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DEVELOPMENT OF SEMIPARAMETRIC PATH ANALYSIS MODELING TRUNCATED SPLINE: DETERMINANTS OF INCREASED REGIONAL ECONOMIC GROWTH

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ABSTRACT

This research aims to determine regional economic improvement to achieve a better Indonesian economy and accelerate the path to achieving a Golden Indonesia in 2045 so that it can be realized in a shorter time. This goal will be achieved with the help of statistical analysis methods, where the analysis used in this research is semiparametric truncated spline indirect effect and total effect analysis. The research becomes original in its approach with the utilization of this method and offers novel insights into the dynamics of regional economic development in Indonesia. These methods in this research serve as a tool for analyzing regional economic dynamics, identifying critical factors for improvement, informing policy decisions aimed at realizing Indonesia's economic aspirations for the future, and providing more flexible results to achieve the research objectives. The study was carried out on data with regional expenditure variables as exogenous variables, labor absorption variables as mediating endogenous variables, and regional economic growth variables as pure endogenous variables. The data used in the research are data published by the National/Provincial Central Bureau of Statistics in the form of the Indonesian Statistics Book, BPS publications in the form of Provinces, Provincial Government Financial Statistics, Directorate General of Financial Balance, Sumreg Bappenas, as well as from Ministries, Institutions or Agencies that related to providing data relating to the variables of this research in 2020. The results of this research are that the relationship between regional expenditure variables and labor absorption variables has a significant effect on regional economic growth variables.

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1. INTRODUCTION

In achieving the goal of improving the regional economy which is driven by high economic growth with economic development as its strength. Development is concluded to achieve community prosperity through economic development to overcome various development cases, and social problems. Not to mention the fact that the gap between rich and poor groups is increasingly widening along with sharp economic growth in Indonesia. Economic growth is economic development that occurs over time and leads to increased income in the region. Economic growth is mainly measured by the increase in income in a region over a certain period of time.

Economic growth is the main condition for economic development, and the emphasis is on who will foster economic growth. If economic growth is only enjoyed by some people, then the benefits of that economic growth will only be enjoyed by some people, so poverty and inequality of opinion will get worse **[1]**. Labor absorption is the number of jobs that have been filled and is expressed in the large number of people working **[2]**, **[3]**. Regional expenditure corresponding to all regional obligations is recorded as a deduction from net asset value in the relevant financial year. It includes all regional obligations recorded as a deduction from net asset value in the relevant financial year.

Previous research analyzing inclusive economic growth and comparative studies between provinces in Indonesia shows that government budgets have a significant effect on regional growth. However, the relationship between regional spending and regional economic growth is still a matter of debate among experts **[4].** This research aims to point out an original direction by assessing the relationships between regional expenditure, labor absorption, and regional economic growth. It explores the complex dynamics of relationship by using the semiparametric truncated spline indirect effect and total effect analysis approach. As a result, this research provides a new viewpoint and enhanced understanding of the factors that propel economic growth at the regional level in Indonesia. Therefore, the novelty of this study resides not only in its methodology but also in its ability to provide a thorough understanding of the interaction between regional expenditure, labor absorption, and regional economic growth. This research contributes to the field of regional economic development in Indonesia by providing valuable insights into making more informed policy decisions and strategic interventions that aim to promote sustainable and inclusive growth at the regional level in Indonesia.

In general, it is known that economic growth is an indicator commonly used by a province to see the progress or capabilities of its province. Economic growth can show the extent to which economic activity will generate additional community income in a certain period. In the regional scope, the definition of regional economic growth is the same as national economic growth; only the location or region is narrowed down to the respective region and adjusted to the operational environment, such as province, city, or district. The specific aspect of regional economic growth that this study focuses on is the increase in overall community income and added value in the targeted region.

The sluggish economy in 2020 was a consequence of the implementation of restrictions on community activities in dealing with the COVID-19 pandemic. Referring to the 2020 BPS report data, it was found that employment and the economy have a fairly close relationship. The labor market plays an important role in advancing the economy, especially in developing countries like Indonesia. Government spending and economic growth have an inconsistent relationship, depending on conditions in a region. From this policy, it can be concluded that the allocation of regional expenditure in determining the minimum wage is also an important consideration, considering the wide regional differences.

One method in statistics used to determine the pattern of relationships between variables is regression analysis. In the analysis, a regression can be approached with three approaches, namely parametric, nonparametric, and semiparametric. If the relationship between the predictor variable and the response variable cannot be determined or there is no complete information regarding the shape of the data pattern, then a nonparametric approach can be used. Nonparametric regression models that are widely used include Kernel, Spline, Fourier Series, and Wavelets.

There is a limitation that regression analysis can only be used when a model only consists of one response variable. So, in its development, path analysis became known which can accommodate models with more than one response variable. Developments that can be carried out based on path analysis are semiparametric structural models, which are a combination of parametric and non-parametric. When the shape of the regression curve is known, the parametric regression approach is used, and when the shape of

the regression curve is unknown, the nonparametric approach is used. The parametric regression model is still imposed as a data pattern model, which will cause inaccurate conclusions if the form of function is unknown. Using knots, the truncated spline technique can be utilized to estimate curves in nonparametric regression models [5].

In the nonparametric regression approach, the form of the estimated relationship pattern model is determined based on the existing data pattern. With the Spline function technique, the pattern of associations between responses and unknown predictors can be inferred [6], [7], [8], Local Polynomials [9], Kernels [10], Wavelets [11], or Fourier Series [12]. Because of its enormous flexibility, the spline technique may manage data relationship patterns whose behavior varies across certain sub-intervals [13]. A function known as a spline is produced by minimizing Penalized Least Squares (PLS), an estimate criterion that combines a penalty function and goodness of fit [11], [14]. Previous research that has been carried out uses regression analysis with a flexible approach. The research discusses parametric, nonparametric, and semiparametric regression analysis [15].

Splines are a component of regression analysis, specifically nonparametric and semiparametric regression. Nonparametric spline regression gives the following advantages for modeling data patterns: (a) Splines have a very specific and accurate statistical interpretation. The spline model is created by optimizing the Penalized Least Squares (PLS) approach. (b) The spline is capable of handling smooth data/functions. (c) Splines are especially good at dealing with data whose behavior is constantly changing at certain sub-intervals. (d) The spline is particularly good at generalizing extensive and intricate statistical modeling.

The spline method in nonparametric regression can be found in various forms, namely smoothing spline and truncated spline, where both spline methods use different coefficients in function estimation. The truncated spline method uses knot points, while the smoothing spline method uses smoothing coefficients, where this difference causes the optimization to obtain an estimator that is also different. The spline is very dependent on the knot points. A truncated spline is a segmented polynomial model that allows for the effective adaptation of local data characteristics [16].

Path analysis is a method of determining the most efficient path by studying the causal link between exogenous and endogenous variables. If the linearity condition is met and the shape of the regression curve is known, path analysis can be performed. Nonparametric route analysis is used if the linearity assumption is violated and the shape of the regression curve is unknown [17]. Parametric path analysis cannot be used, so an analysis was developed that can overcome this problem.

This research is important to determine the determinants of regional economic growth as well as to develop the indirect influence and total influence of semiparametric truncated spline path analysis. The study was carried out on regional expenditure data as an exogenous variable, labor absorption as a mediating endogenous variable, and regional economic growth as a pure endogenous variable. Previous research has been conducted on the influence of direct and indirect spending and investment on economic growth and labor absorption in Berau Regency using path analysis [18]. The difference between this research and previous research is that previous research used parametric path analysis, whereas this research used semiparametric path analysis.

Based on the explanation above, research is needed that investigates (examines in depth) the determinants of increased regional growth by developing a semiparametric path analysis of truncated spline indirect effects and total effects.

2. RESEARCH METHODS

2.1 Nonparametric Path Analysis

Parametric path analysis is one of the multivariate techniques that examines the causal linkages between exogenous and endogenous factors in order to determine the most effective path. Simply said, this model cannot be applied when the linearity assumption is not satisfied, the regression curve's form is uncertain, or the regression function is unknown. Therefore, nonparametric path analysis was developed, which is a development of nonparametric regression analysis. The nonparametric regression-based path

analysis model is a development of nonparametric regression analysis, with the nonparametric path analysis function presented in the following equation [15].

$$y_{1i} = f_1(x_{1i}) + \varepsilon_{1i}; i = 1,2,\dots,n \quad (1)$$

$$y_{2i} = f_2(x_{1i}) + f_2(y_{1i}) + \varepsilon_{2i}; i = 1,2,\dots,n$$
$$= f_1(x_{1i}, y_{1i}) + \varepsilon_{2i}; i = 1,2,\dots,n \quad (2)$$

2.2 Semiparametric Path Analysis

The statistical method used to test causal relationships between variables in a model is semiparametric path analysis, where several variables are considered to have a linear (parametric) relationship, and several other variables have a non-linear (nonparametric) relationship with unknown curve shapes. This method is useful when the relationship between the variables is complex and cannot be fully explained by a linear model. There are two models formed in semiparametric analysis, namely the liner model and the non-linear model. In semiparametric path analysis, the model used is a combination of the path model for parametric variables and the spline regression model for nonparametric variables. For example, if there are two variables, X and Y in a semiparametric path model, where X is the independent variable, and Y is the dependent variable, then the model can be formulated in the following **Equation (3)**.

$$y_i = \beta_0 + \beta_1 x_i + \sum_{k=1}^{K} \gamma_k f_k(x_i) + \varepsilon_i \quad (3)$$

where,

y_i	:	dependent variable (response variable) for the *i* observation.
x_i	:	independent variable (predictor variable) for the *i* observation.
β_0 and β_1	:	linear regression parameters to model the linear relationship between y_i and x_i
k	:	number of spline segments
γ_k	:	regression parameters for each k spline segment.
$f_k(x_i)$	:	k-th spline basis function at point x_i
ε_i	:	error/residue for the *i* observation.

One method used to analyze non-linear relationships is the truncated spline approach. Truncated spline is an approach that can handle data with changing behavior at certain sub-intervals. Truncated spline requires researchers to look for optimal knot points, and many optimal knot points are used because it places more emphasis on subsections. The advantage of the truncated spline is that it is good at dealing with data patterns that show sharp rises or falls with the help of knot points.

2.3 Linearity Test

To test the linearity assumption, the method used is Ramsey's REST method. Ramsey's RESET test can be used to determine the linear relationship between variables (linear or not). If there is a non-linear relationship, the test will proceed to the next stage, namely by carrying out the Modified Ramsey RESET Test.

The Regression Specification Error Test (RESET) method can be used to carry out linearity tests. In its Ramsey RESET approach, it uses Ordinary Least Squares (OLS) to minimize the sum of the squared errors of each observation [15]. The steps for linearity testing using the RESET method are as follows [15].

1) The first regression equation:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \dots + \beta_p X_{pi} + \varepsilon_i \quad (4)$$

Estimating parameters using the Ordinary Least Square (OLS) approach then produces the following estimates.

$$\hat{Y}_i = \hat{\beta}_0 + \hat{\beta}_1 X_{1i} + \dots + \hat{\beta}_p X_{pi} \quad (5)$$

Then do the first R_1^2 calculation with the **Equation (5)**

$$R_1^2 = 1 - \frac{\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2} \quad (6)$$

2) Then OLS is carried out for the second regression equation:

$$Y_i = \alpha_0 + \alpha_1 X_{1i} + \dots + \alpha_p X_{pi} + \alpha_{p+1}\hat{Y}_i^2 + \alpha_{p+2}\hat{Y}_i^3 + \varepsilon_1 \quad (7)$$

$$\hat{Y}_i = \hat{\alpha}_0 + \hat{\alpha}_1 X_{1i} + \ldots + \hat{\alpha}_p X_{pi} + \hat{\alpha}_{p+1} \hat{Y}_i^2 + \hat{\alpha}_{p+2} \hat{Y}_i^3 \quad (8)$$

Then perform R_2^2 calculations to produce the value R_2^2.

3) Testing the form of the relationship between predictor variables and linear or nonlinear response variables. The hypothesis used for the RESET test:

H_0: $\alpha_{p+1} = \alpha_{p+2} = 0$ vs
H_0: there is at least one $\neq 0$, $j = p+1, p+2$

with test statistics following the F distribution as in **Equation (9)**.

$$F = \frac{(R_2^2 - R_1^2)/2}{(1-R_2^2)/(n-(p+2))} \quad (9)$$

The decision to reject H_0 if Test Statistics F $> F_{(2,n-(p+2))}$ or *p-value* < 0,05 which means the relationship between variables is nonlinear.

2.4 Data

The data used in the research are data published by the National/Provincial Central Bureau of Statistics in the form of the Indonesian Statistics Book, BPS publications in the form of Provinces, Provincial Government Financial Statistics, Directorate General of Financial Balance, Sumreg Bappenas, as well as from Ministries, Institutions or Agencies that related to providing data relating to the variables of this research in 2020.

The study was carried out on regional expenditure data as an exogenous variable, labor absorption as a mediating endogenous variable, and regional economic growth as a pure endogenous variable. The research used semiparametric truncated spline path analysis to determine the causal relationship between exogenous, mediating, and endogenous variables. Semiparametric path analysis is a combination of nonparametric and parametric path analysis. The shape of the path diagram with three variables is as follows.

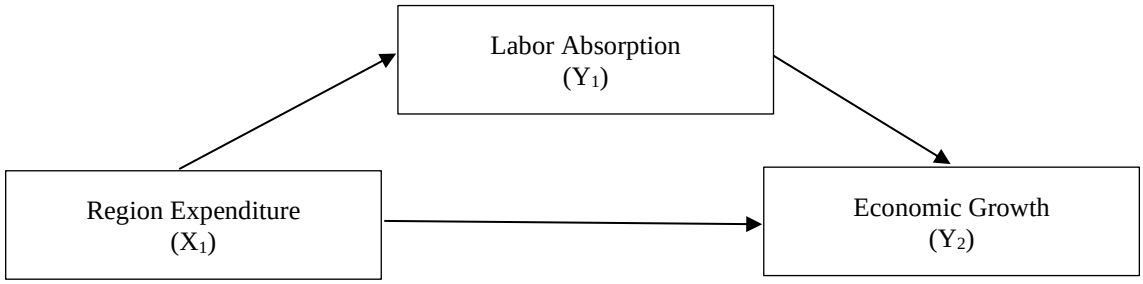

Figure 1. Path Diagram for Research Model

2.5 Analytical Process

In order to ensure transparency and reproducibility of this research, flowchart will be used to systematically present the data analysis process. The flowchart for the methodology as follows.

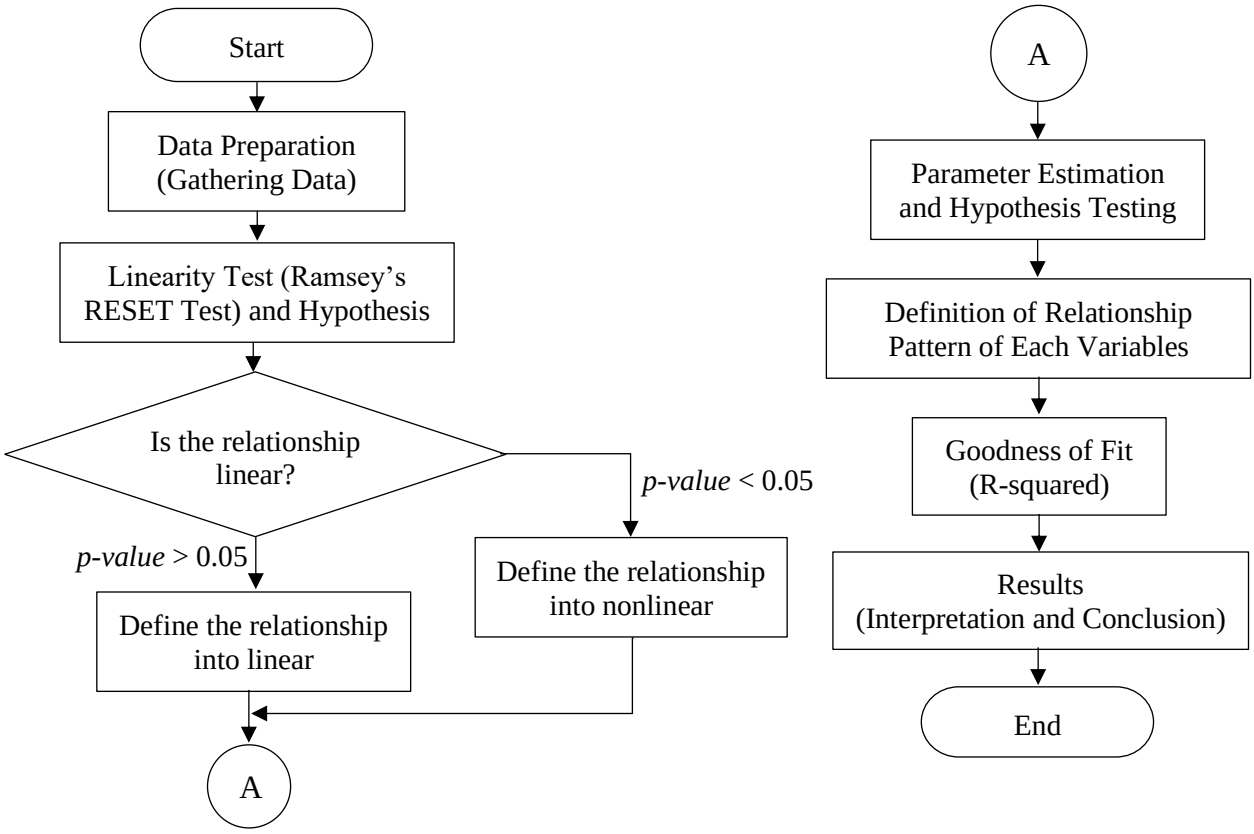

Figure 2. Flowchart of Analytical Process

3. RESULTS AND DISCUSSION

3.1 Linearity Test

Linearity testing is a tool for determining the relationship between variables so that results can be obtained to determine the appropriate analysis method. In this research, linearity test results will be limited to two test results: linear and non-linear. In the results of the Ramsey's RESET Test, relationships that have a linear form will later be resolved using a parametric approach, and non-linear forms of relationships will be continued with a test in the form of modified Ramsey's RESET to see whether the data pattern can be known or unknown. If the data pattern cannot be known, then it is solved using a semiparametric approach. The results of linearity testing using Ramsey's RESET Test method are in **Table 1** below:

Table 1. Table of Result Linearity Test

Relationship	P-value	Linearity	Result Modified Ramsey RESET -Quadratic		Result Modified Ramsey RESET -Qubic	
			P-value	Result	P-value	Result
$X_1 \rightarrow Y_1$	0.004	Not- Linear	0.007	Not-Quadratic	0.004	Not-Qubic
$X_1 \rightarrow Y_2$	0.011	Not- Linear	0.008	Not-Quadratic	0.003	Not-Qubic
$Y_1 \rightarrow Y_2$	0.050	Linear	-	-	-	-

***Data source**: researcher*

The data in **Table 1** shows the results of linearity testing on the three relationships between each endogenous variable and the exogenous variable as follows:

1. The relationship between Regional Expenditures and Labor Absorption has a p-value less than alpha (0.05), so it can be concluded that the relationship between these variables is not linear. So, a modified Ramsey's RESET test is needed to see the pattern of variable relationships. It can be seen that the pattern of relationships between variables cannot be known, so non-parametric estimation is used.

2. The relationship between Regional Expenditures and Economic Growth has a p-value less than alpha (0.05), so it can be concluded that the relationship between these variables is not linear. So, a modified Ramsey's RESET test is needed to see the pattern of variable relationships. The pattern of relationships between variables cannot be known, so non-parametric estimation is used in the estimation.
3. The relationship between Labor Absorption and Economic Growth has a p-value of more than alpha (0.05), so it can be concluded that the relationship between these variables is linear.

Based on the description above, it can be stated that the use of semiparametric methods in research is appropriate because there is a relationship between exogenous variables to endogenous variables and exogenous variables to mediating variables, which is not linear, while the relationship between mediating variables and endogenous variables is linear.

3.2 Parameter Estimation and Hypothesis Testing

The next step is parameter estimation and testing the hypothesis. Parameter estimation and hypothesis testing are carried out using the formed model. The classification of the results of the hypothesis can be determined based on if the p-value is less than 0,05, then the result is significant; meanwhile, if the p-value is more than 0,05, then the result is not significant. The following are the results of parameter estimation and the results of research hypothesis testing, which are written in tabular form in **Table 2** below:

Table 2. Table of Result Parameter Estimation and Hypothesis Testing

Path Model	Parameter	Coefficient	p-value	Result
Y_1	β_{01}	99.724	0.000	Significant
	β_{11}	-0.001	0.278	Not-Significant
	β_{21}	1.709×10^{-8}	0.298	Not-Significant
	β_{31}	-1.819×10^{-8}	0.290	Not-Significant
	β_{41}	2.015×10^{-9}	0.274	Not-Significant
Y_2	β_{04}	-82.279	0.000	Significant
	β_{14}	0.004	0.014	Significant
	β_{24}	-1.677×10^{-7}	0.013	Significant
	β_{34}	1.758×10^{-7}	0.012	Significant
	β_{44}	-1.069×10^{-8}	0.020	Significant
	β_{54}	3.916×10^{-9}	0.145	Not-Significant
	β_{64}	0.572	0.001	Significant

The results obtained contained several parameters that were significant and not significant. Significant parameters indicate that changes in independent variables significantly affect dependent variables; not significant parameters indicate that changes in independent variables do not significantly affect dependent variables. However, in interpreting the value of each path coefficient, it still had meaning because it could still have potential value and precision about the model, so in the interpretation, the coefficients that were not significant were still included, and for further research, this should be investigated by resampling.

3.3 Relationship Between Regional Expenditures (X_1) and Labor Absorption (Y_1)

The relationship between regional expenditure (X_1) and labor absorption growth (Y_1) can be seen in the following **Figure 3**:

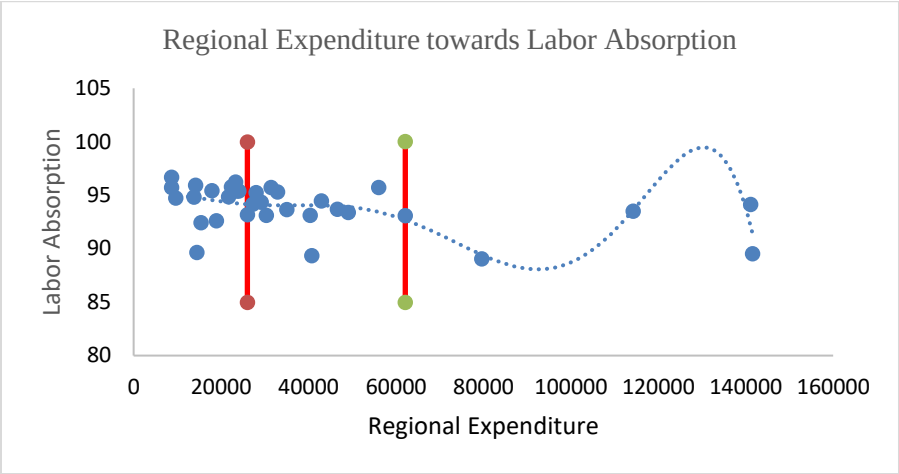

Figure 3. Plot of the Relationship Between Regional Expenditure and Labor Absorption

The scatter plot above shows the relationship between regional expenditure and labor absorption. The addition of the trend line is aimed at obtaining information about the definition of relationship between two variables. Based on the plot above, a non-linear and non-parametric relationship was found between the Regional Expenditure variable(X_1) and Labor Absorption (Y_1), so a non-parametric approach was used to analyze the path between the relationships. With the help of nonparametric truncated spline, it produces 2 knots and divides the regional expenditure into 3 regimes. Regime 1 consists of 0 to 26010.9, Regime 2 consists of 26010.9 to 62131.4, and Regime 3 consists of above 62131.4.

The Nonparametric Truncated Spline Model relationship between regional expenditure and labor absorption is shown in **Equation (10)**.

$$Y_{1i} = 99.72376 - 0.001X_{1i} + 1.709 \times 10^{-8}X_{1i}^2 - 1.819 \times 10^{-8}(X_{1i} - 26010{,}9)_+^2 + 2.015 \times 10^{-9}(X_{1i} - 62131.4)_+^2 + \varepsilon_{1i} \quad (10)$$

$$(X_{1i} - K_{11})_+ = \begin{cases} (X_{1i} - K_{11}) , X_{1i} \geq K_{11} \\ 0 , X_{1i} < K_{11} \end{cases}$$

$$(X_{1i} - K_{12})_+ = \begin{cases} (X_{1i} - K_{12}) , X_{1i} \geq K_{12} \\ 0 , X_{1i} < K_{12} \end{cases}$$

k_{11}: 26010.9

k_{12}: 62131.4

Regime 1: $0 < x < k_{11}$

$$Y_{1i} = 99.723 - 0{,}001X_{1i} + 1.709 \times 10^{-8}X_{1i}^2 + \varepsilon_{1i} \quad (11)$$

Regime 2: $k_{11} < x < k_{12}$

$$Y_{1i} = 87.515 + 0.001X_{1i} - 1.099 \times 10^{-9}X_{1i}^2 + \varepsilon_{1i} \quad (12)$$

$$Y_{1i} = 95.195 + 7.7 \times 10^{-5}X_{1i} + 9.164 \times 10^{-10}X_{1i}^2 + \varepsilon_{1i} \quad (13)$$

3.4 Relationship Between Regional Expenditures (X_1), Labor Absorption (Y_1) and Economic Growth (Y_2)

The relationship between regional expenditure (X_1) and economic growth (Y_2) can be seen in the following **Figure 4**:

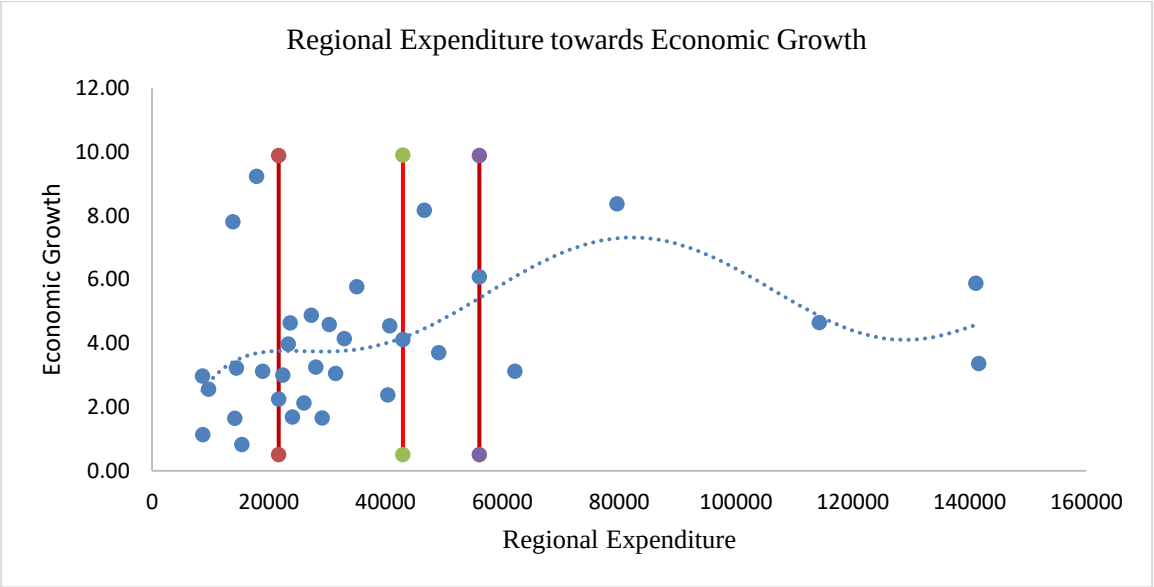

Figure 4. Plot of the Relationship Between Regional Expenditure and Economic Growth

The relationship between labor absorption growth (Y_1) and economic growth (Y_2) can be seen in the following **Figure 5**:

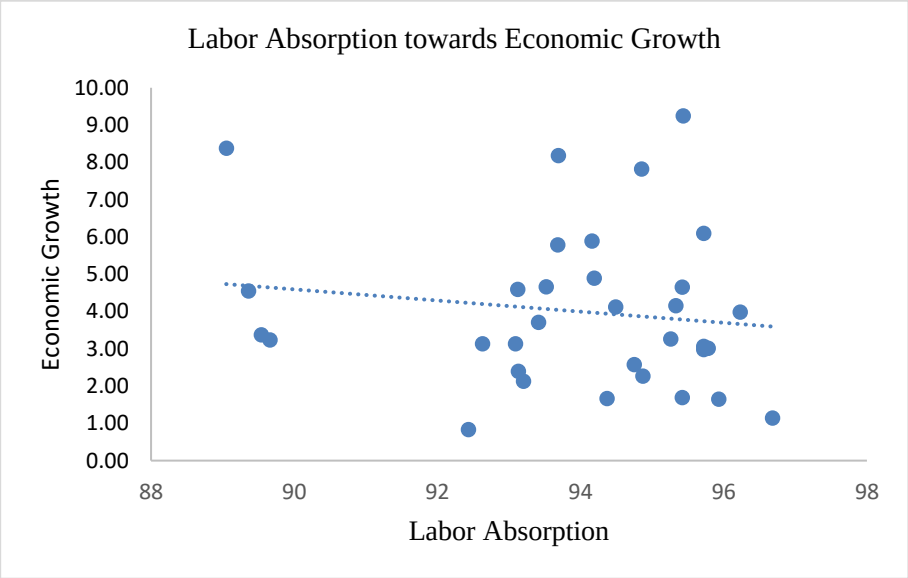

Figure 5. Plot of the Relationship Labor Absorption and Economic Growth

The scatter plot above shows the relationship between regional expenditure and economic growth, and between labor absorption and economic growth. The addition of the trend line is aimed at obtaining information about the definition of the relationship between two variables. Based on the plot above, a non-linear and non-parametric relationship was found between the Regional Expenditure variable(X_1) and Economic Growth (Y_2), so a non-parametric approach was used to analyze the path between the relationships. With the help of nonparametric truncated spline, it produces 3 knots and divides the regional expenditure into 4 regimes. Regime 1 consists of 0 to 21696.34, Regime 2 consists of 21696.34 to 42971.14, Regime 3 consists of 42971.14 to 56057.47, and Regime 4 consists of above 56057.47. Meanwhile, the relationship between labor absorption (Y_1) and Economic Growth (Y_2) has a linear relationship, which is confirmed by the linearity test results table and trend line on the plot.

Based on the two plots before, finding the combination relationship between Regional Expenditure (X_1), and Labor Absorption (Y_1), on Economic Growth (Y_2) that contains nonlinear, nonparametric, and linear relationships requires analysis with approach of semiparametric truncated spline. The Semiparametric Truncated Spline Model of the Relationship Between Regional Expenditures (X_1), and Labor Absorption (Y_1), on Economic Growth (Y_2) is shown in **Equation (11)**.

$$Y_{2i} = -82.28 + 0.004X_{1i} - 1.677 \times 10^{-7}X_{1i}^2 + 1.758 \times 10^{-7}(X_{1i} - 21696.34)_+^2 - 1.069 \times 10^{-8}(X_{1i} - 42971.14)_+^2 + 3{,}916 \times 10^{-9}(X_{1i} - 56057.47)_+^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (14)$$

$$(X_{1i} - K_{21})_+ = \begin{cases} (X_{1i} - K_{11}), X_{1i} \geq K_{21} \\ 0, X_{1i} < K_{21} \end{cases}$$

$$(X_{1i} - K_{22})_+ = \begin{cases} (X_{1i} - K_{22}), X_{1i} \geq K_{22} \\ 0, X_{1i} < K_{22} \end{cases}$$

$$(X_{1i} - K_{23})_+ = \begin{cases} (X_{1i} - K_{23}), X_{1i} \geq K_{23} \\ 0, X_{1i} < K_{23} \end{cases}$$

k_{21}: 21696.34
k_{22}: 42971.14
k_{23}: 56057.47

Regime 1: $0 < x < k_{21}$

$$Y_{2i} = -82.28 + 0.004X_{1i} - 1.677 \times 10^{-7}X_{1i}^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (15)$$

If the government allocates Regional Expenditure funds of less than 21696.34 billion Rupiah, then Regional Expenditure increase will increase Economic Growth by making the labor absorption variable constant.

Regime 2: $k_{21} < x < k_{22}$

$$Y_{2i} = 0.457 - 0.003X_{1i} + 8.059 \times 10^{-9}X_{1i}^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (16)$$

If the government allocates Regional Expenditure funds between 21696.34 to 42971.14 billion Rupiah, then Regional Expenditure increase will reduce Economic Growth by making the labor absorption variable constant.

Regime 3: $k_{22} < x < k_{23}$

$$Y_{2i} = -19.28 + 0.004X_{1i} - 2.630 \times 10^{-9}X_{1i}^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (17)$$

If the government allocates Regional Expenditure funds between 42971.14 to 56057.47 billion Rupiah, then Regional Expenditure increase in Regional Expenditure will increase Economic Growth by making the labor absorption variable constant.

Regime 4: $x > k_{23}$

$$Y_{2i} = -19.28 + 0.004X_{1i} - 2.630 \times 10^{-9}X_{1i}^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (18)$$

If the government allocates Regional Expenditure funds of more than 56057.47 billion Rupiah, then Regional Expenditure increase will reduce Economic Growth by making the labor absorption variable constant. This result is same like regime 3 because β_{54} was not-significant.

$$Y_{2i} = -82.28 + 0.004X_{1i} - 1.677 \times 10^{-7}X_{1i}^2 + 1.758 \times 10^{-7}(X_{1i} - 21696.34)_+^2 - 1.069 \times 10^{-8}(X_{1i} - 42971.14)_+^2 + 3.916 \times 10^{-9}(X_{1i} - 56057.47)_+^2 + 0.572\, Y_1 + \varepsilon_{1i} \quad (19)$$

If the percentage of Labor Absorption for each region increases then in Labor Absorption increase will increase Economic Growth by making the Regional Expenditure variable constant.

3.5 R-Squared

The result of the R-squared between the relationship of three variables, Regional Expenditure, Labor Absorption, and Economic Growth, is shown in **Table 3**.

Table 3. Result of R-Squared

Relationship	R-squared
$X_1 \rightarrow Y_1$	0.999
$X_1 \rightarrow Y_2$	0.528
$Y_1 \rightarrow Y_2$	0.764
Total	0.999

Good predictions will have a high Q-squared [19]. The Q-squared value is 99.99%, which shows that the model has very good predictive relevance. This value can also be interpreted as meaning that the diversity

of the data can be explained by the model by 99.99%. Meanwhile, the amount of diversity in research data that cannot be explained in research is 0.01%.

4. CONCLUSIONS

From the research results, it can be concluded that the regional expenditure variables and labor absorption variables have a significant effect on the regional economic growth variables. The use of the semiparametric Truncated Spline path analysis model in this research is very appropriate because the relationship between regional expenditure variables and economic growth is linear, while the relationship between land conversion variables on agricultural sector growth and rural poverty and between village fund variables and poverty in rural areas is in the form of non-linear.

Total regional expenditure can only be tolerated when it is less than 21696.34 billion Rupiah, between 42971.14 to 56057.47 billion Rupiah, and more than 56057.47 billion Rupiah because if the total regional expenditure is more than 21696.34 billion Rupiah to 42971.14 billion Rupiah, it will have a negative impact on economic growth, namely reducing the rate of economic growth. Changes in increasing the percentage of labor absorption will have an effect on increasing economic growth which has an effect for the increase in labor absorption in the area.

Suggestions for further research based on research that has been carried out that in the parameter estimation hypothesis test, there were several parameters that were not significant, so in future research, it is hoped that a resampling approach will be used to estimate parameters in semiparametric truncated spline path analysis. For the example, further research can use Jackknife and Double Jacknife **[20].** The government should consider allocating funding to each region proportionally by further examining the addition of regional poverty level variables and regional poverty rate variables as several variables determining the amount of funds received by each region. It is hoped that the government can also increase job absorption in its regions, which can be done in various ways, one of which is by opening new job opportunities.

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