“Crowding-out effects of regional transfer fund allocations on local development based on a Bayesian VAR study in West Sumatra”

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CROWDING-OUT EFFECTS OF REGIONAL TRANSFER FUND ALLOCATIONS ON LOCAL DEVELOPMENT BASED ON A BAYESIAN VAR STUDY IN WEST SUMATRA

Abstract

Regional transfers are a key instrument of regional fiscal policy that promote balanced development and reduce disparities across districts, yet the behavioral responses of local governments to these inflows remain insufficiently understood. This study examines how regional transfer fund allocations influence government expenditure, unemployment, infrastructure development, and regional revenue in West Sumatra using quarterly data for 2014–2024. A Bayesian Vector Autoregressive framework is employed to address small-sample limitations and to capture the dynamic responses to transfer shocks. The results show that increases in regional transfers have limited, short-lived effects on unemployment, while capital expenditure on basic infrastructure declines, indicating potential crowding-out of certain government spending categories. At the same time, regional revenue responds positively, suggesting that transfers can support local fiscal capacity in the short term. These findings highlight that, although regional transfers can facilitate immediate fiscal stabilization, they may hinder long-term infrastructure investment unless accompanied by performance-based fiscal mechanisms. Improving transfer design and accountability is therefore essential to ensure that fiscal resources promote sustainable development outcomes.

Keywords regional transfers, Bayesian vector autoregressive, fiscal policy, expenditure, unemployment, infrastructure

JEL Classification C32, E62, H71, O18

INTRODUCTION

Fiscal decentralization has become a defining feature of public finance in middle-income democracies, promising greater responsiveness, equality, and developmental efficiency by delegating expenditure and revenue authority to subnational governments (Sodoma et al., 2022; Ezcurra & Rodríguez-Pose, 2013). In Indonesia, a unitary state that implemented radical decentralization in 2001, intergovernmental fiscal transfers constitute the primary mechanism through which the central government sustains regional public services, reduces fiscal disparities, and shapes development priorities. In provinces such as West Sumatra, official fiscal reports from Indonesia's Ministry of Finance show that transfers from the central government account for the vast majority of total regional revenues, with transfer funds often exceeding 70% of the provincial government's total fiscal resources. This predominance of central transfers over locally generated revenues reflects the broader pattern in Indonesia's intergovernmental finance system, in which subnational governments remain structurally de-

pendent on central budget allocations, a point also emphasized in World Bank analyses on subnational revenue mobilization and fiscal decentralization in Indonesia. Despite their scale, the developmental value of these transfers remains contested. Proponents argue that well-designed transfers can boost local demand, alleviate poverty, and stabilize labor markets (Faguet, 2014; Sodoma et al., 2022), whereas critics highlight risks of fiscal dependency, weakened revenue mobilization, and a shift from productive investment to recurrent consumption (Shah, 2006; Sodoma et al., 2022).

The scientific problem inherent to these debates lies in how transfer-induced fiscal shocks propagate through regional socioeconomic systems and how they interact with labor markets, poverty dynamics, and public expenditure composition under decentralized governance. While national-level studies for Indonesia indicate that government expenditure shocks can stabilize macroeconomic indicators during crises (Devianto et al., 2023), such aggregations mask heterogeneous responses across subnational jurisdictions, where stabilization objectives may coexist with reductions in long-term capital formation. At the provincial level, empirical evidence remains insufficient, particularly with respect to the crowding-out or crowding-in effects of Regional Transfer Fund allocations on infrastructure, welfare, and developmental resilience (Faguet, 2014). West Sumatra provides a pertinent case within this broader scientific problem: it exhibits structural economic vulnerabilities, limited industrialization, and chronic socioeconomic disparities alongside sustained increases in transfer receipts. This combination raises an unresolved question regarding whether transfer inflows reinforce short-term social protection at the expense of strategic capital formation, an issue with significant implications for the sustainability of decentralized development.

1. LITERATURE REVIEW AND RESEARCH HYPOTHESES

Government spending shocks have been shown to stabilize GDP growth, inflation, and interest rates during crises, as observed in Indonesia during the COVID-19 outbreak using Bayesian VAR methods (Bauwens et al., 2000; Boettiger et al., 2023; Canova & Ciccarelli, 2004; Devianto et al., 2023; Gruber & Kastner, 2025; Woźniak, 2016). However, in decentralized systems, subnational governments implement public services primarily through intergovernmental transfers, which can improve resource allocation efficiency but depend on local budgetary autonomy and institutional capacity (Faguet, 2014; Weber et al., 2021).

For instance, Indonesia's Regional Transfer Fund, which accounts for most provincial revenue, can act as a fiscal stabilizer but risks crowding out local effort if not combined with accountability mechanisms (González-Pampillón et al., 2019; Sodoma et al., 2022). Consequently, understanding how transfers affect fiscal shocks at the subnational level is crucial for evaluating the true impact of decentralized fiscal policy.

BVAR approaches are capable of capturing both fiscal effects and socio-environmental dynamics, showing that renewable energy deployment reduces carbon emissions while deforestation increases them (Bauwens et al., 2000; Canova & Ciccarelli, 2004; Devianto et al., 2025; Gruber & Kastner, 2025; Woźniak, 2016). Similarly, studies in Peru show that government consumption and investment shocks influence GDP growth, with capital expenditure mitigating crises, and domestic policy uncertainty affecting macroeconomic variables (Meléndez & Rodríguez, 2025; Müller et al., 2025; Rodríguez & Santisteban, 2026).

Subnational allocations have also been shown to improve social outcomes, including stunting reduction and poverty alleviation, with vertical intergovernmental transfers minimizing regional development gaps (Guerrero et al., 2022; Hamzah et al., 2025; Lago et al., 2024; Wang et al., 2023). In addition, unconditional intergovernmental transfers in the Philippines increase household income and reduce poverty, especially in small municipalities (Tang et al., 2024).

Globalization exhibits nonlinear poverty-reducing effects, which are stronger under robust institutions, and FDI's effect on poverty depends on

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governance quality (Aloui et al., 2024; Bisiriyu et al., 2026). Moreover, government spending reduces energy poverty through education, resource exploration, and green technology innovation, while social security spending is less effective (Xu, 2025).

Fiscal decentralization also has nonlinear effects on ecological footprints, with positive outcomes in lower-regime countries and potential adverse effects in higher-regime contexts (Choudhury & Sahu, 2025). Additionally, expansionary monetary policy can increase emissions, while fiscal and financial policies interact with macroeconomic drivers such as GDP, trade, and public-private investment (Abla Amoah et al., 2025; SenGupta et al., 2026).

Increasing government employment reduces unemployment and stabilizes labor markets while supporting private sector employment through higher income and productivity (Lu & Kameda, 2024). Evidence from the EU shows that fiscal policy and demographic factors such as immigration and population growth affect unemployment heterogeneously, with distributional differences across quantiles (Moridian et al., 2024). Complementary evidence shows age-, gender-, and quantile-specific effects on unemployment duration from fiscal and monetary policies (Zamanzadeh et al., 2020).

Fiscal decentralization lowers structural unemployment, and optimal monetary policy mitigates unemployment risk under zero-lower-bound constraints (Akalbeo et al., 2023; Bonciani & Oh, 2026). Meanwhile, monetary policy shocks in South Africa show asymmetric effects on unemployment, with expansionary interventions slightly more effective than contractionary ones (Nuru, 2025), and fiscal shocks have gender-specific effects on labor participation, wages, and education (Jalles et al., 2026).

Fiscal decentralization, transfer-funded spending, and targeted allocations influence poverty, inequality, energy access, employment, and environmental outcomes across countries (Adebayo, 2025; Banza et al., 2025; Bentour, 2025; Beth Wynter & De Loo, 2024; Coccia & Russo, 2025; Hua & Tong, 2026; Jiao et al., 2025; Tamai & Wang, 2025). Furthermore, fiscal responsibilities within public–private partnerships can constrain corporate innovation, particularly under high debt or limited transfers (Wang et al., 2025).

Building on these insights, this study extends previous national- and environmental-level research by explicitly modeling Regional Transfer Fund allocations in West Sumatra (2014–2024), examining how transfers affect social outcomes and fiscal behavior under decentralized institutional conditions (Devianto et al., 2023, 2025). Conducting the analysis aims to determine whether stabilizing effects observed at the national level continue to hold when examined in the context of local governance.

To investigate the potential short-term and lagged effects of the Regional Transfer Fund on key social and economic outcomes in West Sumatra, the following hypotheses are formulated:

H1: *Regional Transfer Fund does not Granger-cause government expenditure.*

H2: *Regional Transfer Fund does not Granger-cause the open unemployment rate.*

H3: *Regional Transfer Fund does not Granger-cause the basic infrastructure.*

H4: *Regional Transfer Fund does not Granger-cause the regional revenue.*

2. METHOD

2.1. Data

This study utilizes a quarterly time series dataset for West Sumatra covering 44 observations from the first quarter of 2014 to the fourth quarter of 2024, constructed from official sources including Statistics Indonesia for secondary data and the West Sumatra Provincial Budget for primary data. The dataset captures a period of significant fiscal and socio-economic transformation, including the pre-pandemic expansion from 2014 to 2019, the acute contraction and policy response during 2020 to 2021, and the ongoing recovery from 2022 to 2024.

Five endogenous variables are defined for inclusion in the Bayesian Vector Autoregressive system:

a) Regional Transfer Fund, expressed in million Indonesian Rupiah, deflated using the

provincial Gross Domestic Product deflator and log-transformed to ensure proportional interpretation.

b) Government Consumption Expenditure, representing final public consumption spending by provincial and local governments, excluding capital formation, in logarithm of million Indonesian Rupiah.

c) Open Unemployment Rate, defined as the percentage of the labor force that is unemployed and actively seeking work, used at levels due to its bounded nature.

d) Basic Infrastructure Investment, representing aggregated capital expenditure on roads, water supply, energy, and public facilities, in logarithm of million Indonesian Rupiah.

e) Regional Revenue, representing local own-source revenue in logarithm of million Indonesian Rupiah.

It should be noted that GOV data were previously used by Devianto et al. (2023) and are extended here to cover 2014–2024, allowing the examination of the dynamic effects of Regional Transfer Fund allocations on socio-economic outcomes in West Sumatra. All variables were transformed into logarithmic or ratio form to ensure stationarity and comparability. The quarterly series, shown in Figure 1, reveals distinct trends over 44 quarters, providing a foundation for analyzing the dynamic interrelationships among regional fiscal policy, infrastructure investment, and socio-economic outcomes.

2.2. Bayesian Vector Autoregressive (BVAR) framework

To model the dynamic interactions among these variables, we adopt a Bayesian Vector Autoregressive (BVAR) model, a flexible, theoretically grounded framework that overcomes the pitfalls of classical VAR estimation in small-sample settings. Let Z_t be a 5 × 1 vector of endogenous variables, consisting of the Regional Transfer Fund (TAF), Government Expenditure (GOV), Open Unemployment Rate (OUR), Regional Revenue (REV), and Basic Infrastructure (INF). The BVAR(1) model can then be written as:

$$Z_t = \Phi_0 + \Phi_1 Z_{t-1} + \varepsilon_t, \quad (1)$$

where vector Φ_0 represents the constants, Φ_1 represents the matrix of lagged coefficients, and ε_t denotes a vector of stochastic error terms assumed to follow a multivariate normal distribution. This framework allows the model to capture both the autoregressive behavior of each variable and the dynamic interactions across variables while incorporating prior information to enhance estimation accuracy in small-sample settings. Informative priors are imposed using the Minnesota prior. Own-lag coefficients are centered near one, reflecting persistence and near-random-walk behavior. Cross-variable coefficients and higher-lag coefficients are shrunk toward zero, with the degree of shrinkage increasing with lag length and cross-variable distance. This prior is well-suited for macroeconomic systems with strong autocorrelation and limited short-term cross-dynamics, a pattern evident in the posterior median estimates.

To systematically analyze the dynamic interactions among the variables, the following algorithm outlines the steps of the BVAR procedure, from data preparation to causal inference.

a) Data Preparation. The preparation stage includes collecting quarterly data from 2014 to 2024, transforming monetary variables into log differences to ensure stationarity, and keeping non-monetary variables at their levels for interpretability. All variables are then organized into a vector for the BVAR model.

b) Model Specification. A Bayesian Vector Autoregressive (BVAR) model is specified, including five endogenous variables: Regional Transfer Fund, Government Expenditure, Open Unemployment Rate, Poverty Index, and Basic Infrastructure. Lag order is set based on theoretical and empirical considerations.

c) Prior Selection. Informative priors are imposed using the Minnesota prior. Own-lag coefficients are centered near one, reflecting persistence, while cross-variable and higher-lag coefficients are shrunk toward zero to reduce overfitting.

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d) Posterior Estimation. Posterior distributions of parameters are estimated using Bayesian techniques, combining prior information with observed data to obtain robust coefficient estimates in small-sample settings.

e) Impulse Response Analysis. Impulse response functions (IRFs) are computed to trace the dynamic effect of a one-standard-deviation shock in the Regional Transfer Fund on all endogenous variables. Confidence intervals are derived from posterior draws to assess statistical significance.

f) Granger Causality Testing. Granger causality tests are used to evaluate whether past values of the Regional Transfer Fund contain predictive information about the other variables, thereby helping identify short-term directional effects.

In summary, the Bayesian VAR framework, combined with impulse-response and Granger-causality analyses, provides a coherent approach for evaluating the dynamic effects of Regional Transfer Fund allocations on social and fiscal outcomes. This methodology captures both short-term reactions and potential temporal dependencies, providing a robust foundation for interpreting the impact of transfer-funded spending in a decentralized fiscal system.

3. RESULTS

The quarterly movements of government consumption expenditure, open unemployment rate, regional revenue, and basic infrastructure investment provide a preliminary overview of their patterns over the 44 quarters, as illustrated in Figure 1.

Figure 1 depicts Indonesia's economic indicators between 2014 and 2024. Government expenditure and regional revenue both show steady growth, reflecting stronger fiscal capacity and sustained public spending. The unemployment rate fluctuates, rising during periods of economic disruption and declining as recovery policies take effect. Basic infrastructure investment increases sharply in the earlier years, then eases in later years, suggesting a reallocation of fiscal priorities. These patterns highlight how spending, employment, revenue,

Figure 1. Quarterly period of government expenditure in consumption, open unemployment rate, regional revenue, and basic infrastructure in West Sumatra

and infrastructure development evolve together, with clear signs of adjustment in response to external challenges and recovery needs.

Lag selection is essential in estimating vector autoregressive models, including Bayesian VAR, as it determines how many past observations to include. An appropriate lag length captures the dynamic interactions between variables while avoiding overfitting. Four information criteria, the Akaike Information Criterion, Hannan Quinn Criterion, Schwarz Criterion, and Final Prediction Error, were used to guide selection, balancing model fit and complexity. Table 1 presents the lag selection results for lags one through four.

Table 1. Lag selection and information criteria

Lag	AIC(n)	HQ(n)	SC(n)	FPE(n)
1	−33.89001	−33.43343	−32.63618	1.933537×10^{-15}
2	−36.00727	−35.17022	−33.70858	2.463029×10^{-16}
3	−35.56750	−34.34997	−32.22395	4.447295×10^{-16}

According to Table 1, all four information criteria indicate that a lag length of two is optimal, yielding the lowest values of AIC, HQ, SC, and FPE. The results indicate that the BVAR(2) model strikes the optimal blend of explanatory power and parsimony. However, because lag two is the highest latency evaluated in this study, further analyses will examine the performance of BVAR(1) to compare the outcomes. This method ensures that both the shorter- and longer-lag specifications are assessed for their ability to represent the dynamics of government spending, infrastructure investment, total transfer allocation funds, and socioeconomic indicators throughout the 44 quarterly periods spanning 2014 to 2024.

Impulse response functions (IRFs) were employed to analyze the dynamic interactions and short-term reactions among the variables in the BVAR(1) system. These functions trace how a one-time, one-standard-deviation shock to the Regional Transfer Fund Allocation influences its own trajectory as well as the endogenous responses of Government Expenditure in Consumption, the Open Unemployment Rate, Regional Revenue, and the Basic Infrastructure Sector over subsequent periods. By capturing the magnitude, direction, and persistence of these responses, IRFs provide valuable insight into the transmission mechanisms within the system. Figure 2 presents the impulse response functions for both the one-lag and two-lag specifications, allowing comparison of how the temporal structure alters the dynamic behavior of the variables.

Figure 2 illustrates the impulse response functions of the Regional Transfer Fund under one-lag and two-lag specifications. The one-lag specification produces clearer and more stable dynamic patterns, with median responses that are well-defined and confidence intervals that remain relatively narrow. This indicates that shocks to the Regional Transfer Fund generate consistent and statistically reliable effects on government expenditure, the open unemployment rate, regional revenue, and

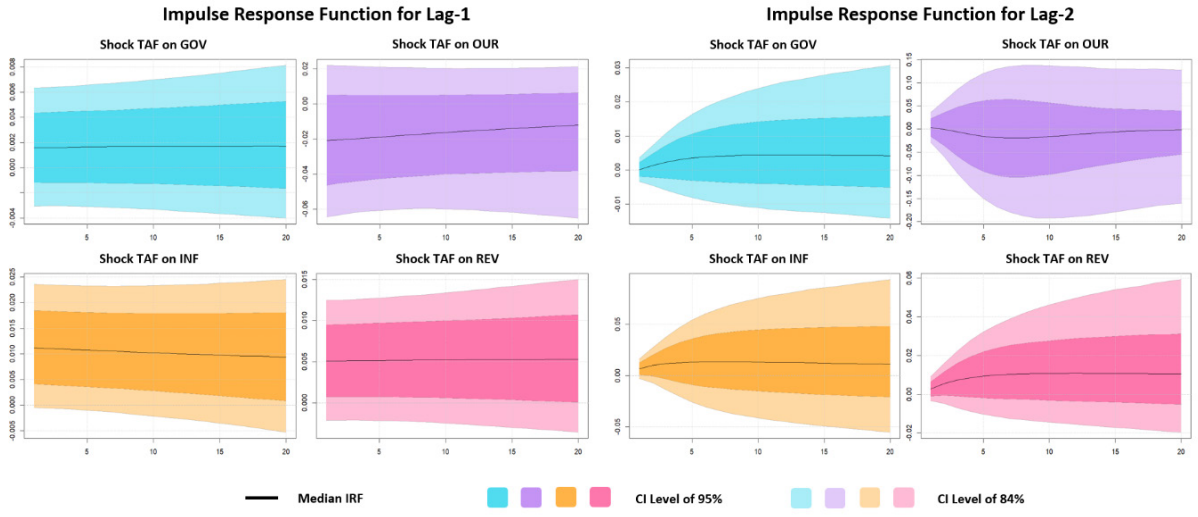

Figure 2. Impulse response functions of the regional transfer fund for lag-1 and lag-2

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infrastructure investment when modeled with a single lag. In contrast, the two-lag specification yields wider confidence intervals and less consistent trajectories, suggesting greater uncertainty in the estimated responses. In several cases, the confidence bands overlap zero, which weakens the evidence of significant short-term effects. The superiority of the one-lag specification is consistent with theoretical expectations in Bayesian VAR modeling, where parsimony often enhances interpretability and reduces estimation noise.

From a theoretical perspective, the clearer responses under the one-lag specification align with the principle that fiscal transfers operate primarily through short-run channels, where government expenditure and infrastructure investment respond quickly to funding shocks. The limited effect on unemployment reflects labor market rigidities, consistent with Keynesian views that employment adjustment is slower and requires sustained fiscal impulses. Meanwhile, the stability of revenue responses supports the notion of fiscal inertia, where past allocations strongly determine current revenue collection. Thus, the empirical evidence in Figure 2 is consistent with established macroeconomic theory: fiscal transfers have immediate and interpretable effects on expenditure and infrastructure, while labor market and revenue outcomes adjust more gradually.

To complement the dynamic patterns illustrated in the impulse response functions, it is essential to verify the statistical reliability of the estimation process. Posterior stability and convergence provide evidence that the Bayesian estimation has reached equilibrium, ensuring that the impulse responses are not driven by random fluctuations or sampling noise. By examining the posterior draws across horizons, one can assess whether the estimated responses remain consistent and statistically valid. Figure 3 displays the posterior stability of the impulse response function estimation, highlighting that the results are statistically stable and therefore can be considered robust.

Figure 3 presents the posterior stability and convergence of the impulse response function (IRF) estimation for shocks to the Regional Transfer Fund. The plots illustrate how the posterior distributions evolve across horizons, showing dense trajectories that gradually stabilize around zero. This convergence pattern indicates that the estimation process is not driven by random fluctuations but instead reflects consistent statistical behavior across repeated draws from the posterior distribution. The fact that the lines cluster tightly and do not diverge over longer horizons provides strong evidence that the IRF estimation is statistically reliable. From an economic perspective, the robustness of these results supports the theoretical

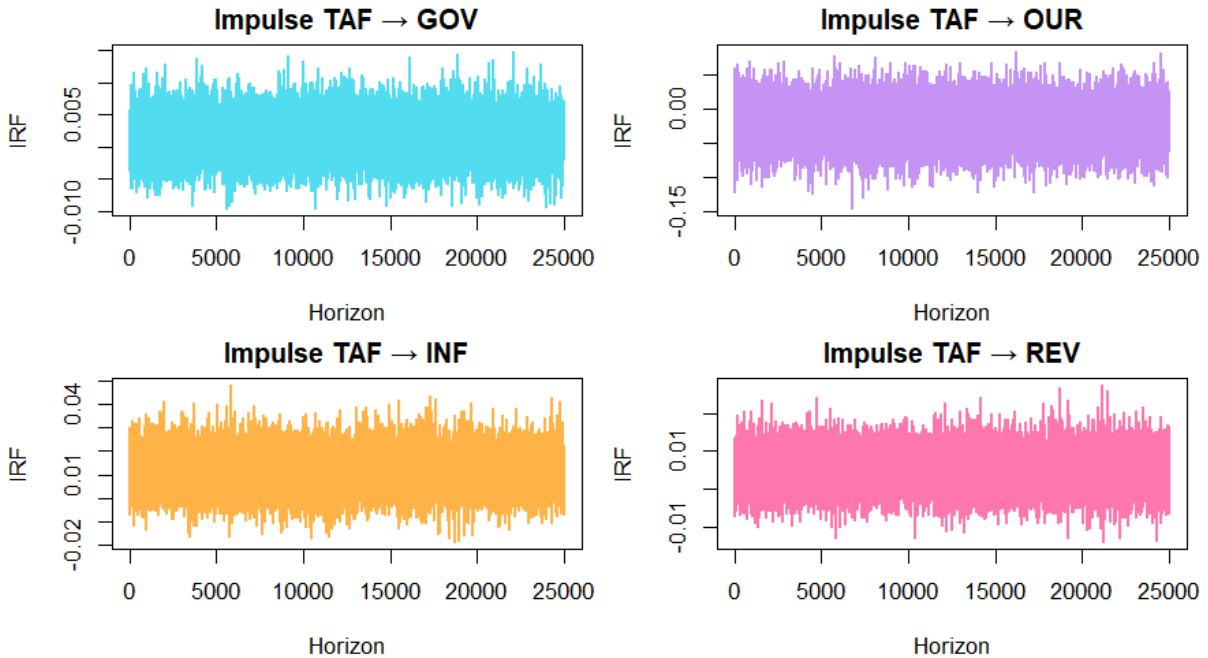

Figure 3. Posterior stability (convergence) of impulse response function (IRF) estimation

expectation that fiscal transfers operate through stable channels of expenditure and infrastructure investment, while labor market and revenue responses adjust more gradually. The convergence of posterior distributions confirms that the estimated effects are not only statistically sound but also economically meaningful, providing confidence that the Regional Transfer Fund functions as a reliable instrument for influencing regional development outcomes.

To further evaluate the appropriateness of the lag length in the BVAR specification, model comparison metrics were examined. These criteria include the log-likelihood, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Schwarz Criterion (SC), and Final Prediction Error (FPE). By comparing these values across different lag structures, it becomes possible to identify which specification provides the best balance between model fit and parsimony.

The results in Table 2 indicate that the one-lag specification achieves a higher log-likelihood and lower information criteria (AIC, BIC, SC) compared to the two-lag specification. Moreover, the Final Prediction Error (FPE) for the one-lag model is substantially smaller, suggesting that it provides more accurate forecasts. In contrast, the two-lag specification, despite yielding a slightly higher log-likelihood, suffers from inflated information criteria and a very large FPE value, which signals over-parameterization and reduced predictive reliability. Taken together, these metrics confirm that the BVAR(1) model offers a more efficient and statistically sound representation of the system, thereby supporting its use in the subsequent analysis of dynamic transmission mechanisms.

The BVAR(1) model was estimated using 44 quarterly observations, five endogenous variables, and one lag, employing a Minnesota-type prior with optimized hyperparameters ($\lambda = 0.2063$, $\sigma = 1.1011$, $\mu = 0.3175$) and a Markov Chain Monte Carlo simulation of 50,000 iterations with 25,000 burn-in. The model captures the dynamic interactions among the Regional Transfer Fund, Government Expenditure, Open Unemployment Rate, Regional Revenue, and Basic Infrastructure, with posterior medians summarizing the magnitude and direction of lagged effects, as shown in Table 3.

The coefficient matrix of the BVAR(1) system shows that each variable is largely explained by its own past values, reflecting strong autoregressive tendencies. Government expenditure, infrastructure investment, and regional revenue all display coefficients of 1.000 on their lagged terms, suggesting that fiscal spending, infrastructure development, and revenue collection follow established trajectories with limited short-term external influence. The Regional Transfer Fund also exhibits a self-driven dynamic, with only negligible spillovers to other variables in the immediate lag.

The Open Unemployment Rate demonstrates persistence with a coefficient of 0.985, indicating that labor market conditions adjust slowly over time. Cross-variable effects are minimal,

Table 2. BVAR model comparison metrics

Lag	LogLikelihood	AIC	BIC	SC	FPE
1	351.1807	708.3615	713.7140	713.7140	6.741798
2	373.5078	753.0155	758.3681	758.3681	190.415603

Table 3. Posterior median of coefficients

Posterior median of coefficients	Regional Transfer Fund	Government Expenditure	Open Unemployment Rate	Basic Infrastructure	Regional Revenue
Constant	0.049	0.020	0.032	0.025	0.026
Regional Transfer Fund (Lag –1)	1.000	0.000	0.001	–0.001	0.000
Government Expenditure (Lag –1)	0.000	1.000	0.001	0.000	0.000
Open Unemployment Rate (Lag –1)	–0.006	–0.001	0.985	0.002	–0.001
Basic Infrastructure (Lag –1)	0.000	0.000	0.000	1.000	0.000
Regional Revenue (Lag –1)	0.000	0.000	0.000	0.000	1.000

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with only very small coefficients such as –0.006 from unemployment to the transfer fund and 0.002 to infrastructure. In economic terms, this pattern implies that fiscal allocations and institutional processes tend to reinforce their own momentum, while labor market and revenue responses are less immediate. For business perspectives, the findings highlight that government expenditure and infrastructure investment can be anticipated with relative stability, whereas employment and revenue outcomes require longer horizons to reflect the impact of fiscal transfers.

Let Z_t be a 5 × 1 vector of endogenous variables, consisting of the Regional Transfer Fund (TAF), Government Expenditure (GOV), Open Unemployment Rate (OUR), Regional Revenue (REV), and Basic Infrastructure (INF). The vector Φ_0 represents the constants, Φ_1 is the matrix of lagged coefficients reported in Table 3, and ε_t denotes a vector of stochastic error terms assumed to follow a multivariate normal distribution. This specification enables the model to capture both the autoregressive behavior of each variable and the dynamic interactions among variables, while incorporating prior information to enhance estimation accuracy given the relatively small sample size. The BVAR(1) model can then be written as:

$$\begin{bmatrix} B\log TAF_t \\ B\log GOV \\ B\,OUR_t \\ B\log INF_t \\ B\log REV_t \end{bmatrix} = \begin{bmatrix} \Phi_{10} \\ \Phi_{20} \\ \Phi_{30} \\ \Phi_{40} \\ \Phi_{50} \end{bmatrix} + \begin{bmatrix} \Phi_{11} & \Phi_{12} & \Phi_{13} & \Phi_{14} & \Phi_{15} \\ \Phi_{21} & \Phi_{22} & \Phi_{23} & \Phi_{24} & \Phi_{25} \\ \Phi_{31} & \Phi_{32} & \Phi_{33} & \Phi_{34} & \Phi_{35} \\ \Phi_{41} & \Phi_{42} & \Phi_{43} & \Phi_{44} & \Phi_{45} \\ \Phi_{51} & \Phi_{52} & \Phi_{53} & \Phi_{54} & \Phi_{55} \end{bmatrix} \begin{bmatrix} B\log TAF_{t-1} \\ B\log GOV_{t-1} \\ B\,OUR_{t-1} \\ B\log INF_{t-1} \\ B\log REV_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix}, \tag{2}$$

$$\begin{bmatrix} B\log TAF_t \\ B\log GOV_t \\ B\,OUR_t \\ B\log INF_t \\ B\log REV_t \end{bmatrix} = \begin{bmatrix} 0.049 \\ 0.020 \\ 0.032 \\ 0.025 \\ 0.026 \end{bmatrix} + \begin{bmatrix} 1.000 & 0.000 & -0.006 & 0.000 & 0.000 \\ 0.000 & 1.000 & -0.001 & 0.000 & 0.000 \\ 0.001 & 0.001 & 0.985 & 0.000 & 0.000 \\ -0.001 & 0.000 & 0.002 & 1.000 & 0.000 \\ 0.000 & 0.000 & -0.001 & 0.000 & 1.000 \end{bmatrix} \cdot \begin{bmatrix} B\log TAF_{t-1} \\ B\log GOV_{t-1} \\ B\,OUR_{t-1} \\ B\log INF_{t-1} \\ B\log REV_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix}, \tag{3}$$

where BlogTAF_t = logTAF_t – logTAF_{t-1}; BlogGOV_t = logGOV_t – logGOV_{t-1}; $BOUR_t = OUR_t - OUR_{t-1}$; Blog$INF_t$ = logINF_t – logINF_{t-1}; and BlogREV_t = logREV_t – logREV_{t-1}. In other forms, the BVAR(1) model can be represented as follows.

3.1. Regional Transfer Fund Allocation (TAF)

$$\begin{aligned} \log TAF_t &= 0.049 + 2\log TAF_{t-1} \\ &- \log TAF_{t-2} - 0.006 OUR_{t-1} + 0.006 OUR_{t-2}. \end{aligned} \tag{4}$$

By retransforming the Regional Transfer Fund Allocation Series TAF_t using the exponential function, the BVAR(1) model for the Regional Transfer Fund Allocation Series TAF_t can be represented as follows:

$$\begin{aligned} TAF_t &= 1.050 \cdot \frac{TAF_{t-1}^2}{TAF_{t-2}} \\ &\times \exp\left(-0.006 OUR_{t-1} + 0.006 OUR_{t-2}\right). \end{aligned} \tag{5}$$

Regional Transfer Fund (TAF) in logarithmic form shows strong dependence on its previous values, with a large positive influence (coefficient 2) from the most recent period and an opposing influence (coefficient 1) from an earlier period, indicating that increases in past allocations tend to be reinforced but also adjusted over time. In level terms, this is reflected in a scaling factor of about 1.050, meaning past increases are slightly amplified. The impact of unemployment is relatively small: a recent rise slightly reduces TAF (coefficient 0.006), while a rise from an earlier period slightly increases it (coefficient 0.006), suggesting a mild and delayed response to economic conditions. In practice, this implies that when unemployment rises, local governments may face tighter fiscal conditions in the short run, leading to slightly lower transfer allocations, while policy ad-

justments or fiscal support tend to follow in later periods, increasing transfers as a response to earlier economic pressures.

3.2. Government Expenditure in Consumption (GOV)

$$\log GOV_t = 0.020 + 2\log GOV_{t-1} - \log GOV_{t-2} - 0.001OUR_{t-1} + 0.001OUR_{t-2} \quad (6)$$

By retransforming the Government Expenditure in Consumption Series $Y1_t$ using the exponential function, the BVAR(1) model for the Government Expenditure in Consumption Series $Y1_t$ can be represented as follows:

$$GOV_t = 1.020 \cdot \frac{GOV_{t-1}^2}{GOV_{t-2}} \times \exp\left(-0.001OUR_{t-1} + 0.001OUR_{t-2}\right) \quad (7)$$

Government Expenditure in Consumption (GOV) in logarithmic form shows strong dependence on its previous values, with a large positive influence (coefficient 2) from the most recent period and an opposing influence (coefficient 1) from an earlier period, indicating that spending tends to be reinforced but also adjusted over time. In level terms, this is reflected in a scaling factor of about 1.020, meaning past increases are slightly amplified. The effect of unemployment is very small, where a recent increase slightly reduces GOV (coefficient 0.001), suggesting that when unemployment rises, government spending on consumption, such as wages, tends to slightly decline, indicating limited fiscal space for maintaining spending levels. An earlier increase in unemployment slightly raises GOV (coefficient 0.001), indicating a mild delayed adjustment.

3.3. Open Unemployment Rate (OUR)

$$OUR_t = 0.032 + 0.001\log\left(\frac{TAF_{t-1}}{TAF_{t-2}}\right) + 0.001\log\left(\frac{GOV_{t-1}}{GOV_{t-2}}\right) + 1.985OUR_{t-1} - 0.985OUR_{t-2}. \quad (8)$$

Open Unemployment Rate (OUR) shows strong dependence on its past values, with a large positive influence (coefficient 1.985) from the most recent period and an opposing influence (coefficient 0.985) from an earlier period, indicating that unemployment tends to persist but gradually adjusts over time. The effects of the Regional Transfer Fund (TAF) and Government Expenditure (GOV) are very small (each with a coefficient of 0.001), suggesting that changes in transfers and government consumption have only a limited direct impact on unemployment. In practical terms, this means that unemployment is largely driven by its own past trend, while increases in government spending or transfers only slightly help reduce unemployment and the effect is not immediate.

3.4. Regional Revenue (REV)

$$\log REV_t = 0.026 - 0.001\log OUR_{t-1} + 0.001\log OUR_{t-2} + 2\log REV_{t-1} - \log REV_{t-2}. \quad (9)$$

By retransforming the Regional Revenue Series REV_t using the exponential function, the BVAR(1) model for the Regional Revenue Series REV_t can be represented as follows:

$$REV_t = 1.026 \cdot \frac{REV_{t-1}^2}{REV_{t-2}} \times \exp\left(-0.001OUR_{t-1} + 0.001\log OUR_{t-2}\right) \quad (10)$$

Revenue in logarithmic form is largely explained by its own past values (1.000) with a very small variance (0.001), indicating a stable and persistent pattern over time. Cross-covariances with other variables are close to zero, suggesting that revenue is not immediately affected by transfers or government expenditure. The small relationship with unemployment (coefficient 0.001) indicates that when unemployment rises, revenue tends to slightly decline due to reduced economic activity and a weaker tax base. At the same time, higher government expenditure and fiscal support can stimulate economic activity, expand the tax base, and strengthen revenue in subsequent periods, although this effect tends to appear gradually rather than immediately.

3.5. Basic Infrastructure Sector (INF)

$$\log INF_t = 0.025 - 0.001\log\left(\frac{TAF_{t-1}}{TAF_{t-2}}\right) + 0.002OUR_{t-1} - 0.002OUR_{t-2} + \log\left(\frac{INF_{t-1}^2}{INF_{t-2}}\right) \quad (11)$$

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By retransforming the Basic Infrastructure Sector Series INF_t using the exponential function, the BVAR(1) model for the Basic Infrastructure Sector Series INF_t can be represented as follows:

$$INF_t = 1.025 \cdot \left(\frac{TAF_{t-1}}{TAF_{t-2}}\right)^{0.001} \left(\frac{\mathrm{INF}_{t-1}^2}{INF_{t-2}}\right) \times \exp\left(0.002 OUR_{t-1} - 0.002 \log OUR_{t-2}\right) \quad (12)$$

Basic Infrastructure Sector (INF) in logarithmic form shows strong dependence on its previous values, indicating a stable and persistent development pattern over time. In level terms, this is reflected in a scaling factor of about 1.025, meaning past increases in infrastructure tend to be slightly amplified. The effect of Regional Transfer Funds (TAF) is very small (coefficient 0.001), suggesting that changes in transfers have only a limited direct impact on infrastructure development. The influence of unemployment is also relatively small: a recent increase slightly raises infrastructure activity (coefficient 0.002), while an earlier increase slightly reduces it (coefficient 0.002), indicating a mild, delayed adjustment. In practice, this suggests that when unemployment rises, there may be a short-term push to increase infrastructure spending as a response, but the effect is limited and tends to stabilize over time.

The variance–covariance matrix provides insight into the stability of shocks within the system and the extent to which fluctuations in one variable are associated with movements in others. This evaluation is important to understand whether fiscal transfers, government spending, unemployment, infrastructure, and revenue interact strongly in the short run or remain largely independent.

Table 4 shows that the Regional Transfer Fund, Government Expenditure, Infrastructure, and Regional Revenue all have very small variances, indicating that their short-term movements are relatively stable. The Open Unemployment Rate, however, shows a much larger variance (0.034), reflecting greater volatility in labor market conditions. The off-diagonal elements are close to zero, suggesting that shocks in one variable do not strongly spill over to others in the same period.

Economically, this means fiscal transfers, government spending, and infrastructure investment can be considered predictable and steady, forming a reliable basis for planning and policy. Regional revenue also appears stable, reinforcing the idea of fiscal consistency. In contrast, unemployment remains more uncertain, showing sharper fluctuations and slower adjustment. From an economic development and business perspective, these findings highlight that fiscal and infrastructure channels provide stability for investment and growth strategies, while employment outcomes require longer horizons and adaptive measures to absorb shocks.

After analyzing the dynamic transmission mechanisms, Granger causality tests were conducted to determine whether past values of the Transfer Allocation Fund provide statistically significant predictive information for government expenditure, open unemployment rate, basic infrastructure investment, and regional revenue. This procedure validates the suitability of the BVAR(1) framework by confirming the suggested directional relationships within the system. The tests were performed under both simultaneous and partial specifications to assess whether the causal structure is robust across different perspectives. The null hypothesis is rejected whenever the probability value (p-value) falls below the 5% threshold. Table 5 reports the results of the Granger causality tests together with the instantaneous causality test, thereby offering a comprehensive view of the predictive and contemporaneous linkages among the variables.

Table 4. Posterior median of variance-covariance matrix

Posterior median of variance-covariance	Regional Transfer Fund	Government Expenditure	Open Unemployment Rate	Basic Infrastructure	Regional Revenue
Regional Transfer Fund	0.002	0.000	–0.001	0.001	0.000
Government Expenditure	0.000	0.000	–0.001	0.000	0.000
Open Unemployment Rate	–0.001	–0.001	0.034	–0.001	0.000
Basic Infrastructure	0.001	0.000	–0.001	0.003	0.000
Regional Revenue	0.000	0.000	0.000	0.000	0.001

Table 5. Simultaneous, partial, and instantaneous Granger Causality tests

Initial Hypotheses (H0)	Test	p-value	Decision for H0
Simultaneous Granger causality test			
The Transfer Allocation Fund does not jointly Granger-cause Government Expenditure, Open Unemployment Rate, Basic Infrastructure Investment, and Regional Revenue	F = 11.523	2.25×10^{-8}	Rejected
Instantaneous causality test			
The Transfer Allocation Fund does not have instantaneous causality with Government Expenditure, Open Unemployment Rate, Basic Infrastructure Investment, and Regional Revenue	$\chi^2 = 7.935$	0.094	Weakly rejected (Significant at 10%
Partial Granger causality test			
Regional Transfer Fund does not Granger-cause the Government Expenditure	F = 8.264	0.0064	Rejected
Regional Transfer Fund does not Granger-cause the Open Unemployment Rate	F = 0.665	0.4196	Accepted
Regional Transfer Fund does not Granger-cause the Regional Revenue	F = 0.147	0.703	Accepted
Regional Transfer Fund does not Granger-cause the Basic Infrastructure	F = 14.710	0.0004	Rejected

According to Table 5, the simultaneous Granger causality test (F = 11.523; p = 2.25×10^{-8}) shows that changes in the Transfer Allocation Fund are followed by changes in government expenditure, unemployment, infrastructure, and revenue. This means that when transfers increase or decrease, they tend to shape the direction of these variables over time. The instantaneous test (χ^2 = 7.935; p = 0.094) suggests that some short-term or same-period relationships may exist, but they are relatively weak and not consistently strong.

The partial results clarify how this influence works in practice. The significant effect on government expenditure (F = 8.264; p = 0.0064) indicates that transfer funds are directly used to finance routine government spending, such as salaries and operational costs. This is consistent with the role of central government transfers, which are generally allocated to support various types of public expenditure. When the amount of transfer funds is limited, local governments need to adjust by finding alternative funding sources, for example, by increasing regional revenue through taxes, levies, or improving local economic activity. The strong effect on infrastructure (F = 14.710; p = 0.0004) shows that transfers are also actively directed toward development projects, especially basic infrastructure such as roads, public facilities, irrigation systems, and health or education infrastructure, which are commonly financed through central government funds. For example, an increase in transfer funds may lead to more road construction or rehabilitation projects, while a decrease may delay or reduce such development programs.

In contrast, the absence of a significant effect on unemployment (F = 0.665; p = 0.4196) suggests that increases in transfers do not immediately create jobs, indicating an indirect or delayed impact on employment. Similarly, the lack of effect on regional revenue (F = 0.147; p = 0.703) indicates that transfers do not directly generate income for the region but rather support spending activities. This means that in practice, the Transfer Allocation Fund mainly functions as a tool to support government operations and infrastructure development, while its impact on broader economic outcomes, such as employment and revenue, depends on how effectively those funds are managed and translated into productive economic activities.

4. DISCUSSION

The findings of this study indicate that the Regional Transfer Fund Allocation, comprising the General Allocation Fund, Special Allocation Fund, and Revenue Sharing Fund, generates observable but generally modest fiscal responses in West Sumatra. Based on the BVAR(1) impulse response analysis, a one standard deviation shock to the Regional Transfer Fund leads to a positive and relatively immediate increase in Government Consumption Expenditure, with responses occurring primarily in the short run and stabilizing within the first few quarters. In contrast, the response of Basic Infrastructure Investment is weak and slightly negative, suggesting limited short-term adjustment rather than a strong crowding-out effect. The Open

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Unemployment Rate exhibits only minimal changes following the shock, indicating that labor market conditions are largely driven by their own persistence and adjust slowly over time. Similarly, Regional Revenue shows very limited short-term responsiveness, reflecting strong internal dynamics and fiscal inertia rather than direct dependence on transfer shocks.

These patterns are consistent with the posterior median estimates, which reveal strong autoregressive persistence across all variables, while cross-variable lagged effects remain generally small. Notable interactions include a mild positive influence of past Regional Revenue on Government Expenditure and a weak negative relationship with unemployment, though these effects are of limited magnitude. The results suggest that Regional Transfer Fund allocations primarily operate through short-term fiscal channels, particularly by supporting government consumption, while their effects on infrastructure development, labor markets, and regional revenue tend to be gradual and relatively constrained.

These patterns align with prior research. Lago et al. (2024) note that unconditional or formula-based transfers often redirect expenditures toward operational or politically salient priorities, sometimes at the expense of long-term infrastructure. Similarly, Alves and Araujo (2024) observe that municipal transfers can increase administrative spending rather than investment in essential services, while Masaki (2018) emphasizes the importance of aligning transfers with long-term development objectives to enhance sustainability. The results show that although government consumption increases moderately, infrastructure investment is reduced, illustrating a trade-off between short-term social benefits and long-term capital accumulation. Granger causality tests indicate that the Regional Transfer Fund significantly predicts government expenditure, regional revenue, and infrastructure investment at one lag, while effects on unemployment remain weak, highlighting the temporal limitation of transfer impacts on labor markets.

These findings complement international evidence indicating that local fiscal autonomy can enhance targeted welfare outcomes, promote regional economic growth, and reduce inequalities (Doan et al., 2025; Song et al., 2025; Zhao & He, 2024). At the same time, our findings underscore the potential trade-off between short-term consumption and long-term capital accumulation, highlighting the need for performance-linked allocations and strategic planning to ensure that transfer systems foster both immediate social benefits and sustainable economic development (Potrafke, 2025; Wang et al., 2024). In West Sumatra, the Regional Transfer Fund Allocation stabilizes short-term socioeconomic outcomes and illustrates how fiscal transfers influence subnational expenditure patterns, providing guidance for policy adjustments that balance welfare improvements with long-term infrastructure development.

CONCLUSION

This study examined the effects of the Regional Transfer Fund Allocation, including the General Allocation Fund, Special Allocation Fund, and Revenue Sharing Fund, on fiscal and socioeconomic outcomes in West Sumatra. The analysis shows that transfer shocks increase government consumption and reduce poverty in the short term, while potentially decreasing investment in basic infrastructure. These results suggest that well-designed transfers can serve as effective fiscal stabilizers, balancing immediate social benefits with potential long-term trade-offs in capital investment.

Careful alignment of transfers with performance-based criteria, earmarked infrastructure funding, and strengthened local planning can enhance the developmental impact of fiscal decentralization. Future research could explore the long-term effects of transfer policies on infrastructure, human capital development, and regional economic growth, as well as investigate optimal designs for combining fiscal rules with decentralized transfers to maximize both welfare and sustainability.

AUTHOR CONTRIBUTIONS

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