Relationship Between Regional Revenue and Expenditures: A Canonical Correlation Analysis

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ABSTRACT

This research aims to determine the relationship between regional revenues and regional expenditures. To achieve this, the method of canonical correlation analysis is employed. The research results show that in terms of regional revenues, regional income (Pendapatan Asli Daerah or PAD), general allocation funds (Dana Alokasi Umum or DAU) and gross regional domestic product (Produk Domestik Regional Bruto or PDRB) do not have a significant relationship. On the other hand, concerning regional expenditures, population size demonstrates a significant relationship, whereas routine expenditure and capital expenditure do not exhibit significance. It is noteworthy that the influence of regional spending on regional revenue surpasses the influence of regional revenue on regional spending. This implies that the government, in collaboration with the legislative body, is significantly influenced by the targeted regional spending in determining the regional revenue amount.

Keywords: Revenues, Expenditures, Regional Administration, Canonical Correlation Analysis, Population Size

ABSTRAK

Penelitian ini bertujuan untuk mengetahui hubungan antara penerimaan daerah dengan belanja daerah. Untuk maksud tersebut, digunakan metode analisis korelasi kanonik. Hasil penelitian menunjukan bahwa dari sisi penerimaan daerah, maka Pendapatan Asli Daerah (PAD), Dana Alokasi Umum (DAU) dan Produk Domestik Regional Bruto (PDRB) maka tidak memiliki hubungan yang signifikan. Sedangkan dari sisi belanja daerah, maka Jumlah penduduk memiliki hubungan yang singifikan sedangkan belanja rutin dan belanja modal memiliki hubungan yang tidak signifikan. Pengaruh belanja daerah terhadap penerimaan daerah lebih besar dibandingkan dengan pengaruh penerimaan daerah terhadap belanja daerah yang berarti besarnya penerimaan daerah yang ditargetkan oleh pemerintah bersama dengan lembaga legislative sangat dipengaruhi oleh besarnya target belanja daerah.

Kata kunci: Pendapatan, Pengeluaran, Administrasi Daerah, Analisis Korelasi Kanonikal, Ukuran Populasi

INTRODUCTION

The ongoing reforms in various fields in Indonesia, starting from 1999, have opened up opportunities to create a more democratic system of governance (Luebke, 2009). The development outcomes are expected to be more equitable, leading to increased welfare for the people. The formerly centralized system of governance has transformed into a decentralized one. The consequence of this governance reform is a reduced role for the central government and an increased role for local governments. Various responsibilities of the Central Government have been decentralized to the Regional Governments, which now have broader autonomy. Regional Governments have the freedom to tap into their local potentials as real resources that can support their financial needs for development programs.

The granting of autonomy to regions, in principle, is to enable them to manage their own affairs effectively and efficiently in the provision of governance, public services, and development implementation. According to Masdiasmo (2002), the policy of regional autonomy and extensive decentralization that is accountable to the regions represents two strategic steps. First, decentralization is a response to Indonesia's local problems, such as the threat of national disintegration, uneven development trends, low quality of life, and human resource development issues.

Second, decentralization is a strategic initial step for regions to prepare for the era of globalization by strengthening their regional economies, especially in the real sector. In simpler terms, decentralization has a significant impact on how regional governments manage their finances, determine Regional Revenue and Expenditure Budgets (*Anggaran Pendapatan dan Belanja Daerah* or APBD), and plan their development directions based on the potentials and needs of their regions. However, a study by Christianingrum & Aida (2020) found that, generally, regional autonomy in Indonesia has not improved the financial capacity of regional governments. In fact, 25 out of 38 provincial regions experienced a decrease in the index of local tax revenue (PAD) as a share of the regional budget (APBD).

The management of regional finances involves three interconnected aspects, namely: the Revenue Aspect, which concerns the Regional Government's ability to tap potential income sources and the associated costs; the Expenditure Aspect, which relates to the magnitude of costs linked to public services and the factors influencing them; and the Budget Aspect, which encompasses the relationship between income and expenditures, along with projections for future trends (Goyal et al., 2021).

Local spending is one of the macroeconomic components that plays a crucial role in regional development (Pike et al., 2017). Apart from constructing various infrastructures needed in the development process, it's also a component of aggregate demand, the increase of which propels gross domestic product (GDP) as long as the economy has not reached full employment levels. The development of various infrastructures and public services can accelerate the improvement of people's welfare (Bohnenberger, 2020). The increase in economic activities and the provision of basic infrastructure, in turn, are expected to boost the region's revenue from various sources.

These expenditures consist of routine spending (current expenditure) and development budgets (capital expenditure). Routine expenditures are used to finance the day-to-day government tasks. These expenditures are indispensable and are categorized as operating and consumptive expenses. On the other hand, development expenditures have a specific characteristic, falling under the investment category. This financing is used to support the agent of development's functions and results in the production of goods that are essential for enhancing economic progress.

Government revenues and expenditures can influence each other in the following ways: firstly, changes in government revenue led to changes in government spending. Secondly, changes in government spending led to changes in government revenue. Thirdly, changes in government revenue and spending can mutually affect each other through feedback. Identifying the causal relationship between revenue and expenditure provides insights into how various policies can aid government budget growth (Ramey &

Zubairy, 2018). If the causality stems from government revenue, imposing taxes to reduce the deficit level will likely result in increased government spending. Conversely, if the causality originates from government spending towards revenue levels, limiting government expenditure will restrain government budget deficits.

Nugroho (2017) found a positive and significant influence of local revenues (*Pendapatan Asli Daerah* or PAD) on capital spending. Ifa (2017) discovered a positive and significant impact of PAD, General Allocation Fund (*Dana Alokasi Umum* or DAU), and Last Year's Remaining Budget (*Sisa Lebih Pembiayaan Anggaran* or SILPA) on capital spending. In a study by Januarti et al. (2022), they found that Local Own-Source Revenue and the Population Size had a positive and significant effect on Regional Expenditure. However, Anggraeni et al. (2022) only found a positive and significant impact of the DAU. On the other hand, Panjaitan (2021) found that components of regional income, namely PAD, DAU, and Other Legal Local Revenues, had a positive and significant impact on regional spending.

While these studies arrive at the common conclusion that PAD and DAU exert influence with varying degrees, this research observes the relationship between local revenue and expenditure by including additional variables like Regional Gross Domestic Product (*Pendapatan Daerah Regional Bruto* or PDRB) and population size. This is intended to provide an understanding that macroeconomic conditions and demographic factors also influence regional revenue and expenditure.

Causality between local revenue and expenditure has not been extensively researched, especially using canonical correlation. Studies employing canonical correlation include Soegiarto's (2015) research on the relationship between the decline in SBI interest rates and changes in the rupiah exchange rate on stock price changes and trading volume changes in stocks of companies listed on the Jakarta Stock Exchange. Lestari et al. (2020) examined multidimensional poverty and poverty levels, Amir et al. (2020) explored the global index, macroeconomics with the composite stock index, Harkim et al. (2021), Nuriyah & Erdkhadifa (2023) delved into service quality and customer satisfaction, and Octaviana (2022) investigated the Covid-19 pandemic and the Islamic capital market.

Canonical correlation analysis has also been used in other fields, including Maharani's (2018) study on spiritual intelligence and logical mathematical intelligence's impact on proof-solving and mathematics anxiety. Adiati (2018) researched decision-making styles of Account Officers in the banking industry concerning risk attitudes and customer orientation, and Suryana et al. (2021) explored similar areas.

RESEARCH METHODS

To examine the relationship between revenue and expenditure simultaneously, the Canonical Correlation Analysis (Tiro, M.A, 2010) statistical approach is employed. Canonical Correlation can be seen as a logical extension of multiple linear regression analysis. While multiple linear regression typically involves a single dependent variable Y and one or more independent variables X, Canonical Correlation aims to simultaneously relate several dependent variables (Y1, Y2, … Yp) to several independent variables (X1, X2, … Xq). In other words, Canonical Correlation is utilized to understand the relationship between a set of dependent variables and a set of independent variables all at once.

The steps for conducting Canonical Correlation analysis can be summarized as follows: Firstly, the determination of variable categories is essential, clarifying which serves as the dependent variable and which as the independent variable. Subsequently, the process involves deriving a canonical function. The number of canonical functions that can be derived from a set of variables equals the minimum of either the number of dependent variables or independent variables. In general, the canonical function for each variable is explained in Figure 1.

$$U = aY = a_1 Y_1 + a_2 Y_2 + \ldots\ldots a_p Y_p$$

$$V = bX = b_1 X_1 + b_2 X_2 + \ldots\ldots b_q X_q$$

Figure 1. Canonical Equation

Explanation:
(p) = Original dependent variables
(q) = Independent variables
U = Variable Y
V = Variable X

For the cases in this research, each canonical function is stated as follows:

$$U_1 = a_{11} Y_1 + a_{12} Y_2 + a_{13} Y_3$$

$$U_2 = a_{21} Y_1 + a_{22} Y_2 + a_{23} Y_3$$

$$U_3 = a_{21} Y_1 + a_{22} Y_2 + a_{23} Y_3$$

Figure 2. Dependent Variable's Canonical Variable function

$$V_1 = a_{11}X_1 + a_{12} X_2 + a_{13}X_3 + a_{14} X_4$$

$$V_2 = a21X1 + a_{22}X_2 + a_{23}X_3 + a_{24} X_4$$

$$V_2 = a21X1 + a_{22}X_2 + a_{23}X_3 + a_{24} X_4$$

Figure 3. Independent Variable's Canonical Variable function

Explanation for Figure 2 and 3:
Y1 = Routine expenses
Y2 = Development expenditure
Y3 = Population
X1 = PAD
X2 = DAU
X3 = GRDP

The number of canonical functions depends on the minimum number of dependent variables, which, in this case, is three. Consequently, three canonical functions are formed and subsequently subjected to a canonical correlation significance test to identify the ones that can be further utilized. To assess the significance of canonical coefficients, the canonical correlation coefficient's value must exceed 0.5 (Tiro, 2010). The interpretation encompasses several canonical coefficients.

Canonical weight assesses the contribution of the original variables to the canonical variables. In this research, it pertains to evaluating how variables like Original Regional Income (X1), General Allocation Funds (X2), and Gross Regional Domestic Product (X3) contribute to regional revenues (independent variable X) and the contribution of

variables like routine expenditure (Y1), capital expenditure (Y2), and population (Y3) to regional expenditure (dependent variable Y). A higher coefficient value indicates a more substantial contribution of the variable to the canonical variable (dependent variable Y).

Canonical Loadings or Canonical Structures quantify the degree of correlation between the canonical variable and the original variable that generated it. In this research, it involves examining correlations between variables such as Original Regional Income (X1), General Allocation Funds (X2), and Gross Regional Domestic Product (X3) with regional revenues (independent variable X), as well as the correlation between variables like routine expenditure (Y1) and capital expenditure (Y2) and population (Y3) with regional expenditure (dependent variable Y). A higher loading coefficient value signifies a closer relationship between the canonical variable and the original variable.

Overlap Coefficient (Redundancy Coefficient): This coefficient clarifies how variations in one canonical variable relate to variations in other canonical variables. It offers insights into how changes in regional expenditure variables can be explained by changes in regional revenue variables and vice versa. The overlap coefficient value can be calculated using the formula $RC_{Yi} = U_{Yi}^2 \; x \; r_i^2$ for the dependent variable and $RC_{Xi} = U_{Xi}^2 \; x \; r_i^2$.

RESULTS AND DISCUSSION

Geographically, the Maluku Region comprises both large and small islands, encompassing a total area of 712,479.69 km2, of which 658,331.52 km2 (92.4%) is water, and 54,158 km2 (7.6%) is land. This predominance of water areas makes the Maluku Province strategically significant from both geopolitical and geo-economic standpoints. In terms of socio-economic conditions, the Maluku Province still lags behind other regions in Indonesia. Economic growth contracted during the COVID-19 pandemic, with only a few sectors showing positive growth (Sangadji et al., 2021; Ramly et al., 2022). However, in the post-pandemic phase, economic growth rebounded to 3.05% in 2021 and 5.11% in 2022 (Central Statistics Agency, 2023), largely driven by improved global business conditions and increased foreign direct investment (Ramly et al., 2023).

Furthermore, local government spending on productive sectors with multiplier effects on various economic sectors such as education, health, and housing has improved (Central Statistics Agency, 2023). Therefore, local governments are increasingly focused on increasing regional revenue, which in turn leads to higher regional expenditures.

This research analyzes the relationship between regional revenue and regional expenditure, considering various influencing factors. The study's results, obtained through the canonical correlation model, involve several steps outlined in the attached document (Appendix 1). Initially, the coefficients are interpreted, evaluating the canonical functions for subsequent processing. As detailed in the methodology chapter, multiple canonical functions are derived, with a minimum of two.

To determine which canonical function will be processed further, the canonical function test is used by looking at the magnitude of the eigenvalues and the canonical correlation as shown in Table 1.

Table 1. Eigenvalues and Canonical Correlations

Root No	Eigenvalue	Pct.	Cum. Pct	Canon Cor.	Sq. Cor
1	54.23764	95.52095	95.52095	.99091	.98190
2	2.52827	4.45268	99.97363	.84651	.71657
3	.01497	.02637	100.00000	.12146	.01475

Table 1 indicates that the first canonical function, with an eigenvalue of 54.23764, accounting for 95.52095%, is the one selected for further processing.

To confirm that only the first canonical function can proceed, a Dimension Reduction Analysis test was conducted, as shown in Table 2.

Table 2. Dimension Reduction Analysis

Roots	Wilks L	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.00506	12.75364	9.00	14.75	.000
2 TO 3	.27924	3.12333	4.00	14.00	.049
3 TO 3	.98525	.11980	1.00	8.00	.738

Table 2 indicates that the suitable test method is Wilks Lambda due to its low significance value. The results of the significance test reveal that the first canonical function, despite being a canonical function, has the smallest significance value at 0.000, rendering it suitable for further processing. While the second canonical function also exhibits significance at 0.049, the focus will remain on the first canonical function for further analysis.

Table 3. Canonical Weight

Dependent variable	Standardized canonical coefficients for DEPENDENT variables
Y_1	0.34853
Y_2	0.07044
Y_3	0.61270
Independent variable	**Standardized canonical coefficients for COVARIATES**
X_1	0.36421
X_2	0.26006
X_3	0.40400

Based on Table 3, the results can be summarized as follows:
$V_1 = 0.34853\ Y_1 + 0.07044\ Y_2 + 0.61270\ Y_3$
$U1 = 0.36421\ X_1 + 0,26006\ X_2 + 0,40400\ X_3$.

Looking at the canonical weights, it becomes evident that among the dependent canonical variables, only the canonical weight coefficient for Y3 (population) exceeds 0.5. This indicates that the dependent canonical variable is primarily associated with the original variable Y3 (population), with a dominant contribution of 0.61270 compared to variables Y1 and Y2 (routine expenditure and capital expenditure) at 0.34853 and 0.07044, respectively. In other words, routine expenditure and capital expenditure contribute relatively less to regional expenditure, with values of 0.34853 and 0.07044. These findings align with previous studies (Fatharani et al., 2022; Hermanto, 2017; Ramadhan & Umiyati, 2021), although they differ from Herlina (2013), who reported that the influence of population on regional spending was not significant, and Dahliah (2022), who found a non-significant negative effect of population size on regional spending. Furthermore, there are no independent canonical variables exceeding 0.5, indicating that none of them make a significant contribution to regional revenues. From the calculation results contained in attachment 1, it can be displayed again as shown in Table 4.

Table 4. Canonical Loading

Dependent variable	Correlations between DEPENDENT and canonical variables
Y_1	0,96113
Y_2	0,80133
Y_3	0,99327
Independent variable	**Correlations between COVARIATES and canonical variables**
X_1	0,96703
X_2	0,96858
X_3	0,98000

The results of the analysis of the canonical content or structure, as shown in Table 4 present the equation for the canonical function.
$V1 = 0,96113\ Y_1 + 0,80133\ Y_2 + 0,99327\ Y_3$
$U1 = 0,96703\ X_1 + 0,96858\ X_2 + 0,98000\ X_3$

The canonical structure coefficients that dominate (greater than 0.5) in the dependent variables are Y1 (routine expenditure), Y2 (capital expenditure), and Y3 (population). Therefore, it can be said that the relationships between the regional expenditure variables and routine expenditure, capital expenditure, and population are all quite significant, each being greater than 0.5.

On the other hand, the second equation indicates that the dominant canonical structure in the independent variables is X1 (local own-source revenue, PAD), X2 (General Allocation Fund, DAU), and X3 (Regional Gross Domestic Product), each having canonical loadings greater than 0.5. Thus, it can be said that the relationships between the regional revenue variables and PAD, DAU, and Regional Gross Domestic Product are also quite significant, each being greater than 0.5.

In conclusion, regional expenditure in this case, Y1 (routine expenditure), Y2 (capital expenditure), and Y3 (population) in the Maluku Province has a relationship with X1 (PAD), X2 (DAU), and X3 (Regional Gross Domestic Product). This means that the magnitude of changes in the dependent variables or the amount of regional expenditure is determined by the magnitude of changes in the independent variables, namely X1 (PAD), X2 (DAU), and X3 (Regional Gross Domestic Product). A similar study on the impact of PAD, DAU, and/or Regional Gross Domestic Product on regional expenditure was found in research by Fitriana & Sudarti (2018) and Amylia et al. (2022).

In partial terms, the variable that most dominantly relates to regional expenditure is X3 (Regional Gross Domestic Product), followed by X2 (DAU), and then X1 (PAD). This coefficient value can explain variations in changes in the dependent variable (regional spending), which can be explained by the independent variable through the value of the overlapping coefficient, or vice versa.

$RC_Y = U_Y^2 \ x \ r_i^2$ for the dependent variable. The result is: U_Y^2 = (0,96113)² + (0,80133)² + (0,99327)²/3 x 0,98190 = 0.83543.

$RC_X = V_X^2 \ x \ r_i^2$ for the independent variable. The result is: V_x^2 = (0.96703)² + (0.96858)² + (0,98000)²/4 x 0.98190 = 0,92747.

This can be interpreted to mean that the variation in changes in the dependent variable (regional expenditure) can be explained by the independent variable (regional revenues) of 0.83543 or 83.54 percent, while the variation in changes in the independent variable (regional revenues) can be explained by the dependent variable (regional expenditure) of 0.83543 or 83.54 percent. 0.92747 or 92.75 percent. This means that the influence of regional spending on regional revenues is greater than the influence of regional revenues on regional spending.

CONCLUSION

Regional Original Income, General Allocation Fund, and Gross Regional Domestic Product do not have a significant relationship with regional revenues. In contrast, the population has a significant relationship with regional spending, indicating that as the population increases, regional expenditure also increases. Moreover, the influence of regional spending on regional revenue is greater than the influence of regional revenue on regional spending. This suggests that the government, in collaboration with the legislative body, is significantly influenced by the size of the regional spending target when determining regional revenue.

The findings of this research hold significant theoretical implications for comprehending the relationship between regional income, regional expenditure, and the influencing factors. On a practical level, it underscores the necessity for government to take into account the substantial impact of regional spending on regional income during the planning of budget policies and regional expenditures.

However, it is important to note that this research is not without its limitations, such as constraints related to data availability and the methodologies employed. Furthermore, the exclusive focus on specific variables might inadvertently overshadow other factors that could potentially affect the relationship between regional income and expenditure. Considering these limitations, it is advisable that future research endeavors consider the inclusion of additional variables that could influence the income-expenditure dynamic. Moreover, conducting further analyses to unravel the intricate interplay between these factors is warranted. Expanding the geographic scope or delving deeper into specific facets of regional income and expenditure could also be valuable avenues for future research.

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APPENDIX 1

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manova y1 to y3 with x1 to x3
/print=error (sscp cov cor) signif
(hypoth eigen dimenr)
/DISCRIM=RAW STAN ESTIM COR ALPHA (5.0).
 [DataSet0]
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Multivariate Tests of Significance (S = 3, M = -1/2, N = 2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	1.71322	3.55043	9.00	24.00	.006
Hotellings	56.78088	29.44194	9.00	14.00	.000
Wilks	.00506	12.75364	9.00	14.75	.000
Roys	.98190				

- -

Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
1	54.23764	95.52095	95.52095	.99091	.98190
2	2.52827	4.45268	99.97363	.84651	.71657
3	.01497	.02637	100.00000	.12146	.01475

- -

Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 3	.00506	12.75364	9.00	14.75	.000
2 TO 3	.27924	3.12333	4.00	14.00	.049

3 TO 3   .98525   .11980   1.00   8.00   .738

Standardized canonical coefficients for DEPENDENT variables
        Function No.

392

Variable	1	2
Y1	.34853	2.97457
Y2	.07044	.57231
Y3	.61270	-3.34005

- -

Correlations between DEPENDENT and canonical variables
        Function No.

Variable	1	2
Y1	.96113	.25480
Y2	.80133	-.25308
Y3	.99327	-.11584

- -

Standardized canonical coefficients for COVARIATES
        CAN. VAR.

COVARIATE	1	2
X1	.36421	-1.22913
X2	.26006	3.05787
X3	.40400	-1.80939

- -

Correlations between COVARIATES and canonical variables
        CAN. VAR.

Covariate	1	2
X1	.96703	-.11483
X2	.96858	.24776
X3	.98000	-.05596

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