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REGIONAL BUDGET AND REGIONAL DEVELOPMENT IN SIMALUNGUN REGENCY: A VAR APPROACH

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ABSTRACT

This study aims to examine the preparation and control of regional budgets in supporting regional development in Simalungun Regency. It also investigates the application of the Vector Autoregressive (VAR) method as an econometric approach to generate strategic recommendations for improving regional development planning and fiscal management. This research employs a quantitative design with an econometric approach, emphasizing the analysis of numerical data processed through statistical methods. Data were collected through documentation and interviews to obtain relevant information related to regional budget management and development performance. The findings, based on the Impulse Response Function analysis, indicate that regional budget preparation and control are dynamically associated with regional development. The interaction between these variables produces temporary responses before gradually returning to a stable equilibrium. These results suggest that regional budget policies in Simalungun Regency should be formulated by considering both short-term fluctuations and long-term development impacts. Therefore, more effective and evidence-based planning is required to ensure that budget allocations not only promote regional economic growth but also maintain fiscal sustainability and development stability in the long run.

Keywords: Regional Budget, Regional Development, Vector Autoregressive, Fiscal Management, Simalungun Regency.

ABSTRAK

Penelitian ini bertujuan untuk mengkaji penyusunan dan pengendalian anggaran daerah dalam mendukung pembangunan daerah di Kabupaten Simalungun. Selain itu, penelitian ini juga menganalisis penerapan metode Vector Autoregressive (VAR) sebagai pendekatan ekonometrika untuk menghasilkan rekomendasi strategis dalam meningkatkan perencanaan pembangunan daerah dan pengelolaan fiskal. Penelitian ini menggunakan desain kuantitatif dengan pendekatan ekonometrika, yang menekankan pada analisis data numerik yang diolah melalui metode statistik. Data dikumpulkan melalui dokumentasi dan wawancara untuk memperoleh informasi yang relevan terkait pengelolaan anggaran daerah dan kinerja pembangunan.Temuan penelitian berdasarkan analisis Impulse Response Function menunjukkan bahwa penyusunan dan pengendalian anggaran daerah memiliki hubungan dinamis dengan pembangunan daerah. Interaksi antara variabel-variabel tersebut menghasilkan respons yang bersifat sementara sebelum secara bertahap kembali menuju kondisi keseimbangan yang stabil. Hasil ini menunjukkan bahwa kebijakan anggaran daerah di Kabupaten

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Simalungun perlu dirumuskan dengan mempertimbangkan fluktuasi jangka pendek serta dampak pembangunan dalam jangka panjang. Oleh karena itu, perencanaan yang lebih efektif dan berbasis bukti diperlukan untuk memastikan bahwa alokasi anggaran tidak hanya mendorong pertumbuhan ekonomi daerah, tetapi juga menjaga keberlanjutan fiskal dan stabilitas pembangunan dalam jangka panjang

Kata Kunci: Anggaran Daerah, Pembangunan Daerah, Vector Autoregressive, Pengelolaan Fiskal, Kabupaten Simalungun

I. INTRODUCTION

Development is fundamentally related to two main things: the state and the people. The state is the organizer of development through government organizations, and the people are both the goal and the (participatory) subject where development is implemented. Development can also be defined as a deliberate and measurable change in the level of welfare. Regional development is an important element in efforts to improve community welfare. Regional Development is usually implemented with financing or known as a budget.

Basically, the Planning and Development System in Indonesia adheres to a planning and budgeting system. In this context, the preparation and control of regional budgets have a strategic role as planning and control tools to achieve effective and efficient development goals. Regional development is an effort to improve the quality of life of the entire region as a unit of life for both individuals and community members; because the implementation of national development is in the regions, regional development plans are part of the general framework of national development patterns, and regions must support each other.

Vector Auto Regressive (VAR) is a statistical method used to analyze dynamic relationships between several time variables (time series) simultaneously. In the Vector Auto Regressive (VAR) Method, every variable in the system is treated as a dependent variable explained by lags of all variables in the system, including itself. Econometric methods offer a relevant approach for analyzing dynamic relationships between economic variables. By using this method, patterns of cause-and-effect relationships between regional budget allocations and development indicators can be identified. VAR is able to accommodate changes that occur simultaneously in the system of variables, providing a more holistic picture of the impact of budget policies on regional development. By understanding the dynamic relationship between budget allocations, government spending, and development indicators, regional governments can formulate strategies that are more targeted to increase efficiency and accountability in managing public finances.

Problem Formulation:

1. How is the preparation and control of regional budgets in Simalungun Regency?
2. How can the application of the Vector Auto Regressive (VAR) method help the Regional Budget in supporting regional development?

Research Objectives:

1. To determine the preparation and control of regional budgets in Simalungun Regency.
2. To determine the use of the Vector Auto Regressive (VAR) method to provide strategic recommendations in supporting regional development in Simalungun Regency.

II. THEORETICAL FRAMEWORK

Regional budget is a process carried out by public sector organizations to allocate resources owned by the region to unlimited needs. The Regional Revenue and Expenditure Budget (APBD) reflects policies, programs, and priorities of the regional government aimed at meeting community needs and supporting regional development. According to (Suwandi, 2015), the regional budget is a tool for determining income and expenditure, assisting in decision-making and development planning, expenditure authority, and coordination for all activities across various work units. Nurkholis & Khusani (2019) define the regional budget as a government work plan in the form of money (rupiah) for a certain period.

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Legal Basis in Simalungun Regency

Regent Regulation Number 44 of 2024 concerning the Elaboration of the Regional Revenue and Expenditure Budget of Simalungun Regency for 2025. This regulation details the sources of regional income and allocation of expenditure for various sectors to ensure transparent financial management.

Components of Regional Budget

1. Regional Revenue: Consists of Regional Original Income (PAD), Balancing Funds, and other Legitimate Regional Income. PAD includes regional taxes and levies. Balancing Funds are obtained from the central government as a form of fiscal decentralization.
2. Regional Expenditure: A manifestation of regional government spending for public services, including Personnel, Goods and Services, Capital, and other expenditures.
3. Regional Financing: Financial transactions intended to cover the difference between Regional Revenue and Expenditure.

Previous research refers to studies that have been conducted previously and have the same or relevant objects or topics as those currently being studied by the author. Previous studies serve as references and supporting materials in conducting a research study (Sujawerni, 2015). In this section, the researcher presents ten previous studies based on the research topics and problems, concepts and theories, methodologies, and research findings, which are described in the following table:

Table 1. Previous Research

No	Author and Year	Research Title	Research Method	Conclusion
1	According to (Abustan & Mahyuddin, 2009)	Vector Auto Regressive (VAR) Analysis on the Correlation Between Public Expenditure and Economic Growth in South Sulawesi, 1985–2005	Quantitative Econometrics Vector Auto Regressive (VAR)	The unit root test results showed that the GRDP and APBD variables were not stationary at the level data. The causality relationship between GRDP and APBD was only one-way, meaning public expenditure performance did not affect economic growth.
2	According to (Aji & Wijayanti, 2021)	Analysis of Fiscal Policy on Economic Growth in Indonesia	Quantitative Econometrics Vector Auto Regressive (VAR)	The variables only had one-way relationships. In the short term, foreign debt negatively affected economic growth, while subsidies had a positive effect.
3	According to (Aimon, 2021)	Causality Analysis of Public Sector Expenditure and the Regional Economy of West Sumatra Province (VAR Approach)	Descriptive Quantitative Econometric Approach	The regional economy and public sector expenditure had a positive causal relationship. Increased expenditure also improved the regional economy within approximately two years.
4	According to (Hafidh, 2022)	Analysis of the Relationship Between Education Expenditure and Economic Growth Using the VAR Approach	Quantitative Econometrics Vector Auto Regressive (VAR)	GDP directly influenced increases in the education budget, while education expenditure affected economic growth three years later.
5	According to (Sihaloho, 2020)	Analysis of the Effect of Tax Revenue on Indonesia's Economic Growth: A	Quantitative Econometrics Vector Auto Regressive (VAR)	Income tax and value-added tax significantly influenced government revenue and Indonesia's economic growth

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		Vector Auto Regressive Approach		positively.

Regional Budget is one of the determining factors for the success of a region in providing public services. Based on the explanation above, it can be stated that the dependent variable is Regional Development (Y), which is influenced by the independent variable, namely Regional Budget (X). Based on the conceptual framework, the relationship among the variables in this study can be seen in the following framework diagram:

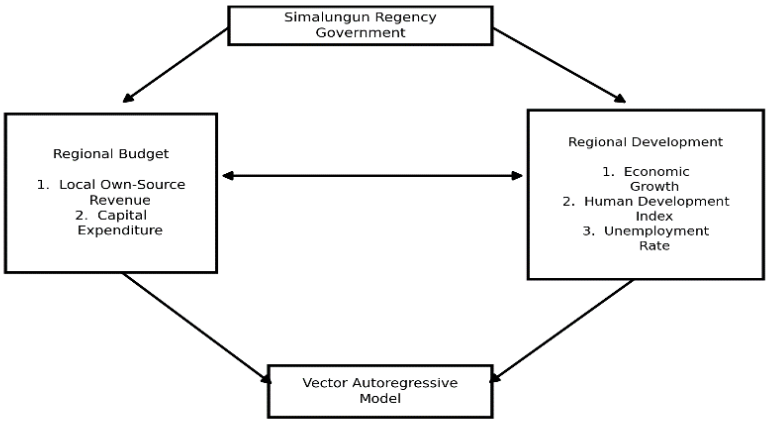

Figure 1. Conceptual Framework

III. RESEARCH METHOD

This study was conducted from February to April 2025 at the Regional Government of Simalungun Regency, North Sumatra. It employed a quantitative research approach using an econometric method. Econometrics is a quantitative analytical approach that integrates economic theory, mathematics, and statistical techniques to examine economic relationships based on empirical data. This method enables researchers to test hypotheses, generate forecasts, and measure the effects of various economic factors in a systematic and objective manner.

The research design adopted in this study is a quantitative design with an econometric approach, in which the analysis focuses on numerical data processed through statistical procedures. In addition, a descriptive approach was applied to provide a systematic and accurate explanation of the facts, conditions, and characteristics of the research object. Through this design, the study is able to analyze the relationship between regional budget preparation and control and regional development, while also providing a clearer empirical description of budget management practices in Simalungun Regency.

Operational definitions were established to provide clear guidelines for measuring each research variable. These definitions specify how the variables are conceptualized and operationalized, thereby ensuring measurement accuracy, consistency, and reliability. By formulating precise operational definitions, each variable can be examined objectively and aligned with the objectives of the studyTable 1 Variable Parameters

Table 1. Variable Parameters

Variable	Definition	Variable Indicators	Measurement Scale
Regional Budget (X)	Regional Budget is an annual financial plan prepared by the regional government and approved by the legislature to	According to the Ministry of Finance of the Republic of Indonesia (2017): • Revenue	Ratio Scale

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	manage regional revenues and expenditures in order to achieve regional development goals effectively and efficiently.	• Regional Expenditure	
Regional Development (Y)	Regional Development is an effort by the regional government to improve public welfare through the provision of infrastructure, public services, and the improvement of human resource quality in accordance with regional potential and needs.	According to Ekbang Setda (2024): • Economic Growth Rate • Human Development Index • Unemployment Rate	Ratio Scale

This study employed quantitative data, namely numerical data obtained through measurement and calculation and analyzed using statistical methods. The data were derived from regional financial reports, development indicators, and macroeconomic data relevant to budget management and regional development in Simalungun Regency. The study used both primary and secondary data. Primary data were obtained through interviews with officials involved in regional financial management, particularly from the Regional Financial and Revenue Management Agency (BPKPD). These interviews provided contextual information on budget preparation, implementation, and control. Secondary data were collected from official documents, including the Regional Revenue and Expenditure Budget (APBD), regional financial reports, economic growth data, development indicators, and other relevant macroeconomic records.

Data were collected through documentation and interviews. Documentation was used to obtain historical and numerical data from official reports, archives, financial records, and statistical publications. Meanwhile, interviews were conducted to gain clarification and supporting insights from relevant stakeholders. The combination of these techniques enabled the study to obtain both empirical evidence and contextual understanding for analyzing the relationship between regional budget management and regional development.

Data Analysis Technique

Vector Auto Regressive (VAR)

The Vector Autoregressive (VAR) Method is a simultaneous equation modeling method that contains several endogenous variables simultaneously, where each endogenous variable is explained by the lag of its own values and the lag of other endogenous variables within the model. The VAR method is used to overcome problems related to interdependent variables. According to (Ekananda, 2016), VAR analysis has several advantages, including:

1. There is no need to distinguish between independent variables and dependent variables.
2. It uses the Ordinary Least Square (OLS) method in estimating each equation.
3. Forecasting using the Vector Autoregressive (VAR) method is, in some cases, better than complex simultaneous equations

In general, the Vector Autoregressive (VAR) Method can be formulated as follows:

$$x_t = \mathrm{A}_0 + \mathrm{A}_1 x_{t-1} + \mathrm{A}_2 x_{t-2} + \mathrm{A}_3 x_{t-3} + \cdots + \mathrm{A}_p x_{t-p} + e_t$$

x_t : An n×1 vector containing n variables in the VAR Model
A_0 : An n×1 intercept vecto
A_1 : An n × n coefficient matrix

In applying the Vector Auto Regressive (VAR) Method, there are several tests used in this study, namely as follows:

Data Stationarity Test

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According to (Ekananda, 2016), data stationarity is a property of data indicating that basic statistical properties such as the mean, variance, and covariance do not vary significantly over time. Stationary data have a constant trend or no trend at all. Stationarity is an important concept in time series analysis. Time series data can be considered stationary if their mean and variance do not change systematically over time, or in other words, if the mean and variance remain constant.

The Data Stationarity Test in this study uses the Augmented Dickey-Fuller Test (ADF Test). The Augmented Dickey-Fuller Test (ADF Test) is a statistical test commonly used to determine whether a time series is stationary or not. It is one of the most widely used statistical tests for analyzing the stationarity of a series.

In this test, there is a concept known as the Unit Root. A unit root is a characteristic of a time series that causes it to become non-stationary. Technically, a unit root is said to exist in a time series when the value of alpha = 1 in the following equation:

$$\mathbf{Y_t = \alpha Y_{t-1} + \beta X_e + €}$$

Yt : Dependent variable at time ttt
αYt−1 : The first lag component of variable YYY, used to test whether α=1\alpha = 1α=1 (an indicator of the existence of a unit root). βXe\beta X_e
βX_e : an additional component used to control exogenous effects or deterministic trends, such as constants (intercepts) and time trends.
€ : Error term (residual) representing the stochastic component of the model.

Determination of Optimal Lag Length

Lag examination is used to determine the optimal lag length that will be applied in further analysis and to estimate the parameters of the Vector Autoregressive (VAR) Model. In the Vector Autoregressive (VAR) Model, lag length indicates the degree of freedom. The best model is the one that has the smallest Akaike Information Criterion (AIC) value. The criterion can be formulated as follows:

$$\mathbf{AIC\ (k) = T1n\ (\frac{SSR\ (K)}{T}) + 2n}$$

Description:
T : Number of observations used
K : Lag length
SSR : Residual sum of squares
n : Number Of estimated parameters

Granger Causality Test

The causality test is conducted to determine the cause-and-effect relationship between variables in the Vector Autoregressive (VAR) system. The causality test in the Vector Autoregressive (VAR) model aims to examine the influence among variables in both the long term and short term. The existence of a relationship among variables does not necessarily prove causality or influence; therefore, to determine whether there is a one-way or two-way influence, a causality test must be conducted (Ekananda, 2016).

If an event (X) occurs before (Y), then there is a possibility that (X) influences (Y), but not vice versa. This is the basic idea behind the application of the Granger causality test (Gujarati, 2023).

In the causality test, the formula can be expressed as follows:

$$F = \frac{(RSS_R - RSS_{UR})/p}{RSS_{UR}/(n-b)}$$

Description:
RSSR :Residual Sum of Squares from the restricted regression
RSSUR : Residual Sum of Squares from the unrestricted regression

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p :Number of lags
n : Number of observations
b : Number of parameters estimated in the model

Impulse Response Function (IRF)

The Structural Impulse Response Function is used to describe how shocks received by a variable originate either from the variable itself or from other variables. The Impulse Response Function (IRF) is used to measure the impact of a shock in one variable on other variables over a certain period of time (Ekananda, 2016).

The Impulse Response Function (IRF) test also aims to determine how long a variable responds to a shock. The IRF calculation is as follows:

$$\mathbf{IRF\ (h) = \Gamma^{h}}$$

Description:
Γ :Parameter matrix of the VAR Model
h :Forecasting period
C : Cholesky decomposition matrix of the shock variance-covariance matrix

To facilitate the researcher in managing and analyzing the research data, a computer software program, namely EViews 12, was used.

IV. RESULTS AND DISCUSSION

Descriptive statistics are statistics related to describing, illustrating, explaining, and elaborating data so that the data can be understood (Siregar, 2018). The descriptive statistics presented in this study include the mean, standard deviation, minimum value, and maximum value of each variable, which can be described in the following table

Table 1

Descriptive Statistics of Regional Budget Variables – Regional Expenditure (X)

Variable	Years	Amount (Rp)	Overall Value			
			Mean	Std. Dev	Min	Max
Regional Expenditure	2010	Rp 1.016.067.667,00	Rp 1.824.580.332,71	Rp 469.725.409,39	Rp 1.016.067.667,00	Rp 2.423.685.403,00
	2011	Rp 1.088.622.687,00				
	2012	Rp 1.378.042.599,00				
	2013	Rp 1.432.130.758,00				
	2014	Rp 1.648.278.063,00				
	2015	Rp 1.824.943.466,00				
	2016	Rp 2.185.034.609,00				
	2017	Rp 2.382.381.117,00				
	2018	Rp 2.269.698.962,00				
	2019	Rp 2.423.685.403,00				
	2020	Rp 2.340.664.187,00				
	2021	Rp 2.252.487.063,00				
	2022	Rp 1.677.148.951,00				
	2023	Rp 1.624.939.126,00				

Source: Primary data processed in Excel 2019

Based on the data presented above, we can conclude that the average regional expenditure during this period was Rp 1,824,580,323.71. This indicates that, in general, regional expenditures each year hover around this value. Furthermore, the standard deviation of Rp 469,725,409.39 indicates significant fluctuations in regional expenditures from year to year. The larger the standard deviation, the greater the variation in regional expenditures between years.

Meanwhile, the lowest regional expenditure occurred in 2010, at Rp 1,016,067,667.00. This could indicate that at the beginning of the analysis period, the regional expenditure budget was still

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relatively small compared to subsequent years. The highest regional expenditure occurred in 2019, at Rp 2,473,685,403.00. This could indicate a budget spike in that year, possibly due to development programs or specific policies that increased regional spending.

Based on this, Simalungun Regency's regional spending has shown an increasing trend from 2010 to 2023, averaging IDR 1.82 trillion. However, there is significant variation between years, as indicated by the relatively high standard deviation. The peak in spending occurred in 2019, likely due to specific policies or projects that significantly increased regional spending.

Table 2. Descriptive Statistics of Regional Budget Variables - Regional Revenue (X)

Variable	Years	Amount (Rp)	Overall Value			
			Mean	Std. Dev	Min	Max
Regional Revenue	2010	Rp 970.540.796,00	Rp 1.919.321.769,07	Rp 490.239.595,04	Rp 970.540.796,00	Rp 2.404.665.304,00
	2011	Rp 1.078.592.676,00				
	2012	Rp 1.394.640.673,00				
	2013	Rp 1.468.168.468,00				
	2014	Rp 1.644.477.023,00				
	2015	Rp 1.930.943.305,00				
	2016	Rp 2.218.572.431,00				
	2017	Rp 2.302.692.922,00				
	2018	Rp 2.193.012.744,00				
	2019	Rp 2.354.406.284,00				
	2020	Rp 2.175.717.502,00				
	2021	Rp 2.355.905.716,00				
	2022	Rp 2.404.665.304,00				
	2023	Rp 2.378.168.923,00				

Source: Primary data processed in Excel 2019

Based on the data presented in the table above, it can be concluded that the average regional income during this period was Rp 1,919,321,169.07. This indicates that regional income per year tends to hover around this figure. Furthermore, the standard deviation of Rp 490,239,595.04 indicates significant variation or fluctuation in regional income from year to year.

The lowest Minimum (MIN) regional income value occurred in 2010, at Rp 970,540,796.00. This indicates that at the beginning of the analysis period, regional income was still relatively small compared to subsequent years. Meanwhile, the highest Maximum (MAX) regional income value occurred in 2022, at Rp 2,404,665,304.00. This indicates a significant increase in regional income during that year.

Based on this, Simalungun Regency's regional revenue grew from 2010 to 2023, averaging IDR 1.92 trillion per year. There was significant fluctuation, as indicated by the high standard deviation. Regional revenue reached its lowest point in 2010, while its peak occurred in 2022. This increase in revenue likely contributed to increased regional spending.

And for the next variable, namely Regional Development (Y). Descriptive statistics on Regional Development (Y) can be seen in the table below:

Table 3. Descriptive Statistical Variables Regional Development – Economic Growth (Y)

Variable	Year	Amount (%)	Overall Value			
			Mean	Std. Dev	Min	Max
Region Developmen	2010	4,50%	4,33%	1,70%	-1,50%	5,70%
	2011	5,00%				
	2012	5,20%				
	2013	5,10%				
	2014	4,80%				
	2015	4,60%				
	2016	4,70%				

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	2017	4,90%				
	2018	5,00%				
	2019	4,80%				
	2020	-1,50%				
	2021	3,20%				
	2022	4,68%				
	2023	5,70%				

Source: Primary data processed in Excel 2019

Based on the data presented in the table above, it can be concluded that the average rate of regional development during this period was 4.33%. This indicates that, in general, regional development growth tended to remain around this figure. Furthermore, the standard deviation was 1.70%, indicating variations or fluctuations in regional development growth from year to year.

Regarding the Minimum (MIN) value, the lowest regional development growth occurred in 2020, amounting to -1.50%. This indicates that during that year, there was a contraction or decline in regional development. This decline was caused by external factors such as the COVID-19 pandemic, which affected the economic and development sectors. As a result, Regional Development experienced a drastic decline in 2020 compared to other years.

Meanwhile, for the Maximum (MAX) value, the highest regional development growth occurred in 2023, amounting to 5.70%. This indicates a significant recovery or improvement in regional development caused by the external factor of the 2020 COVID-19 pandemic.

In addition, the three variables in this study, namely regional expenditure and regional revenue (X), and regional development (Y), can be illustrated in the figure below:

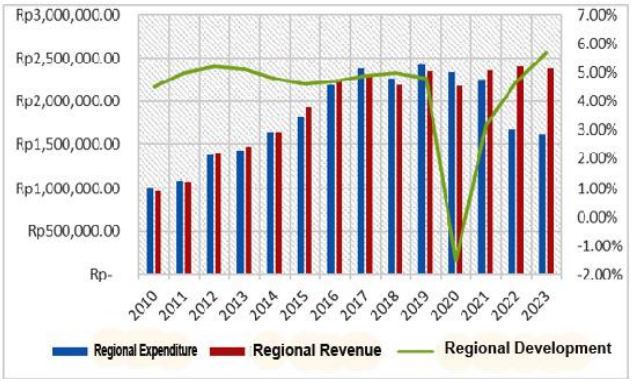

Figure 2. Graph of Regional Budget Variables (X) and Regional Development (Y)

Based on the figure above, the following explanations can be drawn:

a. Trend of Regional Expenditure and Regional Revenue (X)
   1. Regional expenditure (blue line) and regional revenue (orange line) show an increasing trend from 2010 to 2019.
   2. The year 2019 became the highest point for regional expenditure, while regional revenue continued to increase until reaching its peak in 2022.
   3. In 2020, there was a sharp decline in regional revenue and expenditure, most likely due to the impact of the COVID-19 pandemic.
   4. After 2020, both variables increased again, with regional revenue reaching its peak in 2022, while regional expenditure increased steadily until 2023.

b. Trend of Regional Development (Y)
   1. Regional development (gray line) tended to remain stable within the range of 4.5%–5.5% from 2010 to 2019.
   2. In 2020, there was a drastic decline below 0% (-1.50%),

3. indicating a contraction in development, most likely due to the pandemic.
4. After 2020, regional development began to recover significantly, reaching its highest point in 2023 (5.70%).

c. Relationship Between Variables
1. The positive correlation indicates that, in general, when regional revenue and expenditure increase, regional development also increases.
2. The year 2020 became an exception, where regional expenditure remained relatively high while regional development experienced contraction. This shows that external factors such as the pandemic had a significant impact.
3. The post-pandemic recovery period (2021–2023) indicates that increases in regional revenue and expenditure contributed to the acceleration of development.

V. CONCLUSION AND SUGGESTIONS

Conclusion

This study aims to determine the preparation and control of regional budgets in Simalungun Regency and the use of the Vector Auto Regressive (VAR) Method to provide strategic recommendations in supporting regional development in Simalungun Regency. Based on the results of the research and analysis, the following conclusions can be drawn:

1. The application of the Vector Auto Regressive (VAR) Method in the preparation and control of regional budgets to support regional development in Simalungun Regency can provide significant benefits in supporting regional development. This is evidenced by the Granger Causality Test results, where the F-Statistic value was 0.4825 and the probability value was 0.6853. Since the probability value is > 0.05, it can be stated that the preparation and control of regional budgets do not significantly affect regional development. On the other hand, Regional Budget also does not significantly support Regional Development, where the F-Statistic value was 0.04519 with a probability value of 0.9680 or > 0.05. Therefore, it can be concluded that Regional Development also does not Granger-cause the preparation and control of regional budgets.
2. Based on the Impulse Response Function Analysis, the relationship between Regional Budget and Regional Development is mutually influential, with impacts that are temporary before eventually returning to stability. Therefore, budget preparation and control policies in Simalungun Regency must consider both short-term and long-term impacts on regional development. More effective planning is required to ensure that budget allocation not only supports regional economic growth but also maintains fiscal balance in the long term.

Suggestions

Based on the conclusions above, the researcher provides the following suggestions:

1. The Government of Simalungun Regency needs to improve its capacity in regional development planning by using more accurate data and methods, such as the Vector Auto Regressive (VAR) Method, in order to support evidence-based and more effective decision-making.
2. Based on the research findings, the impact of the budget on regional development is not directly observable. Therefore, periodic evaluations of budget policies are necessary so that adjustments can be made when needed.

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