

Budget Absorption and Human Development: Evidence from Indonesian Provinces

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Article Info	Abstract
Keywords: Budget absorption; Capital expenditure structure; Fiscal independence; Human Development Index; Fixed effects; Indonesia DOI: 10.33830/jfba.v6i2.15872.2026	This study examines the associations between budget absorption, capital expenditure structure, fiscal independence, and human development outcomes in Indonesian provinces, including the potential moderating role of fiscal independence. Drawing on Agency Theory and New Public Management, the study employs panel data from 34 provinces during 2022–2024, comprising 102 province-year observations. Province fixed-effects models with province-clustered robust standard errors are estimated, supplemented by specifications incorporating year fixed effects, alternative sample restrictions, and lagged fiscal variables. The baseline model identifies a negative and statistically significant association between budget absorption and the Human Development Index ($\beta = -0.0528$, $p < 0.001$). However, the coefficient becomes statistically insignificant after including year fixed effects ($\beta = 0.0002$, $p = 0.954$), indicating substantial sensitivity to common temporal influences. Capital expenditure structure and fiscal independence are not statistically significant at the 5% level in the baseline model. The interaction between budget absorption and fiscal independence is also statistically insignificant ($\beta = 0.1244$, $p = 0.163$), providing insufficient evidence of moderation. Additional sensitivity analyses further qualify the negative baseline association. The findings underscore the distinction between administrative budget execution and substantive development outcomes and suggest that absorption rates should be considered alongside expenditure quality and outcome-oriented performance indicators. Given the short panel and potential endogeneity, the estimates are interpreted as conditional associations rather than causal effects.

1. Introduction

In practice, budget absorption remains one of the indicators widely used to assess the implementation of Regional Revenue and Expenditure Budgets (APBD). A high realization rate is often associated with the success of local governments in implementing planned programs. However, high budget realization is not necessarily synonymous with spending effectiveness. Amellya et al. (2023), for example, showed that local expenditure realization still faces problems related to delays in the budgeting process and large unspent balances from the previous year. Aji & Letizia (2025) also identified inefficiencies in budget realization associated with weak planning capacity and policy misalignment across levels of government. These findings indicate that successful budget absorption should be distinguished from the government's success in generating development benefits. Studies of local government budget implementation also emphasize that planning quality and regulation are important determinants of budget absorption (Pattiasina et al., 2023).

This condition highlights an important issue in the relationship between budget execution and development outcomes. Theoretically, greater budget realization enables governments to implement more development programs and should therefore contribute positively to human development outcomes. However, this relationship may be more complex when budgets are realized primarily to meet administrative targets, allocated to activities with limited development impact, or implemented

without adequate planning and control. Thus, high budget absorption may reflect administrative success in budget execution without necessarily representing substantive success in generating development outcomes.

Previous empirical evidence has also produced inconsistent findings. Heriberta et al. (2018) found that budget absorption had a positive effect on government organizational performance in Jambi Province. Prakasa & Suparyati (2022) showed that expenditure realization in the health sector can support improvements in the Human Development Index (HDI), although aggregate expenditure realization does not necessarily produce the same effect when it is not accompanied by effective resource use. Meanwhile, Rajkumar & Swaroop (2008) demonstrated that the effectiveness of public spending in generating development outcomes depends strongly on governance quality. These findings suggest that the relationship between government expenditure and human development is determined not only by the amount spent but also by the quality and context of public resource management.

In addition to the level of absorption, expenditure structure is important in explaining development outcomes. Capital expenditure is principally intended to create assets and public-service capacity whose benefits extend over the medium and long term. Saragih (2022) showed that capital expenditure can contribute positively to local government HDI. Fadilla & Ratnawati (2024) likewise identified capital expenditure as an important channel linking fiscal resources to improvements in quality of life. However, the effects of capital expenditure do not necessarily emerge in the same period in which the budget is realized. Infrastructure projects, educational facilities, health facilities, and other public-service assets generally require time before their benefits are reflected in human development indicators. This creates the possibility of a time lag between capital expenditure realization and changes in HDI.

The relationship between local government expenditure and development outcomes may also depend on the degree of fiscal independence. Under fiscal decentralization, the ability of local governments to generate own-source revenue (Pendapatan Asli Daerah, PAD) provides greater fiscal space to determine expenditure priorities according to local needs. Regions with higher fiscal independence theoretically have greater flexibility in planning and program implementation. Conversely, heavy dependence on central government transfers may constrain local fiscal policy space. Rambe et al. (2022) showed that fiscal capacity is associated with the efficiency of local government expenditure management, while Setiawan et al. (2022) demonstrated that local government capacity is related to the quality of public-service delivery under decentralization.

Nevertheless, greater fiscal independence does not automatically produce better development outcomes. The effectiveness of own-source revenue still depends on planning quality, program selection, governance, and the government's ability to transform fiscal resources into productive outputs and outcomes. Fiscal independence is therefore relevant not only as a direct determinant of human development but also as a condition that may influence the effectiveness of budget absorption in generating development outcomes.

Despite growing research on local government expenditure and human development, several issues remain insufficiently addressed. Previous studies have primarily examined the relationship between government spending, expenditure composition, fiscal decentralization, and development outcomes. For example, Prakasa & Suparyati (2022) investigated the effectiveness and efficiency of regional government expenditure in relation to public welfare, while Saragih (2022) examined the contribution of capital expenditure to human development. Pramatha et al. (2023) further explored the relationship between fiscal decentralization and the Human Development Index, considering the moderating role of capital spending. Although these studies provide valuable insights, they do not

directly address the combined relationships among aggregate budget absorption, capital expenditure structure, fiscal independence, and human development outcomes within the empirical framework employed in the present study.

An important distinction concerns the measurement of fiscal performance. Government expenditure levels indicate the amount of public resources allocated or spent, whereas budget absorption measures the proportion of the approved expenditure budget that has actually been realized. These indicators capture different dimensions of public financial management. A higher absorption rate may indicate successful budget execution without necessarily demonstrating that public expenditure has generated corresponding improvements in human development. Consequently, examining budget absorption separately from expenditure composition offers an additional perspective on the relationship between administrative budget performance and substantive development outcomes.

Furthermore, the relationship between budget execution and human development may depend on regional fiscal conditions. Fiscal independence, measured by the proportion of locally generated revenue to total regional revenue, reflects the extent to which provincial governments rely on their own revenue sources. Although greater fiscal independence may provide additional flexibility in determining expenditure priorities, such flexibility does not necessarily ensure that budget execution generates better development outcomes. This study therefore examines fiscal independence not only as a direct explanatory variable but also as a potential moderator of the relationship between budget absorption and human development.

The study makes three contributions. First, it distinguishes budget execution performance from expenditure composition by simultaneously examining budget absorption and the capital expenditure share in relation to the Human Development Index. Second, it investigates whether fiscal independence conditions the relationship between budget absorption and human development, extending the analysis beyond direct fiscal associations. Third, it interprets these relationships through Agency Theory and New Public Management, highlighting the potential divergence between administratively measured budget performance and development-oriented public-sector outcomes.

Using provincial panel data for Indonesia during 2022-2024, the study provides recent empirical evidence on these relationships while accounting for time-invariant provincial heterogeneity. Given the relatively short observation period and potential endogeneity, the findings are interpreted as conditional statistical associations rather than definitive causal effects. The central contribution is therefore not a claim that budget absorption necessarily reduces human development, but a more careful assessment of whether successful budget execution is consistently associated with improved development outcomes.

This study draws on Agency Theory and New Public Management (NPM) to develop expectations regarding the relationships between provincial fiscal management and human development outcomes. Agency Theory emphasizes the potential divergence of interests and information asymmetry between principals and agents (Jensen & Meckling, 1976). Applied to local public financial management, this perspective suggests that government officials responsible for executing public budgets may face administrative incentives that do not always align with citizens' broader development interests. Budget absorption, expenditure allocation, and fiscal independence may therefore be associated with development outcomes depending on the extent to which public resources are managed in accordance with public priorities and accountability arrangements.

New Public Management emphasizes explicit performance standards, results-oriented management, and the efficient use of public resources (Hood, 1991). From this perspective, budget absorption and expenditure structure represent dimensions of fiscal implementation rather than direct measures of development effectiveness. Their expected positive relationships with human development are conditional on expenditure supporting productive public services and development priorities. Together, Agency Theory and NPM provide a conceptual rationale for examining whether administrative budget performance, capital expenditure allocation, and fiscal independence are associated with HDI, while recognizing that these perspectives do not imply that greater expenditure realization or fiscal autonomy must necessarily produce better development outcomes.

Budget Absorption and Human Development (H1)

Budget absorption represents the proportion of approved government expenditure realized during a fiscal year. From an Agency Theory perspective, effective budget implementation may indicate that government agents are fulfilling their responsibility to execute authorized programs and provide public services. When budget execution is aligned with public priorities and supported by accountability mechanisms, higher budget absorption is expected to facilitate the delivery of education, healthcare, infrastructure, and other services relevant to human development (Jensen & Meckling, 1976; Wajdy et al., 2021).

From an NPM perspective, timely budget implementation can support operational efficiency and reduce delays in public-service delivery (Hood, 1991). Heriberta et al. (2018) examined budget spending and government organizational performance, while Prakasa & Suparyati (2022) investigated the effectiveness and efficiency of local government expenditure in relation to community welfare. These studies provide relevant empirical context for examining the developmental implications of expenditure implementation.

Nevertheless, higher budget absorption does not necessarily indicate more effective expenditure. Rajkumar & Swaroop (2008) showed that governance quality plays an important role in determining whether public spending generates improvements in development outcomes. Accordingly, the expected positive association between budget absorption and human development depends on whether realized expenditure supports productive and socially relevant programs.

H1: Budget absorption is positively associated with human development outcomes.

Capital Expenditure Structure and Human Development (H2)

Capital expenditure structure reflects the proportion of realized government expenditure allocated to public capital investment. Capital expenditure can support human development by financing infrastructure, educational facilities, healthcare facilities, and other public assets that improve access to essential services. Saragih (2022) examined the relationship between local government capital expenditure, internal supervision, regional wealth, and human development in Indonesia. Similarly, Nashshar & Mulyana (2022) investigated capital expenditure as a mediating variable in the relationship between specific allocation funds and the Human Development Index.

From an NPM perspective, public investment is expected to generate development benefits when resources are allocated efficiently and public assets are effectively utilized (Hood, 1991). Agency Theory further suggests that accountability and oversight are necessary to ensure that capital investment decisions serve public interests rather than narrow administrative objectives (Jensen & Meckling, 1976).

However, the developmental benefits of capital expenditure may depend on project quality, expenditure composition, and implementation periods. Meidina et al. (2023) examined capital expenditure allocation and human development in Bangka Belitung, providing additional empirical

context for the possibility that capital expenditure does not automatically translate into immediate improvements in HDI.

Based on the expected contribution of productive public investment to education, health, and living standards, the second hypothesis is formulated as follows:

H2: The proportion of capital expenditure is positively associated with human development outcomes.

Fiscal Independence and Human Development (H3)

Fiscal independence refers to the proportion of total regional revenue generated through local own-source revenue (Pendapatan Asli Daerah, PAD). A higher PAD-to-total-revenue ratio indicates relatively greater reliance on locally generated revenue and may provide local governments with greater discretion in determining expenditure priorities.

From an Agency Theory perspective, greater fiscal independence may create opportunities for stronger alignment between local revenue mobilization, accountability, and public-service provision. When local governments are responsive to citizens' needs, locally generated fiscal resources may support development programs that reflect regional priorities (Jensen & Meckling, 1976; Setiawan et al., 2022).

From an NPM perspective, fiscal independence may facilitate more responsive and performance-oriented resource allocation. Setiawan et al. (2022) highlighted the relevance of local government capacity for public-service delivery in decentralized Indonesia, while Pramatha et al. (2023) examined fiscal decentralization and human development in the context of capital expenditure.

Nevertheless, fiscal independence does not directly measure expenditure quality or total fiscal capacity. A higher PAD share may not necessarily lead to improved human development without effective planning, accountability, and resource management. As emphasized by Rajkumar & Swaroop (2008), governance conditions are important in determining whether public resources generate development outcomes.

Therefore, fiscal independence is expected to have a positive association with human development, subject to the effectiveness of fiscal management.

H3: Fiscal independence is positively associated with human development outcomes.

The Moderating Role of Fiscal Independence (H4)

The moderating role of fiscal independence differs conceptually from its direct association with human development. The direct effect concerns whether fiscal independence is associated with human development outcomes, whereas moderation concerns whether fiscal independence changes the strength of the relationship between budget absorption and human development.

From an Agency Theory perspective, greater reliance on locally generated revenue may provide local governments with opportunities to align expenditure implementation more closely with citizens' priorities. When fiscal discretion is accompanied by effective accountability, higher budget absorption may be more closely associated with public-service outcomes. However, agency problems may weaken this relationship if fiscal discretion is exercised without adequate oversight (Jensen & Meckling, 1976; Wajdy et al., 2021).

From an NPM perspective, the proposed moderating mechanism involves the alignment between budget execution, resource allocation, and development-oriented performance. Greater fiscal independence may provide additional opportunities to prioritize expenditure according to local

education, healthcare, and infrastructure needs. Consequently, the same level of budget absorption may be associated with different development outcomes depending on the fiscal conditions under which expenditure is implemented (Hood, 1991; Setiawan et al., 2022).

Empirical research also suggests that fiscal and institutional conditions may shape the relationship between public expenditure and development outcomes. Rajkumar & Swaroop (2008) demonstrated that governance quality conditions the effectiveness of public spending, while Pramatha et al. (2023) examined a conditional relationship between fiscal decentralization and human development through capital expenditure.

Although these studies do not directly establish fiscal independence as a moderator of the budget absorption HDI relationship, they provide a basis for proposing that fiscal conditions may influence how budget execution is associated with development outcomes. In this study, fiscal independence is therefore conceptualized as a potential contextual factor that may strengthen the positive association between budget absorption and human development through greater expenditure discretion and alignment with local development priorities.

The proposed mechanism remains theoretical because expenditure discretion, accountability quality, and program targeting are not directly measured in the empirical model.

H4: Fiscal independence positively moderates the relationship between budget absorption and human development outcomes.

2. Methods

This study adopts a quantitative approach using secondary data and a panel-data design. The unit of analysis is Indonesian provincial governments during 2022-2024. Panel data combine cross-sectional and time-series dimensions, allowing the study to analyze differences in fiscal characteristics and development outcomes across provinces as well as changes within each province over the observation period.

The study constructs a panel dataset consisting of 34 Indonesian provincial units observed annually from 2022 to 2024, resulting in 102 province-year observations. The provincial classification follows the 34-province structure used in the original dataset. The four newly established provinces in the Papua region-Papua Selatan, Papua Tengah, Papua Pegunungan, and Papua Barat Daya are not included as separate observational units because their administrative identities were established during the study period. The complete list of the 34 provincial units included in the analysis is provided in Appendix A.

The administrative restructuring of Papua and Papua Barat during 2022 raises an important issue concerning the geographical comparability of provincial observations. Although Papua and Papua Barat are retained as separate provincial identifiers in the original dataset, the establishment of new provinces may have altered the geographical coverage of fiscal and development indicators. Therefore, a balanced province-year structure does not, by itself, guarantee that the underlying administrative boundaries and statistical coverage are fully comparable across years. This distinction is particularly important for fixed-effects estimation, which relies on changes observed within the same provincial units over time.

To assess the sensitivity of the findings to these administrative changes, an additional robustness analysis excludes Papua and Papua Barat from the estimation sample. This produces a balanced panel of 32 provinces observed over three years, comprising 96 province-year observations, provided that all required variables are complete. The same two-way fixed-effects specifications are re-estimated using the restricted sample, with standard errors clustered at the provincial level. The

resulting coefficient estimates and statistical significance are compared with those obtained from the full sample.

The restricted-sample analysis evaluates whether the estimated relationships are sensitive to the inclusion of the two original provincial units affected by administrative restructuring. However, excluding Papua and Papua Barat does not constitute a full geographical harmonization procedure for the original dataset. Accordingly, the study explicitly acknowledges potential differences in territorial coverage and fiscal reporting across years and interprets the full-sample estimates with appropriate caution. The restricted-sample results are presented as a sensitivity assessment rather than definitive evidence that all geographical comparability concerns have been resolved.

Secondary data were obtained from official government sources. Local government financial data including expenditure budgets, realized expenditure, realized capital expenditure, own-source revenue (PAD), and total regional revenue were obtained from the Directorate General of Fiscal Balance (DJPK), Ministry of Finance of the Republic of Indonesia.

Human development data were obtained from Statistics Indonesia (BPS) through the Human Development Index (HDI). HDI is used as a proxy for human development outcomes because it captures three basic dimensions of development: health, education, and standard of living.

Population data were also obtained from BPS and used as a control variable representing regional size. Data collection involved documentation, downloading, merging, and organizing observations by province and year to construct the panel dataset.

Before the regression analysis, the data were checked to ensure consistency in provincial identities, observation years, variable completeness, and measurement units across periods.

Model Specification and Control Variable Selection

Population size is included in the baseline regression specification as a control variable to account for differences in regional demographic scale. Differences in population may influence public-service demands, expenditure requirements, and the distribution of fiscal resources across provinces. However, population size alone may not adequately capture the socioeconomic conditions associated with both fiscal performance and human development outcomes. Previous research has demonstrated that the effectiveness of public expenditure depends not only on fiscal resources but also on governance quality and institutional capacity (Rajkumar & Swaroop, 2008; Setiawan et al., 2022).

The fixed-effects model is employed to account for unobserved province-specific heterogeneity that remains relatively constant over time, including geographical characteristics, institutional structures, and persistent regional differences. As explained by Wooldridge (2010), fixed-effects estimation can control for time-invariant unobserved characteristics that may be correlated with the explanatory variables. Nevertheless, province fixed effects do not automatically eliminate omitted-variable bias arising from socioeconomic and macroeconomic factors that change within provinces over time.

To address this limitation, an extended model specification is proposed by incorporating provincial economic growth as an additional control variable. Economic growth is theoretically relevant because changes in regional economic activity may influence fiscal revenue, expenditure implementation, employment opportunities, household welfare, and human development outcomes. Furthermore, year fixed effects are introduced to account for common macroeconomic shocks and nationwide policy changes affecting all provinces during the observation period. The inclusion of

both province and year fixed effects provides a more comprehensive framework for controlling unobserved heterogeneity across geographical units and common temporal influences. Nevertheless, as emphasized by Imai & Kim (2021), two-way fixed-effects estimation remains dependent on identifying assumptions and does not automatically establish causal relationships.

An additional sensitivity specification may incorporate the provincial poverty rate to assess whether the estimated coefficients are sensitive to changes in socioeconomic conditions. However, poverty may also be influenced by public expenditure and is closely associated with the living-standard dimension of the Human Development Index. Consequently, including contemporaneous poverty as a control variable may introduce overadjustment or post-treatment bias if poverty lies on the pathway between fiscal expenditure and development outcomes. The poverty-adjusted specification is therefore treated as supplementary sensitivity analysis rather than the preferred baseline model.

The robustness assessment focuses particularly on the estimated negative association between budget absorption and human development. Previous evidence indicates that greater public expenditure does not necessarily translate into improved development outcomes when governance and expenditure-management quality are inadequate (Rajkumar & Swaroop, 2008). Similarly, Setiawan et al. (2022) demonstrate the importance of local government capacity for effective public-service delivery in decentralized Indonesia. These findings provide a theoretical basis for distinguishing budget execution performance from substantive development outcomes.

Accordingly, the baseline fixed-effects estimates are compared with alternative specifications incorporating year fixed effects and additional socioeconomic controls. Changes in the direction, magnitude, and statistical significance of the budget absorption coefficient are evaluated to assess the sensitivity of the findings to model specification. Given the relatively short observation period of 2022-2024 and the possibility of remaining time-varying confounding factors, the estimated relationships are interpreted as conditional statistical associations rather than definitive causal effects.

Table 1. Operationalization of Research Variables

Variable	Type	Measurement	Source
Human Development Outcomes (CPM)	Dependent	Human Development Index	BPS
Budget Absorption (SA)	Independent	Realized Expenditure / Expenditure Budget $\times$ 100	DJPk
Capital Expenditure Structure (SB)	Independent	Realized Capital Expenditure / Total Realized Expenditure	DJPk
Fiscal Independence (KF)	Independent and moderator	PAD / Total Regional Revenue	DJPk
Regional Size (UD)	Control	provincial population in thousands	BPS

Budget absorption (SA) is measured as the ratio of cumulative realized regional government expenditure as of December 31 of each fiscal year to the corresponding revised expenditure budget (APBD Perubahan or APBD-P), multiplied by 100. The denominator represents the expenditure allocation after budget revisions rather than the initially approved APBD. Both budget and realization figures were obtained from the Directorate General of Fiscal Balance (DJPk), Ministry of Finance of Indonesia, and are expressed in millions of Indonesian rupiah.

To maintain comparability, the numerator and denominator are matched by provincial government, fiscal year, and aggregate expenditure category. The calculation uses year-end

cumulative expenditure realization and the revised expenditure budget for the corresponding fiscal year, rather than mixing interim realization figures with annual budget allocations.

A review of the dataset identified 19 province-year observations with absorption ratios exceeding 100%, with the highest value of 110.27% recorded for East Kalimantan in 2023. These values indicate that the reported realization exceeds the corresponding revised budget amount. However, ratios above 100% are not automatically interpreted as unauthorized expenditure or data-entry errors. Their underlying causes require verification against the original fiscal reporting records.

The observations are retained without capping the absorption ratio at 100%, preserving the values reported in the research dataset. The presence of above-100% ratios is acknowledged as a measurement consideration when interpreting the empirical results.

Two panel-data regression specifications were developed to examine the associations between regional fiscal management and human development outcomes. The first specification estimates the direct relationships of budget absorption (SA), capital expenditure structure (SB), and fiscal independence (KF) with human development (CPM), while controlling for regional population size (UD). Province fixed effects are incorporated to account for unobserved, time-invariant characteristics across provinces.

Model 1 Direct Effects

$$CPM_{it} = \beta_0 + \beta_1 SA_{it} + \beta_2 SB_{it} + \beta_3 KF_{it} + \beta_4 UD_{it} + \mu_i + \varepsilon_{it}$$

The second specification introduces an interaction term between budget absorption and fiscal independence to assess whether fiscal independence moderates the association between budget absorption and human development.

Model 2 Moderating Effects

$$CPM_{it} = \beta_0 + \beta_1 SA_{it}^c + \beta_2 SB_{it} + \beta_3 KF_{it}^c + \beta_4 UD_{it} + \beta_5 (SA_{it}^c \times KF_{it}^c) + \mu_i + \varepsilon_{it}$$

For the mean-centered moderation specification, budget absorption and fiscal independence are transformed by subtracting their respective sample means before constructing the interaction term:

$$SA_{it}^c = SA_{it} - \text{mean}(SA)$$

$$KF_{it}^c = KF_{it} - \text{mean}(KF)$$

The interaction term is subsequently calculated as the product of the two centered variables. This transformation facilitates interpretation of the main-effect coefficients without changing the estimated interaction effect when both constituent variables are included in the regression.

In these equations, *i* denotes province and *t* denotes year. The coefficients β_0 – β_5 represent the intercept and slope parameters, μ_i denotes unobserved province-specific effects, and ε_{it} represents the idiosyncratic error term.

The baseline models incorporate province fixed effects without year fixed effects. To account for common temporal influences and assess the sensitivity of the baseline estimates, additional two-way fixed-effects specifications are estimated by including year indicators. Further robustness analyses exclude Papua and Papua Barat to address provincial boundary comparability concerns and incorporate provincial economic growth (EG) as an additional time-varying control.

Standard errors are clustered at the provincial level to account for within-province dependence. All estimated coefficients are interpreted as conditional associations rather than causal effects.

Symbol	Variable
CPM	Human Development Index (HDI)
SA	Budget Absorption
SB	Capital Expenditure Share
KF	Fiscal Independence
SA x KF	Interaction between Budget Absorption and Fiscal Independence
UD	Regional Population Size
α_i	Province-specific fixed effects
β	Regression coefficients
ε_{it}	Idiosyncratic error term
i	Province index
t	Year index

Given the relatively short observation period (2022-2024), additional model specifications were estimated to assess the sensitivity of the results to common time-specific influences. In addition to province fixed effects, the robustness analysis incorporates year fixed effects to account for unobserved factors affecting all provinces within a particular year, including nationwide policy changes, macroeconomic developments, and common temporal trends.

The two-way fixed-effects specification includes province-specific intercepts and year indicators, with 2022 serving as the reference year. Standard errors are clustered at the provincial level to account for heteroskedasticity and within-province error correlation.

The analysis compares the original province fixed-effects estimates with the two-way fixed-effects estimates. Both specifications are also examined using the restricted sample of 32 provinces, excluding Papua and Papua Barat.

Because the panel contains only three annual observations per province, the analysis is primarily interpreted as evidence of short-term statistical associations. The limited time dimension constrains the assessment of delayed fiscal effects and does not permit strong causal conclusions. Accordingly, the alternative specifications are used to evaluate the stability of the estimated relationships rather than to establish causal effects.

Diagnostic tests indicated heteroskedasticity and autocorrelation. Accordingly, the FEM was estimated using robust standard errors clustered at the provincial level. This approach provides standard errors that are more robust to violations of homoskedasticity and within-panel residual correlation. Residual normality is reported only as supplementary diagnostic information and is not used as the primary criterion for determining the validity of the fixed-effects estimator.

H1, H2, and H3 were tested based on the sign of the regression coefficients and the statistical significance of SA, SB, and KF. The primary significance level was 5 percent ($\alpha = 0.05$). A positive directional hypothesis was considered supported when the coefficient was positive, consistent with the theoretical prediction, and the probability value was below 0.05.

H4 was tested using the interaction coefficient. Fiscal independence was considered to strengthen the positive relationship between budget absorption and human development outcomes when the interaction coefficient was positive and statistically significant. Results with a direction inconsistent

with the hypothesis or that did not reach the specified significance level were interpreted as not supported by the data rather than as evidence that the underlying theory was entirely invalid.

3. Results and Discussions

Overview of the Study Sample

The unit of analysis comprises Indonesian provincial governments during 2022-2024. Based on data availability and consistency across periods, the analysis includes 34 provinces observed for three years, yielding 102 province-year observations.

The dependent variable is Human Development Outcomes (CPM), proxied by the Human Development Index (HDI). The independent variables are Budget Absorption (SA), Capital Expenditure Structure (SB), and Fiscal Independence (KF). Regional Size (UD) is included as a control variable. In addition to its role as an independent variable, fiscal independence is used as a moderator of the relationship between budget absorption and human development outcomes.

Data were processed using Stata 17 and panel-data regression. Based on the model-selection results, the Fixed Effects Model (FEM) was used as the primary specification, with robust standard errors clustered at the provincial level.

Descriptive Statistics

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum	Observations
Human Development Outcomes (CPM)	74.0564	3.2998	66.03	84.15	102
Budget Absorption (SA)	95.4821	6.2553	68.9221	110.2727	102
Capital Expenditure Structure (SB)	0.1735	0.0511	0.1000	0.3731	102
Fiscal Independence (KF)	0.2276	0.1334	0.0458	0.6956	102
Regional Size (UD)	8,045.539	11,424.120	710	50,345.2	102

Source: Processed data (2026)

Human development outcomes have a mean HDI of 74.0564 and a standard deviation of 3.2998. The minimum of 66.03 and maximum of 84.15 indicate variation in human development across provinces. However, the relatively small standard deviation compared with the mean also suggests that overall HDI variation in the sample is limited.

Budget absorption has a mean of 95.4821 percent and a standard deviation of 6.2553. This indicates that provincial governments, on average, realized most of their budgeted expenditures. Absorption ranges from 68.9221 percent to 110.2727 percent, indicating heterogeneity in budget execution across provinces.

The maximum value of 110.2727 percent was recorded for East Kalimantan Province in 2023. Verification against the SIKD Data Portal of the Directorate General of Fiscal Balance confirmed that this value is consistent with official data: a Regional Expenditure budget/ceiling of IDR 55,508.77 billion and realization of IDR 61,211.04 billion, or 110.27 percent. The observation was therefore retained in the main estimation and was not treated as a data error.

Capital expenditure structure has a mean of 0.1735, or approximately 17.35 percent of total realized expenditure. The minimum of 0.1000 and maximum of 0.3731 indicate substantial variation

in the share of capital expenditure across provinces. This reflects differences in the composition of local government expenditure allocated to asset formation and medium- to long-term public investment.

Fiscal independence has a mean of 0.2276. Thus, on average, approximately 22.76 percent of total regional revenue in the sample was derived from own-source revenue (PAD). The range from 0.0458 to 0.6956 indicates substantial differences in provincial governments' ability to generate locally sourced revenue and, consequently, in their dependence on central government transfers.

Regional size, measured by population, has a mean of 8,045.539 thousand people, with a minimum of 710 thousand and a maximum of 50,345.2 thousand. The standard deviation of 11,424.120 indicates considerable variation in population size across provinces. This heterogeneity in provincial scale needs to be controlled when estimating the relationship between fiscal characteristics and human development outcomes.

Model Selection

Panel-regression model selection was conducted to determine the most appropriate specification among Pooled Ordinary Least Squares (POLS), the Fixed Effects Model (FEM), and the Random Effects Model (REM). The POLS-versus-FEM test produced $F(33,64) = 57.76$ with a p -value < 0.001 . Because the probability value is below 0.05, the null hypothesis is rejected, indicating that a model incorporating province-specific effects is more appropriate than POLS.

Table 3. Chow Test Results (POLS vs. Fixed Effects)

Description	Value
F-statistic	$F(33, 64) = 57.76$
<i>p-value</i>	0.0000
Decision	FEM is more appropriate than POLS

The choice between FEM and REM was subsequently assessed using the Hausman test.

Table 4. Panel-Data Model Selection Tests

Test	Statistic	p-value	Decision
Conventional Hausman	$\chi^2(3) = 8.27$	0.0407	Reject H_0
CRE/Mundlak (cluster-robust)	$\chi^2(4) = 13.32$	0.0098	Reject H_0

The selection between fixed-effects (FE) and random-effects (RE) estimators was evaluated using the conventional Hausman specification test and a correlated random-effects (CRE/Mundlak) specification test. Both procedures were applied to the balanced panel comprising 34 Indonesian provinces observed over the 2022-2024 period, yielding 102 province-year observations.

The conventional Hausman test compared FE and RE estimates for four time-varying regressors: budget absorption (SA), capital expenditure structure (SB), fiscal independence (KF), and regional size (UD). The test yielded $\chi^2(3) = 8.27$ ($p = 0.0407$), indicating rejection of the null hypothesis of no systematic coefficient differences at the 5% significance level.

Although four regressors were included, Stata reported that the covariance-difference matrix had a rank of three, resulting in three effective degrees of freedom. This rank deficiency warrants caution in interpreting the conventional Hausman statistic.

To address the covariance-specification concern, a CRE/Mundlak test was subsequently performed by augmenting the random-effects model with province-level means of the four time-

varying regressors. The model was estimated using province-clustered robust standard errors, consistent with the covariance specification employed in the main regression analysis.

The joint Wald test of the four province-level mean coefficients yielded $\chi^2(4) = 13.32$ ($p = 0.0098$), rejecting the null hypothesis that these coefficients are jointly zero. This finding provides evidence against the conventional random-effects exogeneity assumption and supports the use of province fixed effects for the main analysis.

Accordingly, the fixed-effects estimator was retained as the baseline specification, with standard errors clustered at the provincial level to account for heteroskedasticity and within-province dependence.

Model Diagnostic Tests

Diagnostic tests assessed multicollinearity, heteroskedasticity, and autocorrelation. The results indicate no serious multicollinearity in the model. In contrast, heteroskedasticity and autocorrelation were detected in the panel residuals.

Table 5. Summary of Model Diagnostic Tests

Test	Statistic	<i>p-value</i>	Conclusion
Shapiro-Wilk	W = 0.97733	0.0766	Residual diagnostic information
VIF	Mean VIF = 1.22 (1.04–1.40)	-	No serious multicollinearity
Heteroskedasticity	$\chi^2(34) = 3,497.99$	0.0000	Heteroskedasticity detected
Wooldridge	F(1, 33) = 41.952	0.0000	Autocorrelation detected

Model diagnostic tests were conducted to assess multicollinearity, groupwise heteroskedasticity, and serial correlation in the fixed-effects panel specification. Residual normality was not included as a primary diagnostic requirement because the consistency of fixed-effects estimation does not depend on normally distributed disturbances.

Multicollinearity was assessed using variance inflation factors (VIFs) calculated from province-demeaned explanatory variables, consistent with the within-province variation used in fixed-effects estimation. The individual VIF values ranged from 1.04 to 1.40, with a mean VIF of 1.22, indicating no serious multicollinearity among the regressors.

The modified Wald test for groupwise heteroskedasticity produced $\chi^2(34) = 3,497.99$ ($p < 0.001$), rejecting the null hypothesis of homoskedastic errors across provinces. Furthermore, the Wooldridge test for first-order serial correlation yielded $F(1,33) = 41.952$ ($p < 0.001$), indicating statistically significant within-province serial dependence.

In response to these diagnostic findings, the fixed-effects models were estimated using province-clustered robust standard errors, which allow for heteroskedasticity and within-province error correlation. Given the relatively short observation period (2022-2024), the resulting statistical inference is interpreted with appropriate caution.

Panel-Data Regression Results

Two models were estimated. Model 1 examines the direct relationships of budget absorption, capital expenditure structure, and fiscal independence with human development outcomes. Model 2 adds the interaction between budget absorption and fiscal independence to test the moderation effect.

Table 6. Fixed Effects Model Estimation Results

Variable	Model 1 (Direct Effects)	Model 2 (Moderation)
	Coef. (p-value)	Coef. (p-value)
Constant (α)	77.576 (0.000)***	79.949 (0.000)***
Budget Absorption (SA)	-0.0528 (0.000)***	-0.08283 (0.000)***
Capital Expenditure Structure (SB)	-6.613 (0.087)*	-6.258 (0.103)
Fiscal Independence (KF)	-0.924 (0.876)	-10.814 (0.148)
SA $\times$ KF	-	0.124 (0.163)
UD - Regional Size	0.0004 (0.037)**	0.0004 (0.048)**
R ² (<i>within</i>)	0.3920	0.4197
R ² (<i>between</i>)	0.1144	0.1306
R ² (<i>overall</i>)	0.1161	0.1325
F-statistic	F(4.33) = 19.39	F(5.33) = 18.97
N observations	102	102

Note: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. Values in parentheses are p-values.

Standard errors are clustered at the provincial level.

Two fixed-effects regression models were estimated to examine the relationships between fiscal management variables and human development outcomes. Model 1 assessed the direct associations of budget absorption, capital expenditure structure, and fiscal independence with human development, controlling for regional size. Model 2 additionally incorporated the interaction between budget absorption and fiscal independence to assess the proposed moderating relationship. Both models employed province fixed effects and province-clustered robust standard errors.

As reported in Table 6, budget absorption was negatively associated with human development in Model 1 ($\beta = -0.0528$, $SE = 0.0108$, $p < 0.001$) and Model 2 ($\beta = -0.0823$, $SE = 0.0189$, $p < 0.001$). Capital expenditure structure showed a negative coefficient in both models, but neither estimate reached the prespecified 5% significance threshold. The Model 1 estimate ($p = 0.087$) provides only suggestive evidence at the 10% level.

Fiscal independence was not statistically significant in either specification. Furthermore, the interaction between budget absorption and fiscal independence was positive but statistically insignificant ($\beta = 0.1244$, $SE = 0.0871$, $p = 0.163$), providing insufficient evidence of a moderating relationship. Regional size exhibited a positive and statistically significant coefficient in both models.

The within R² increased from 0.3920 in Model 1 to 0.4197 in Model 2. However, this increase should not be interpreted as evidence of a statistically significant moderation effect. All hypothesis-testing conclusions are based on the primary 5% significance threshold.

Conditional Marginal Effects of Budget Absorption

Table 7. Conditional Marginal Effects of Budget Absorption at Selected Levels of Fiscal Independence

Fiscal Independence	KF Value	Marginal Effect	Robust SE	p-value	95% CI
Low (P25)	0.1392	−0.0650	0.0095	<0.001	[−0.0837, −0.0463]
Medium (P50)	0.1993	−0.0575	0.0082	<0.001	[−0.0735, −0.0415]
High (P75)	0.2737	−0.0483	0.0106	<0.001	[−0.0690, −0.0275]

Note: Marginal effects are estimated using the province fixed-effects moderation model with province-clustered robust standard errors. The 95% confidence intervals are calculated using the delta method. Low, medium, and high fiscal independence correspond to the 25th, 50th, and 75th percentiles, respectively. Statistical significance is evaluated at the 5% level.

To further examine the proposed moderating role of fiscal independence, conditional marginal effects of budget absorption were estimated at the 25th, 50th, and 75th percentiles of fiscal independence, using the province fixed-effects moderation model with province-clustered robust standard errors.

The results indicate that the estimated marginal effect of budget absorption remained negative and statistically significant at all three selected levels of fiscal independence. At the 25th percentile (KF = 0.1392), the marginal effect was −0.0650 (95% CI [−0.0837, −0.0463], $p < 0.001$). At the median (KF = 0.1993), the estimated effect was −0.0575 (95% CI [−0.0735, −0.0415], $p < 0.001$). At the 75th percentile (KF = 0.2737), the effect was −0.0483 (95% CI [−0.0690, −0.0275], $p < 0.001$).

Although the point estimates suggest that the negative association between budget absorption and human development becomes weaker at higher levels of fiscal independence, the interaction coefficient was not statistically significant ($\beta = 0.1244$, SE = 0.0871, $p = 0.163$). Therefore, these results do not provide sufficient statistical evidence that fiscal independence significantly moderates the relationship between budget absorption and human development outcomes.

Importantly, the statistical significance of the conditional marginal effects at individual levels of fiscal independence should not be interpreted as evidence that these effects differ significantly across fiscal independence levels. Accordingly, H4 is not supported at the prespecified 5% significance level.

Robustness of Statistical Inference

To examine the sensitivity of statistical inference to the relatively small number of provincial clusters, wild cluster bootstrap-t tests were conducted using 9,999 replications, Rademacher weights, and province-level clustering.

The reported bootstrap results indicate that the statistical significance of selected coefficients is sensitive to the inference procedure. In particular, the bootstrap p-values for capital expenditure share and population size were 0.1941 and 0.2483, respectively, while the initial budget absorption test produced a p-value of 0.0107.

In the restricted-sample two-way fixed-effects specification, budget absorption remained statistically insignificant under wild cluster bootstrap inference ($p = 0.8756$).

These results suggest that statistical inference is sensitive to the model specification and resampling procedure. Bootstrap p-values should be compared only within matching specifications and estimation samples; the tests do not resolve omitted-variable bias or endogeneity.

Robustness Analysis: Model Specification and Provincial Boundary Changes

To assess the robustness of the baseline findings, three additional specifications were estimated. First, year fixed effects were incorporated into the full 34-province panel to account for common temporal influences. Second, the two-way fixed-effects model was re-estimated using a restricted sample of 32 provinces, excluding Papua and Papua Barat due to concerns regarding administrative boundary changes. Third, provincial economic growth was introduced as an additional time-varying control variable in the restricted sample. All specifications employed province-clustered robust standard errors.

The baseline province fixed-effects model revealed a negative and statistically significant association between budget absorption and human development ($\beta = -0.0528$, $p < 0.001$). However, this relationship became statistically insignificant after introducing year fixed effects in the full sample ($\beta = 0.0002$, $p = 0.954$).

The restricted-sample two-way fixed-effects model produced a similarly insignificant coefficient for budget absorption ($\beta = 0.0011$, $p = 0.790$). After controlling for provincial economic growth, the coefficient remained statistically insignificant ($\beta = 0.0022$, $p = 0.374$). Economic growth itself was also statistically insignificant ($\beta = -0.0106$, $p = 0.431$).

The within R-squared increased from 0.3920 in the baseline specification to 0.9846 in the full-sample two-way fixed-effects model, and further to 0.9865 in the extended restricted-sample model. This substantial increase indicates that common year effects account for considerable within-province variation in human development outcomes during the observation period.

Overall, the results demonstrate that the negative association between budget absorption and human development identified in the baseline model is sensitive to the inclusion of year fixed effects. The relationship remains statistically insignificant after excluding provinces affected by administrative restructuring and incorporating economic growth as an additional control.

These findings do not provide robust evidence that higher budget absorption is associated with lower human development outcomes. Nevertheless, the restricted-sample analysis does not eliminate all potential geographical comparability concerns, and the estimates should be interpreted as conditional associations rather than causal effects.

Robustness Analysis: Sensitivity to Above-100% Budget Absorption

To assess whether unusually high budget absorption observations influence the estimated relationship between budget absorption and human development outcomes, two additional sensitivity analyses were conducted using the baseline province fixed-effects specification with province-clustered robust standard errors.

First, East Kalimantan Province in 2023, which recorded the highest budget absorption rate of 110.2727 percent, was excluded from the estimation. The coefficient of budget absorption remained negative and statistically significant ($\beta = -0.0557$, $p < 0.001$), compared with the full-sample estimate ($\beta = -0.0528$, $p < 0.001$). This indicates that the negative association in the baseline model was not driven solely by this particular observation.

Second, the analysis excluded all 19 province-year observations with budget absorption rates exceeding 100 percent. The resulting sample comprised 83 observations across 34 provinces. Although the coefficient remained negative ($\beta = -0.0242$), it was no longer statistically significant

($p = 0.139$). This suggests that the statistical significance of the baseline relationship is sensitive to the inclusion of the broader group of above-100-percent absorption observations.

As an additional specification check, year fixed effects were introduced alongside province fixed effects. Under this two-way fixed-effects specification, the budget absorption coefficient was close to zero and statistically insignificant ($\beta = 0.0002$, $p = 0.954$). The results therefore indicate that the negative association observed in the baseline specification is also sensitive to the treatment of common temporal variation.

Overall, these findings suggest that the negative relationship between budget absorption and human development should be interpreted cautiously. While the result is not driven by the single highest observation, its statistical significance is not consistently maintained across alternative sample restrictions and fixed-effects specifications. Consequently, the findings should be interpreted as specification-dependent associations rather than robust evidence of a general negative relationship between budget absorption and human development.

Budget Absorption and Human Development Outcomes

The baseline province fixed-effects estimation reveals a negative and statistically significant association between budget absorption and the Human Development Index (HDI), with a coefficient of -0.0528 ($p < 0.001$). This finding contradicts the positive relationship proposed in H1; therefore, H1 is not supported. Specifically, a one-percentage-point increase in budget absorption is associated with a 0.0528-point decrease in HDI, holding other included variables constant. However, this result represents a conditional statistical association rather than evidence that increased budget absorption causally reduces human development.

Importantly, the negative association is sensitive to model specification. After incorporating year fixed effects to account for common temporal influences, the coefficient becomes positive but statistically insignificant ($\beta = 0.0002$, $p = 0.954$). Conversely, excluding Papua and Papua Barat from the baseline province fixed-effects estimation produces a negative and statistically significant coefficient ($\beta = -0.0502$, $p < 0.001$). Similarly, excluding the observation with the highest budget absorption rate yields a negative and significant coefficient ($\beta = -0.0557$, $p < 0.001$). These sensitivity analyses indicate that the baseline negative association is not driven solely by the selected provincial observations or the single highest absorption value. Nevertheless, its disappearance after controlling for year effects demonstrates that the negative relationship is not robust across alternative temporal specifications.

Conceptually, the baseline finding may be viewed as an apparent budget absorption paradox, reflecting a potential divergence between administrative budget execution performance and substantive development outcomes. Budget absorption measures the proportion of authorized expenditure that has been realized, whereas HDI captures achievements in health, education, and living standards. These indicators represent different dimensions of public-sector performance. Therefore, a higher budget absorption rate does not necessarily imply a corresponding improvement in human development. However, because the negative coefficient is not consistently maintained across model specifications, the apparent paradox should be interpreted as a conceptual tension suggested by the baseline evidence rather than an established empirical regularity.

Several theoretical mechanisms may help explain this potential divergence. From the perspective of New Public Management, public-sector performance should be assessed through efficiency, effectiveness, and development outcomes rather than expenditure realization alone (Hood, 1991). Differences in planning quality, expenditure targeting, implementation efficiency, and value for

money could potentially influence the extent to which realized budgets generate development benefits. Nevertheless, these mechanisms are not directly measured or tested in the present regression model. They should therefore be understood as plausible explanations requiring further empirical investigation rather than demonstrated causes of the observed association.

Agency Theory provides an additional conceptual interpretation. The delegation of public resource management responsibilities may create differences between administrative performance incentives and broader public welfare objectives (Jensen & Meckling, 1976). When budget execution is evaluated primarily through realization targets, government officials may face incentives to prioritize measurable administrative achievements. Such incentives could potentially weaken the alignment between budget implementation and development outcomes. However, the present study does not directly examine managerial incentives, accountability arrangements, or principal–agent conflicts. Accordingly, this interpretation remains theoretical.

Another potential explanation concerns the timing of development outcomes. Public expenditure on education, healthcare, and infrastructure may generate benefits that become observable only after a considerable period. However, the additional one-year-lagged analysis does not provide statistically significant evidence of a negative association between previous-year budget absorption and current HDI after controlling for province and year fixed effects ($\beta = -0.0036$, $p = 0.481$). The corresponding contemporaneous specification using the same estimation period is also insignificant ($\beta = -0.0019$, $p = 0.644$). These findings suggest that the negative baseline association is sensitive to temporal model specification rather than providing consistent evidence of an adverse relationship. Nevertheless, because the observation period covers only three years, longer-term and cumulative expenditure effects remain beyond the scope of the present analysis.

The findings highlight the importance of distinguishing administrative budget execution from substantive human development outcomes. In the baseline province fixed-effects specification, budget absorption exhibits a negative and statistically significant association with HDI ($\beta = -0.0528$, $p < 0.001$), contrary to the positive relationship proposed in H1. However, this negative association is not robust to the inclusion of year fixed effects and is not statistically significant in the one-year-lagged two-way fixed-effects specification. Therefore, the results should not be interpreted as evidence that higher budget absorption generally reduces human development or that budget realization is inherently an unreliable indicator of government performance. Rather, the contribution of this finding lies in demonstrating that the relationship between budget absorption and human development is sensitive to model specification and that administrative expenditure realization should be evaluated alongside, rather than independently of, substantive development indicators. Given the short observation period and the potential influence of unobserved time-varying factors, these findings should be interpreted as conditional statistical associations rather than causal effects.

Time-Lag Sensitivity Analysis

To address concerns regarding the delayed relationship between fiscal expenditure and human development, additional fixed-effects regressions were estimated using one-year-lagged fiscal variables. The lagged specification relates current Human Development Index (HDI) values to budget absorption, capital expenditure structure, and fiscal independence measured in the preceding year. Introducing one-year lags reduces the estimation sample from 102 to 68 province-year observations, covering 34 Indonesian provinces during 2023–2024.

The province fixed-effects model produces a negative and statistically significant coefficient for lagged budget absorption ($\beta = -0.0771$, $p < 0.001$). However, after incorporating year fixed effects, the coefficient decreases substantially in magnitude and becomes statistically insignificant ($\beta = -0.0036$, $p = 0.481$). The corresponding 95% confidence interval ranges from -0.0140 to 0.0067 ,

indicating that the data do not provide sufficient evidence of a negative lagged association after accounting for common year-specific influences.

To distinguish the implications of lagged specification from changes in the estimation sample, a contemporaneous two-way fixed-effects model was also estimated using the same 2023–2024 observations. This model produces a similarly insignificant coefficient for budget absorption ($\beta = -0.0019$, $p = 0.644$). Thus, neither the contemporaneous nor the one-year-lagged specification provides statistically significant evidence of an association between budget absorption and HDI once province and year fixed effects are included.

These findings suggest that the negative association observed in specifications without year fixed effects is sensitive to common temporal influences. Nevertheless, the analysis does not establish which specific macroeconomic, institutional, or policy-related factors explain this sensitivity. Furthermore, the three-year observation period limits the ability to identify longer-term or cumulative benefits of public expenditure, particularly in education, healthcare, and infrastructure.

Accordingly, the negative baseline coefficient should not be interpreted as evidence that greater budget absorption adversely affects human development. Rather, the results underscore the importance of distinguishing contemporaneous fiscal associations from potentially delayed development outcomes and of interpreting short-panel estimates cautiously. Future research using longer observation periods and more detailed expenditure indicators is needed to investigate the temporal mechanisms linking budget execution to human development.

Endogeneity Considerations and HDI Persistence

Reverse causality, unobserved time-varying provincial conditions, and the persistence of HDI may affect the estimated fiscal associations. The negative budget absorption coefficient in the baseline province fixed-effects model becomes statistically insignificant after including year fixed effects ($\beta = 0.0002$, $p = 0.954$). In the lagged-fiscal-variable two-way fixed-effects specification, lagged budget absorption is also statistically insignificant ($\beta = -0.0036$, $p = 0.481$). An exploratory specification including lagged HDI yields a positive lagged-outcome coefficient ($\beta = 0.3497$, $p = 0.052$) and an insignificant budget absorption coefficient ($\beta = -0.0011$, $p = 0.790$). However, with only three annual observations per province, fixed-effects estimation with a lagged dependent variable is susceptible to dynamic-panel bias. These checks assess sensitivity but do not resolve endogeneity or identify causal effects.

Capital Expenditure Structure and Human Development Outcomes

In Model 1, capital expenditure structure has a coefficient of -6.613 with a p-value of 0.087. The coefficient is negative, whereas H2 predicts a positive relationship. Accordingly, H2 is not supported.

The p-value of 0.087 indicates relatively weak statistical evidence at the 10 percent significance level, while the direction remains contrary to the hypothesis. The result therefore does not support for H2.

Because SB is measured as a ratio between 0 and 1, the coefficient of -6.613 means that a 0.01 increase in the capital expenditure share, or one percentage point, is associated with an approximately 0.066-point decrease in HDI, *ceteris paribus*. This interpretation is more appropriate than stating that a one-percent increase in capital expenditure reduces HDI by 6.613 points.

The negative direction does not imply that public investment inherently reduces human development. A more plausible explanation is the gestation period or time lag of capital investment.

Education and health infrastructure, roads, and other service facilities require time to be completed, become operational, and generate benefits. Because the observation period covers only 2022–2024, the long-term effects of these investments may not yet be reflected in contemporaneous HDI.

In addition, the variable measures only the proportion of capital expenditure and does not distinguish the quality or purpose of the assets created. Two provinces with the same capital expenditure share may have very different compositions: one may invest in education and health facilities, while another allocates more to administrative assets. The size of the capital expenditure share alone is therefore insufficient to ensure a development impact.

From an NPM perspective, this result reinforces the importance of public-investment quality and value for money. Policy should not merely encourage a larger capital expenditure share but should ensure that financed projects respond to community needs, are completed on time, are effectively utilized, and generate measurable development outcomes.

Fiscal Independence and Human Development Outcomes

In Model 1, fiscal independence has a coefficient of -0.924 with a p-value of 0.876, indicating no statistically significant relationship with HDI. Accordingly, H3 is not supported.

Because KF is measured as the ratio of own-source revenue to total regional revenue, the result indicates that differences in the share of revenue derived from PAD do not significantly explain changes in HDI after controlling for time-invariant provincial heterogeneity.

The finding shows that a greater ability to generate own-source revenue does not automatically produce higher human development outcomes. Fiscal independence provides greater fiscal space and flexibility, but its benefits still depend on how those resources are allocated and managed.

Under Indonesia's fiscal decentralization system, basic public services are also financed through various intergovernmental transfers. Provinces with relatively low PAD can therefore continue to finance education, health, and other basic-service needs through central government transfers. This may reduce differences in outcomes that arise directly from variation in PAD.

From an NPM perspective, the result shows that fiscal resources are not equivalent to fiscal performance. A strong ability to generate own-source revenue is insufficient without high-quality planning, expenditure efficiency, accountability, and the capacity to transform fiscal resources into development outcomes.

This finding also has an important terminological implication. Because the variable is measured as the ratio of PAD to total regional revenue, "fiscal independence" is more precise than the broader term "fiscal capacity."

The Moderating Role of Fiscal Independence

The moderating hypothesis proposes that fiscal independence may strengthen the relationship between budget absorption and human development by providing greater scope to align realized expenditure with locally relevant development priorities. Unlike the direct effect of fiscal independence, which concerns its association with the level of human development, the moderating effect concerns whether the marginal association between budget absorption and human development changes as fiscal independence varies.

In the original province fixed-effects specification, the interaction between budget absorption and fiscal independence is positive but statistically insignificant ($\beta = 0.124$; $p = 0.163$). This result does not provide sufficient evidence to support H4 under the original specification. However, the final interpretation of the moderation hypothesis must be based on the revised two-way fixed-effects model, which additionally controls for common year-specific influences.

The proposed theoretical mechanism depends on whether fiscal discretion is translated into effective expenditure targeting, public-service delivery, and accountability. Because these mechanisms are not directly measured in the present study, the interaction analysis cannot establish whether they explain differences in development outcomes. Fiscal independence should therefore be interpreted as a potential contextual condition rather than a direct measure of expenditure quality or government effectiveness.

The findings should be discussed in terms of the estimated interaction coefficient, its statistical uncertainty, and its sensitivity to model specification. A statistically insignificant interaction would indicate insufficient evidence that fiscal independence systematically changes the budget absorption–human development association; it would not demonstrate that this relationship is identical across all levels of fiscal independence.

Table 8. Summary of Hypothesis Testing Results

Hypothesis	Prediction	Empirical Result	Decision
H1: SA → CPM	Positive	$\beta = -0.0528$; $p < 0.001$	Not supported
H2: SB → CPM	Positive	$\beta = -6.613$; $p = 0.087$	Not supported
H3: KF → CPM	Positive	$\beta = -0.924$; $p = 0.876$	Not supported
H4: SA × KF → CPM	Positive	$\beta = 0.124$; $p = 0.163$	Not supported

Overall, none of the hypotheses is supported as predicted. This does not diminish the relevance of the findings. Instead, the empirical results indicate that the mechanisms linking budget execution, expenditure structure, fiscal independence, and human development are more complex than the assumption that increases in fiscal inputs or realization automatically improve outcomes.

Implications of the Findings

The findings offer policy-relevant considerations for performance-based budgeting, although their implications should be interpreted cautiously given the associational nature of the analysis and the possibility of endogeneity. The negative association between budget absorption and HDI observed in the baseline province fixed-effects model is not consistently maintained across alternative specifications, particularly after controlling for year fixed effects. Consequently, the results do not establish that higher budget absorption adversely affects human development or that changes in budget evaluation practices would necessarily improve development outcomes. Nevertheless, the findings reinforce the conceptual argument that budget absorption should not be treated as a stand-alone indicator of successful regional fiscal management. As a complementary evaluation approach, local governments may consider assessing budget realization alongside program outputs, service-delivery indicators, expenditure quality, and measurable development outcomes. Such an approach is consistent with the principles of performance-based budgeting and New Public Management, but its effectiveness in improving human development requires further empirical evaluation.

Second, the capital expenditure findings indicate that increasing the share of public investment should be accompanied by evaluation of project quality, asset utilization, and alignment with human development priorities. Policy attention should shift from the amount of capital expenditure alone toward the productivity of the public assets created.

Third, the insignificant direct and moderating effects of fiscal independence indicate that increasing PAD alone is insufficient. Strengthening fiscal independence needs to proceed alongside

improvements in planning capacity, expenditure-management quality, accountability, and outcome orientation.

Conceptually, the findings reinforce the distinction among budget execution, fiscal resources, and development outcomes. High budget realization and strong fiscal independence are important conditions in local public financial management, but neither can be treated as a direct substitute for development achievement.

From a theoretical perspective, the findings provide a qualified contribution to the application of Agency Theory and New Public Management in local public financial management. The negative association between budget absorption and HDI observed in the baseline specification, together with its sensitivity to year fixed effects, highlights the importance of distinguishing administrative budget execution from substantive development outcomes. This distinction is consistent with Agency Theory's concern regarding potential differences between agents' performance incentives and principals' interests, although the present study does not directly measure agency conflicts or information asymmetry (Jensen & Meckling, 1976).

4. Conclusions

This study examined the relationships between budget absorption, capital expenditure structure, fiscal independence, and human development outcomes across 34 Indonesian provinces during 2022–2024, using panel-data fixed-effects regression.

The baseline province fixed-effects model identified a negative and statistically significant association between budget absorption and the Human Development Index (HDI) ($\beta = -0.0528$, $p < 0.001$), contrary to the positive relationship proposed in H1. However, this association became statistically insignificant after incorporating year fixed effects. Additional one-year-lagged analysis also failed to identify a statistically significant association after controlling for province and year effects. These findings indicate that the negative baseline relationship is sensitive to model specification and should not be interpreted as evidence of a causal effect.

Capital expenditure structure exhibited a negative coefficient that was not statistically significant at the 5% level ($p = 0.087$), while fiscal independence showed no statistically significant direct association with HDI ($p = 0.876$). Furthermore, the interaction between budget absorption and fiscal independence was statistically insignificant ($p = 0.163$), providing insufficient evidence of a moderating effect. Accordingly, none of the four hypotheses received empirical support in the predicted direction.

Overall, the findings highlight the importance of distinguishing administrative budget execution from substantive development outcomes. Budget absorption should therefore be considered alongside broader performance indicators rather than treated as a stand-alone measure of development success. Given the sensitivity of the estimates to alternative specifications and the short observation period, the findings should be interpreted as conditional associations rather than causal relationships.

5. Limitations

Several limitations should be considered when interpreting the findings. First, the observation period covers only three years (2022–2024), limiting the ability to assess longer-term and cumulative relationships between public expenditure and human development. Although a one-year-lagged specification was estimated as a sensitivity analysis, the resulting two-year estimation period provides limited information about longer-term fiscal dynamics.

Second, the estimated relationship between budget absorption and HDI is sensitive to model specification. While the baseline province fixed-effects model produces a negative and statistically significant coefficient, the association becomes statistically insignificant after incorporating year fixed effects. The findings therefore do not establish a consistently negative relationship across alternative specifications.

Third, Potential endogeneity remains an important limitation of this study. Reverse causality, unobserved time-varying factors, and persistence in HDI may affect the estimated relationships. Although province and year fixed effects and supplementary lagged-variable specifications were examined, these approaches do not fully resolve endogeneity concerns. Moreover, the relatively small cross-sectional dimension ($N = 34$) and very short time dimension ($T = 3$) limit the suitability of dynamic-panel estimators, particularly those relying on internal instruments. The exploratory fixed-effects specification incorporating lagged HDI is also susceptible to dynamic-panel bias and is therefore not interpreted as a consistent dynamic estimate. Consequently, the findings should be understood as conditional statistical associations rather than causal effects.

Fourth, HDI is used as the principal indicator of human development. Although it captures important dimensions of health, education, and living standards, it does not fully represent the quality, accessibility, or efficiency of individual public services. Furthermore, capital expenditure is measured as an aggregate share without distinguishing the purposes or developmental characteristics of specific investments.

Fifth, the analysis does not directly measure planning quality, expenditure targeting, implementation efficiency, accountability, or value for money. Consequently, these factors can only be discussed as possible explanatory mechanisms rather than empirically verified determinants of the observed relationships. In addition, changes in provincial administrative boundaries during the study period may affect geographical comparability, particularly in the Papua region, despite the supplementary restricted-sample analysis.

6. Suggestions

Based on the findings and methodological limitations, several suggestions are proposed for future research and public financial management evaluation. First, regional government budget performance may be assessed using complementary indicators of expenditure realization, program outputs, service delivery, and development outcomes. Such an approach could provide a more comprehensive assessment of fiscal performance, although its effectiveness in improving human development requires further empirical evaluation.

Third, future research should prioritize extending the panel's time dimension to provide a more appropriate basis for examining potential endogeneity, dynamic relationships, and persistence in human development outcomes. Given the relatively small number of cross-sectional units ($N = 34$) and the very short observation period ($T = 3$), the present dataset is not well suited to reliable dynamic-panel estimation using System GMM. With a sufficiently extended panel and an appropriate identification strategy, future studies may consider dynamic-panel estimators after carefully evaluating their assumptions and suitability for the available data. If a GMM-based estimator is employed, researchers should explicitly report the instrument count, instrument validity, serial-correlation diagnostics, and overidentification tests, including relevant Hansen or Sargan statistics and Arellano–Bond serial-correlation tests. Particular attention should be given to instrument proliferation and the reliability of specification tests. Such procedures would help assess model adequacy but would not, by themselves, establish causal identification.

Fourth, future studies are encouraged to employ more detailed expenditure classifications and multidimensional development indicators. Distinguishing expenditure on education, healthcare, infrastructure, and administrative assets may provide additional insights into sector-specific fiscal relationships. Complementary indicators of service accessibility, educational attainment, healthcare outcomes, and infrastructure quality could further enrich the assessment of public expenditure performance.

Finally, future research should directly examine institutional and managerial factors, including planning quality, expenditure targeting, accountability, procurement effectiveness, implementation efficiency, and value for money. These factors may represent potential mechanisms linking budget execution to development outcomes, but their explanatory roles require direct empirical testing.

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