

Analysis of Labor Demand and Supply in North Sumatra

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Abstract— The availability of a large number of workers in North Sumatra can be seen from the level of labor force participation which continues to increase from year to year. Where an increase in the availability of the number of workers must be followed by an increase in the availability of jobs that can be seen from the level of demand and supply of the number of workers. This study aims to analyze the factors that can affect the demand and supply of labor in North Sumatra. The method of analysis used is the Two-Stage Least Square (2SLS) method using time series data from 1999-2019. The estimation results show that from the demand side, the minimum wage variable has a negative effect on labor demand, while the Regional GDP, Investment, Labor Productivity, and inflation variables have a positive effect on labor demand. Meanwhile, the estimation results of the supply of labor show that the minimum wage, the level of labor force participation, and household consumption has a positive effect on the level of labor supply in North Sumatra.

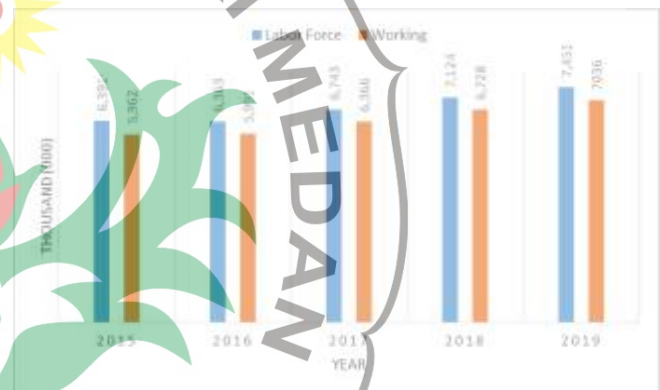
Keywords—2SLS, Labor Demand and Supply, Minimum Wages, Regional GDP, Investment, Inflation, Consumption, Labor Productivity, Labor Force Participation Rate

I. INTRODUCTION

The development process calls for economic growth followed by changes in the economic structure from agriculture to industry or services and institutional changes either through regulation or institutional reform itself. One of the indicators used to measure the economic development of an area is seen from the absorption of labor, the increase in the number of jobs, and the types of employment opportunities for the local community [1]. An economy that is growing rapidly is not a guarantee for a region that can be said to be prosperous if it is not followed by an expansion of employment opportunities to accommodate new workers who annually enter the world of work [2].

According to Gray [3], the goal of creating job opportunities is closely related to the consideration of equal distribution of income, considering that the largest part of the population group that is classified as unemployed as well as those with low income. The availability of a large number of workers in North Sumatra can be seen from the level of labor force participation which continues to increase from year to year. However, an increase in the availability of the number of workers must also be accompanied by an increase in the availability of employment opportunities. In general, both in

developing and developed countries, the rate of population growth is greater than the rate of employment which can have an impact on the unemployment rate.



Source: BPS Sumatera Utara

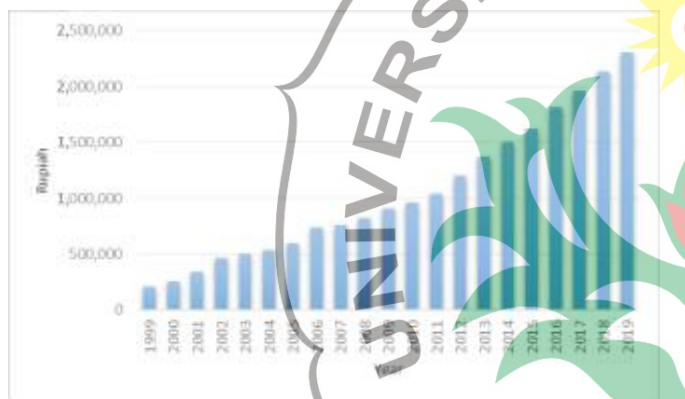
Fig. 1. Number of Labor and Employment in North Sumatra

From Fig. 1 above, it can be seen that the number of people who work every year is always below the number of the labor force. This explains that the amount of demand for labor is always below the supply of labor in the labor market which will certainly lead to the unemployment rate. In fact, even in developed countries it is unlikely that the unemployment rate will be at the level of 0 percent. However, the value must always be pressed to a low level so that the economy of a region can be said to be running well. In this case in North Sumatra, the open unemployment rate based on statistical data has decreased annually from 6.71 percent in 2015 to 5.56 percent in 2019.

When talking about the labor market, it must be seen from two sides, namely, supply and demand. In terms of employment, the demand for labor describes how much a company will employ workers with various levels of wages in a certain period. Meanwhile, the supply of labor is a relationship between the level of wages and the number of workers that labor providers are ready to provide. The demand and supply of labor is strongly influenced by the level of wages. For companies wages are costs incurred while for the community wages are income received. Changes in wage levels can affect the demand and supply of labor. An increase

in wages will reduce the absorption of labor from the demand side and increase the supply of labor [4].

A company in determining wages proportionately for its employees is determined by various factors, including the minimum wage standards set by the government in each region. Minimum Wage is a minimum standard used by entrepreneurs or industry players to provide wages to workers in a business environment calculated based on the fulfillment of the decent needs of the community in an area. From the supply side, increasing wages are expected to increase welfare for workers. On the other hand, the determination of the minimum wage often does not pay attention to the mechanisms in the labor market from the demand side, resulting in a decrease in labor absorption which can increase the unemployment rate [5].



Source: BPS Sumatera Utara

Fig. 2. Amount of Regional Minimum Wage in North Sumatra Province

Based on Fig. 2 above shows that the minimum wage setting by the government continues to experience growth every year. The highest minimum wage rate growth occurred after the 1998 crisis with an average UMR growth of above 20 percent until 2002 by recording the growth of the UMR in North Sumatra of 36.27 percent. Meanwhile, the lowest growth occurred in 2007 which only recorded a growth in the UMR rate in North Sumatra of 3.15 percent.

Apart from the level of wages, there are several other factors that can influence the demand and supply of labor. According to Rizqal [6], in addition to wages, factors such as GRDP, direct investment and rising prices for consumer goods can affect labor absorption. Connell et.al. [7] say that there is an effect of labor productivity on labor demand. Meanwhile, from the supply side of labor, Simanjuntak [8] states that in addition to wages, there are factors such as the level of labor force participation that can affect the supply of labor.

II. REVIEW OF LITERATURE

A. Demand and Supply of Labor

The demand for labor can be influenced by the demand for a production good so that the company will increase the

workforce for its production if the demand for manufactured goods increases. Therefore, the demand for labor is called a derived demand [9]. The demand for labor has an individual character in the labor market. Labor is purchased not to meet the need for labor, but is purchased because of certain tasks to fulfill and to have services provided [10].

Meanwhile, the supply of labor is very much determined by the number of people of working age who have become the labor force. The more labor force, the labor supply will also increase [11]. According to Bloom and Freeman [12], the factors that influence the supply of labor are population, the larger the population, the more available labor for either the labor force or the non-labor force, thus the greater the supply of labor. And the age structure of the population, increasing the longevity of the population is one of the main achievements of society. This reflects an increase in health and well-being. Indonesia is included in the young age structure, this can be seen from the pyramid shape of Indonesia's population. Although population growth can be reduced, the supply of labor is getting higher because more people are entering the working age, thus the supply of labor will also increase. According to Borjas [9], the factor that affects the labor supply is productivity. Productivity is a concept that shows a link between output and work hours needed to produce a product from a person's available labor. In general, labor productivity is a function of education, technology and skills.

B. Previous Research

Research by Rizqal [6] shows that, based on the results of the simultaneity test and panel data regression, it shows that there is a simultaneous relationship between wage levels and labor absorption in a negative direction. Regional economic growth variables significantly affect the level of wages and labor absorption. Provincial minimum wage variables and workers' education level have a significant positive effect on wage levels. And physical investment variables and the level of price changes significantly affect labor absorption. Yossia [13] in his research shows that labor productivity has a significant negative effect on labor absorption, while real wages and economic growth have a positive effect on labor absorption. Chikwanha [14] in his research shows that in the long run several variables are statistically significant in explaining labor demand. The results showed that the increase in wages and import variables were significant in reducing worker demand. The results also show the strong positive impact of sector-based investment in increasing the demand for workers. Turyus [15] in his research shows that the provincial minimum wage has a negative and significant effect on labor absorption. And investment has a negative and insignificant effect on employment. Kadir [16] in his research shows that investment has a positive effect on labor absorption, while consumption has a negative effect. The higher the investment, the lower the employment in the manufacturing industry. And Wahyu [17] in his research shows that real GRDP, real PMA and the number of industrial units are significant and have a positive effect on labor demand, while real wages are significant and have a negative effect on labor demand. For labor supply, labor force and real wages have a significant and positive effect on labor

supply, while the human development index is significant and has a negative effect on labor supply.

III. RESEARCH METHOD

This study focuses on the demand and supply of labor for North Sumatra Province as a whole or in aggregate. The research year was conducted from 1998-2018. This study uses secondary data in the form of time series sourced from the Badan Pusat Statistik (BPS) of North Sumatra.

Therefore, the structural equation models used in this study are:

$$L_{Dt} = \alpha_0 + \alpha_1(U_{pt}) + \alpha_2(PDRB_t) + \alpha_3(Inv_t) + \alpha_4(PTK_t) + \alpha_5(Inf_t) + \mu_0 \quad (1)$$

$$L_{St} = \beta_0 + \beta_1(U_{pt}) + \beta_2(TPAK_t) + \beta_3(Kons_t) + \mu_1 \quad (2)$$

$$L_{Dt} = L_{St} \quad (3)$$

Equation (1) above is a structural equation for the labor demand function. The structural equation for labor supply can be seen in equation (2). Meanwhile, equation (3) is an equilibrium condition of demand and supply of labor in the labor market.

Where, L_d (demand for labor / working), L_s (supply for labor), U_p (Regional Minimum Wage), $PDRB$ (Value of real gross regional domestic product), Inv (Investment), PTK (Labor productivity), Inf (Inflation Rate) and $TPAK$ (Labor force participation rate), $Kons$ (Total household consumption).

From the structural equation above, the reduced form equation is formed in the form of the reduced form wage rate equation (equation 4) and the reduced form equation for labor demand and supply in equilibrium conditions (equation 5) as follows:

$$U_{pt} = \theta_0 + \theta_1(TPAK_t) + \theta_2(Kons_t) + \theta_3(PDRB_t) + \theta_4(Inv_t) + \theta_5(PTK_t) + \theta_6(Inf_t) + \mu_3 \quad (4)$$

$$L_{Dt} = \theta_0 + \theta_1(TPAK_t) + \theta_2(Kons_t) + \theta_3(PDRB_t) + \theta_4(Inv_t) + \theta_5(PTK_t) + \theta_6(Inf_t) + \mu_4 \quad (5)$$

A. Simultaneous Equation Identification

Based on the function of demand and supply of labor in this study, there are two endogenous variables (L and U_p) and six exogenous variables ($GDRP$, Inv , PTK , Inf , $TPAK$ and $Kons$).

TABLE I. IDENTIFICATION OF DEMAND AND SUPPLY SIMULTANT EQUATION LABOR

Equation	Variable		K - k	m - 1	Kon disi	Note
	Endogenous	Exogenous				
Demand (L_d)	U_p, L_d	$PDRB, Inv, PTK, Inf$	6 - 4	2 - 1	$2 > 1$	Over identified

Supply (L_s)	U_p, L_s	$TPAK, Kons$	6 - 2	2 - 1	4 > 1	Over identified
Where: M = the number of endogenous variables in the model m = the number of endogenous variables in a particular equation K = the number of endogenous variables in the model k = the number of exogenous variables in a particular equation						

Based on Table I, it can be seen that the two structural equations are overidentified. So because these equations are in the over identified category, the right parameter prediction technique to use is the Two Stage Least Square (2SLS) method.

B. The Hausman Simultaneous Test

The purpose of the simultaneous test is to prove empirically that a system of equations actually has a simultaneous relationship between its structural equations. Simultaneity problems arise because several endogenous regressor variables are correlated with error and disturbance, therefore a simultaneity test is needed to test whether the endogenous regressor variables are correlated with error. Hausman proposed a test called Hausman's specification error test [18].

C. Simultaneous Equation Estimation

There are several methods that can be used to estimate the simultaneous equation parameters, namely the ILS (Indirect Least Square) method, 2SLS (Two Stage Least Square), LIML (Limited Information Maximum Likelihood) and 3SLS (Three Stage Least Square). If an equation in the simultaneous model is over identified, the ILS (Indirect Least Square) method cannot be used to predict the structural coefficient. Therefore, to predict an over identified equation it can be done with 2SLS (Two Stage Least Squares), 3SLS (Three Stage Least Squares), LIML (Limited Information Maximum Likelihood) or FIML (Full Information Maximum Likelihood).

In this study, the model estimation method used is 2SLS, with several considerations, namely the application of 2SLS produces consistent, simple and easy estimates, while the 3SLS and FIML methods use more information and are more sensitive to measurement errors and model specifications. Error [19].

IV. RESULT AND DISCUSSIONS

A. Simultaneous Test

Using a test called Hausman's specification error test. With the initial step taken is to regress the reduced form equation (4) to get a residual, then regress the reduced form equation (5) which added residual variables so that the following results are obtained:

TABLE II. SIMULTANEOUS TEST

Dependent Variable: LS				
Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	3518075.	665667.8	5.285030	0.0001
TPAK	24197.28	10956.70	2.208447	0.0458
KONS	32.49672	7.014965	4.632485	0.0005
PDRB	-9.612798	4.740518	-2.027795	0.0636
INV	-0.025489	0.020026	-1.272750	0.2254
PTK	-32.12635	14.34753	-2.239155	0.0433
INF	13421.88	9190.735	1.460370	0.1679
RES	0.464652	0.770937	0.602711	0.0571
R-squared	0.953265			
Adjusted R-squared	0.928101			
Prob(F-statistic)	0.000000			

Source: eviews output

The table above shows that the residual variable coefficient is significant at $\alpha = 0.1$ with a p value of 0.0571, which means that the null hypothesis (no simultaneous relationship) is rejected. Therefore, it can be concluded that the Hausman test shows that there is a simultaneous relationship between the labor demand / supply variable and the minimum wage.

B. Simultaneous Equation Estimation

The estimation results from the simultaneous model of labor supply and demand equations are as follows:

1) Labor Demand

The estimation results show that from the demand side, the minimum wage variable has a negative effect on labor demand, while the GDP, investment, labor productivity and inflation variables have a positive effect on labor demand.

TABLE III. ESTIMATED EQUATION OF LABOR DEMAND

Dependent Variable: LD				
Method: Two-Stage Least Squares				
Instrument specification: PDRB INV PTK INF TPAK KONS				
Variable	Coef.	Std. Error	t-Statistic	Prob.
C	4512102.	276922.5	16.29373	0.0000
UP	-2.336276	1.110371	-2.104051	0.0527
PDRB	6.297668	4.236230	1.486621	0.1578
INV	0.063871	0.029739	2.147691	0.0485
PTK	58.41921	21.21388	2.753820	0.0148
INF	4239.798	12524.99	0.338507	0.7397
R-squared	0.884423			
Adjusted R-squared	0.845897			
Prob (F-statistic)	0.000001			

Source: eviews output

Based on the table. III, it can be seen that the minimum wage level has a negative and significant effect at $\alpha = 10$ percent on the level of labor demand in North Sumatra. This means that an increase in the minimum wage will reduce the demand for labor. These results are in accordance with research conducted by Turyus [15] which states that minimum

wages have a negative and significant effect on labor absorption. Meanwhile, the amount of investment and labor productivity has a positive and significant effect at $\alpha = 5$ percent on the level of labor demand in North Sumatra. This means that an increase in the amount of investment and labor productivity will also affect the increasing demand for labor in North Sumatra. This is also in accordance with research conducted by Turyus [15] and Kadir [16] which states that investment has a positive and significant effect on employment. However, on the other hand, regional income and inflation variables do not have a significant effect on labor demand in North Sumatra.

The estimation result of the equation of the level of labor demand gives a coefficient of determination (Adj. R2) of 0.84. This shows that the independent variables in the model are able to explain 84 percent of the variation in each variable in labor demand relatively well. The independent variables together have a significant effect on the labor demand variable in North Sumatra at $\alpha = 1$ percent which is indicated by the F statistical value with a p-value <0.01, it can be concluded that all parameters are assumed to be different from zero or the model used is correct.

2) Labor Supply

The estimation results show that the minimum wage, labor force participation rate, and household consumption have a positive effect on the level of labor supply in North Sumatra.

TABLE IV. ESTIMATED EQUATION OF LABOR SUPPLY

Dependent Variable: LS				
Method: Two-Stage Least Squares				
Instrument specification: PE INV PTK INF TPAK KONS				
Variable	Coef.	Std. Error	t-Statistic	Prob.
C	830244.4	3008988.	0.275921	0.7859
UP	4.355461	4.857893	0.896574	0.0382
TPAK	80754.96	59345.97	1.360749	0.1914
KONS	24.30204	22.78991	1.066351	0.0301
R-squared	0.745425			
Adjusted R-squared	0.700500			
Prob(F-statistic)	0.000010			

Source: eviews output

Based on the table. IV, it is known that the minimum wage rate has a positive and significant effect at $\alpha = 5$ percent on the level of labor supply in North Sumatra. This means that an increase in the minimum wage will increase the supply of labor. Household consumption also has a positive and significant effect at $\alpha = 5$ percent on the level of labor supply in North Sumatra. This means that an increase in the amount of household consumption will have an effect on the increase in the supply of labor in North Sumatra. Meanwhile, the labor force participation rate variable does not have a significant effect on the level of labor supply in North Sumatra.

The estimation result of the equation of the level of labor supply gives the coefficient of determination (Adj. R2) of

0.70. This shows that the independent variables in the model are able to explain 70 percent of the variation in each variable in the labor supply relatively well. The independent variables together have a significant effect on the labor supply variable in North Sumatra at $\alpha = 1$ percent which is indicated by the F statistical value with a p-value < 0.01 , it can be concluded that all the parameters or models used are correct.

V. CONCLUSION

Based on the analysis that has been carried out in the previous section, it can be concluded that:

- There is a simultaneous relationship between the variable demand / supply of labor and the minimum wage in North Sumatra.
- Factors that have a significant effect on labor demand in North Sumatra are minimum wages, investment and labor productivity. The minimum wage variable has a negative effect on the level of labor demand. This means that if the minimum wage increases, it will cause the level of labor demand to fall. Meanwhile, the investment and labor productivity variables have a positive effect on the level of labor demand in North Sumatra. This means that if investment and labor productivity increase, the level of labor demand will also increase.
- Meanwhile, the factors that have a significant effect on the supply of labor are the minimum wage and household consumption. All variables have a positive effect on the level of labor supply in North Sumatra. This means that if the minimum wage and the level of household consumption increase, it will increase the supply level of labor.

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