of Eviews 12 software.

This study uses the labor force, electricity consumption and clean water consumption as independent variables, and economic growth as the dependent variable. In this study using the natural logarithm (ln) model This has the benefit of unit equating and reducing the likelihood of heteroscedasticity since the transformation that positions the slope coefficient I and variable measurement scale can directly display the elasticity of Y to Xi, namely the percentage change in Xi (Gujarati, 2009).

Table 1. Operational Definition

Variable	Symbol	Operational Definition	Unit
GDP	GDP	Total value of final goods and services produced by all economic units or total added value produced by all business units in a given nation.	Billion Rupiah
Labor Force	LF	Percentage of people in their working years (15 and older) who are employed	Percent

		and have employment but aren't working right now.	
Electricity Consumption	ELEC	The amount of electricity consumption in each province in Indonesia.	GWh
Clean Water	CW	The amount of potential production capacity of clean water companies in each province in Indonesia.	Liter per second

The model used in this investigation is as follows after using the natural logarithm model (ln):

$$\mathbf{Ln(GDP)it = \alpha_0 + \alpha_1(LF)it + \alpha_2 Ln(ELEC)_{it} + \alpha_3 Ln(CW)_{it} + \mu_{it}}$$

LnGDP : Economics Growth

LF : Labor Force

LnELEC : Electricity Consumption

LnCW : Clean Water Consumption

α_0 : Constant

α_1, α_2, α_3 : The Coefficient Of Each Variable

i : Provincial Cross Section Units in Indonesia

t : Unit Time Series kurun timw period 2014-2019

e : Error term

The classical assumption must be tested in order to satisfy the requirements outlined prior to evaluating the hypothesis using the t-test and F-test because this study employs secondary data. Normality, heteroscedasticity, multicollinearity, and autocorrelation tests are the components of the traditional assumption test. The model in this study is normally distributed and free from heteroscedasticity and multicollinearity issues, according to the results of the classical assumption test. However, the model has an autocorrelation problem, to cure it using the first difference method.

4. RESULTS

The best model in this study must be selected in order to estimate the impact of the labor force, power consumption, and clean water use on Indonesia's economic growth. The value of probe is determined by the Chow test findings. FEM (fixed effect model) is the better model between CEM and FEM if Chi-Square < (0.05). The Hausman test was used to determine which of the FEM and REM models was the best after the Chow test. The prob value is generated from the Hausman test findings. Chi-Square < (0.05)

indicates that the fixed effect model, or FEM, is the best model. The fixed effect model is the most effective model in this set, according to the Chow and Hausman tests.

Asumsi Classic Test

Multikolinearity Test

The term "multicollinearity" refers to the degree of linear resemblance or connection between the variables of GDP , labor force, electricity consumption, and clean water.

Table 2. Multikolinearity Test

Variable	Coefficient Variance	Uncented VIF	Centered VIF
C	0.256576	233.8542	NA
LNLF	0.010704	175.7641	1.004787
LNELEC	0.002094	118.3228	3.892576
LNCW	0.003872	242.3001	3.895127

Based on the results of the multicollinearity test in table 2 above, it can be concluded that this study does not exhibit multicollinearity symptoms, as the VIF values are still below 10. Specifically, the labor force has a VIF value of 1.004787, electricity consumption has a VIF value of 3.892576, and clean water consumption has a VIF value of 3.895127.

Heterokedasticity Test

The goal of heteroskedasticity detection is to determine whether a regression model's residuals vary unequally from one observation to the next.

Table 3. Heterokedasticity Test

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-0.109320	0.139404	-0.784195	0.4340
LNLF	-0.000608	0.010156	-0.059845	0.9524
LNELEC	0.016391	0.008593	1.907527	0.0582
LNCW	0.006263	0.015977	0.392021	0.6955

Based on Table 3, the results of the heteroscedasticity test indicate that the probability values for each variable are > α (0.05), where the Labor Force is 0.9524, electricity consumption is 0.0582, and clean water consumption is 0.6955. Therefore, it can be concluded from this heteroscedasticity test that there is no indication of heteroscedasticity in this study.

Normality Test

To ascertain whether or not the residuals of the regression model under study are normally distributed, normality detection is carried out. The Jarque-Bera test and graphical analysis of the histogram are used in this study to examine the data for normality.

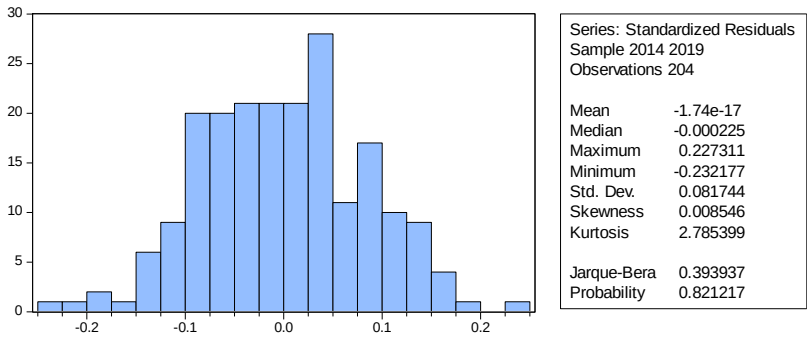

Figure 5. Normality Test

In the Jarque-Bera test, the Jarque-Bera probability value is examined. If the Jarque-Bera value > α (0.05), then the data used is normally distributed. The results from Figure 4.1 in the Jarque-Bera normality test show that the Jarque-Bera probability value of 0.821217 > 0.05, thus it can be concluded that the data used is normally distributed.

Autocorrelation Test

Autocorrelation detection is used to determine whether there is a correlation between the values in sample x and the observed values of the previous sample (x-1). Autocorrelation is detected using the *Breusch-Godfrey* LM Test.

Table 4. Autocorrelation Test
Breusch-Godfey Serial Correlation LM Test

F-Statistic	83.66089	Prob. F (2,198)	0.0000
Obs*R-squared	93.43446	Prob. Chi-Square (2)	0.0000

From table 4 above, the Chi-square probability of the autocorrelation test utilizing the Breusch-Godfrey LM Test is 0.0000 < α (0.05), suggesting an autocorrelation issue. To remedy the symptoms of autocorrelation, the first difference method is used as follows.

Tabel 5. Autokorelasi Test First Difference
Breusch-Godfey Serial Correlation LM Test

F-Statistic	1.916787	Prob. F (2,197)	0.1498
Obs*R-squared	3.874928	Prob. Chi-Square (2)	0.1441

It can be seen from the comparison of table 4 and table 5 that before and after the correction in the autocorrelation test with first difference, the Chi-Square probability

value became 0.1441 where > α (0.05). According to Agus Tri Basuki in 2015, the remedy for the autocorrelation problem can be done using the first difference method. (First difference). This is also supported by the research of Teresa Purwanti and Muhammad Nasrullah in 2019, which stated that the model did not pass the autocorrelation test and was remedied with the first difference, thus the model was free from the autocorrelation problem. Also, research by Rizky Aulia and Azhar Latief in 2020, with results from classical assumption tests, stated that the model did not pass the autocorrelation test and was corrected using the first difference method.

Table 4. Results of Regression Model Estimation

Dependen Variable: GDP	Model Fixed Effect
Constanta	9.872417
Std. Error	0.304138
T-Statistic	32.46028
Probability	0.0000
LOGCO2	5.56E-06
Std. Error	1.51E-05
T-Statistic	0.367201
Probability	0.7140
ENG	0.042863
Std. Error	0.018556
T-Statistic	2.309865
Probability	0.0223
FDI	0.199685
Std. Error	0.035278
T-Statistic	5.660255
Probability	0.0000

The following equation, which summarizes the data above, can be used to build a panel data analysis model that looks at the variables influencing GDP growth in Indonesia:

$$\mathbf{Ln(GDP)it = \alpha_0 + \alpha_1(LF)it + \alpha_2 Ln(ELEC)_{it} + \alpha_3 Ln(CW)_{it} + \mu_{it}}$$

$$LnGDP = 9.793843 - 0.001428LnLF + 0.049289LnELEC + 0.205444LnCW + \mu$$

Coefficient Determination (R^2)

The degree to which independent factors can affect the dependent variable is shown by the coefficient of determination. A number between 0 and 1 represents the coefficient of determination's value. Given the minimal determinant value, the independent factors' ability to change the dependent variable is incredibly low, which is approximately 0. A value near one, on the other hand, suggests that the independent variables provide valuable information about the dependent variable.

The fixed effect model regression's results showed that the dependent variables—labor force, electricity consumption and clean water consumption —on GDP in Indonesia 2014-2019 had a coefficient of determination (R2) value of 99.51%. However, the remaining 0.49% is due to other factors that are not included on the research model.

F-statistic Test

Using the F-test, The dependent variable and the concurrently measured independent variables are related. The F-statistic probability value of 0.000000 (significant at α 5%) indicates that the independent variables collectively have an effect on the dependent variable, according to the estimate findings using the fixed effect model.

t-statistic Test

The purpose of this t-test is to ascertain how much each independent variable adds to the explanation of the variation in the dependent variable. If the probability value α is less than 5%, then the independent variable is relevant to the dependent variable. This test looks into partial significance using the t-test. Nevertheless, the independent variable is not significant for the dependent variable if the probability value α is more than 5%.

Table 5. t-statistic Test Table

Variable	t-Statistic	Prob.
C	33.02206	0.0000
LNLF	-0.066064	0.9474
LNELC	2.696140	0.0077
LNCW	6.044164	0.0000

As can be observed from the preceding table, the influence of the workforce on economic growth can be seen from the probability value of 0.9474 > the significance level of 0.05, which means that the workforce does not influence economic growth. The influence of electricity consumption on economic growth can be seen from its probability value of 0.0077 < significance level of 0.05, which means that electricity consumption affects economic growth.

5. DISCUSSION

The Effect of Labor Force on Economic Growth in Indonesia 2014-2019

The estimation results of the FEM model in table 1 show that the regression coefficient value for the labor force variable shows a negative value of 4.88E-06 and a probability value of 0.7606 > 0.5 or has no significant effect on the level (0.05). This shows that every 1% increase in the labor force will reduce economic growth by 4.88E-

06 with the assumption of *ceteris paribus*. The results of this study are not in line with Todaro and Smith in Karim who explained that traditionally labor growth can increase economic growth. A huge workforce translates into higher production and a larger population growth. Then, depending on how well the local economy absorbs the labor and uses the extra energy at work, it can also be referred to as a positive or negative effect of population expansion (Karim, 2018).

The study's findings also run counter to the notion that economic growth is significantly and favorably impacted by the labor force.

Recent studies that demonstrate that the labor force has little bearing on economic growth, such as Aisyah Safitri and Ariusni (2019), Karim et al. (2018), and Lawal (2018), also validate the findings of this study.

The Effect of Electricity Consumption on Economic Growth in Indonesia 2014-2019

The estimation results of the FEM model in table 1 show that the regression coefficient value for the electricity consumption variable shows a positive value of 0.049518 and a probability value of 0.0075 > 0.5 or has a significant effect on the level (0.05). This shows that every 1 GWh increase in electricity consumption will increase economic growth by 0.049518 with the assumption of *ceteris paribus*.

This is consistent with Mankiw's theory, which states that households earn money from their capital and labor, which they then utilize for savings and spending. Additionally, Mankiw contends that government spending, investment, and consumption all contribute to the economy's output (Mankiw, 2007). J. M. Keynes also assumes the primary component driving economic growth is aggregate expenditure, namely public spending that encompasses commodities and services (Churchill & Ivanovski, 2020). In addition, the theory from Franco Modligiani which states that consumption does not have to depend on income, but also the wealth owned includes savings, investment, income allowance, and inheritance (Apriliana, 2011).

In addition, it is also supported by the latest research from Dwitasari (2020), Oluwatoyin, et al. (2018), Pham Dinh Long (2018), Churchill (2020), and Chi Zhang (2017) with the results of research that electricity consumption has a significant and positive effect on economic growth.

The Effect of Clean Water Consumption on Economic Growth in Indonesia 2014-2019

Table 1's estimation findings from the FEM model demonstrate that the clean water consumption variable's regression coefficient value is positive at 0.198354, with a

probability value of 0.0000 > 0.5, indicating a significant impact on the level (0.05). Based on the assumption of *ceteris paribus*, this indicates that every liter of clean water consumed per second will result in a 0.198354 boost in economic growth..

Furthermore, this research aligns with the most recent findings, namely Rusmusi (2018), Brilyawan (2021), Hutauruk (2021), and Lianna (2020) with research results that clean water consumption Has a noteworthy and advantageous impact on economic expansion.

6. CONCLUSION

Given that its probability value is 0.7606 > significance level of 0.05, it is evident that labor force hasn't an impact on economic growth.

Given that its probability value is 0.0075 < significance level of 0.05, it is evident that electricity usage has an impact on economic growth.

Given that its probability value is 0.0000 < significance level of 0.05, it is evident that clean water consumption has an impact on economic growth.

7. LIMITATION

The limitation in this research is in terms of data. The data presented by BPS has not been updated even though the year has changed. Additionally, there is a limitation in the independent variables due to endogeneity in the variables, which led the author to reduce the number of variables. In this research, it is hoped that it can serve as a reference for conducting more updated studies in terms of data. Additionally, this research can be used as a basis for formulating economic policies.

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