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Mining Dependency, Public Expenditure, and Regional Economic Structural Transformation in Central Sulawesi Province

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Abstract

This study analyzes the effect of dependence on the mining sector and regional public spending on the process of economic structural transformation at the district/city level using panel data from 13 districts/cities in Central Sulawesi Province during the period 2013–2023. The analysis was conducted using a two-way Fixed Effects model with cluster-robust standard errors to control for differences in regional characteristics and intertemporal changes. The results show that dependence on the mining sector has a negative and significant effect on non-mining economic performance per capita ($\beta = -3.35$; $p < 0.01$). This finding indicates the existence of structural pressures arising from the dominance of the extractive sector at the regional level. Population size, as a proxy for economic agglomeration, has a positive and significant effect ($\beta = 1.91$; $p < 0.01$), reflecting the role of economies of scale in strengthening non-mining activities. The public expenditure variable shows an economically relevant coefficient direction. The interaction model shows that capital expenditure has the potential to mitigate the negative impact of mining dependence, but the effect is marginal ($p < 0.10$). The results of this study confirm that regions that depend on the mining sector tend to face obstacles in strengthening their non-mining economic base. A reorientation of public expenditure that is more productive and focused on developing the non-extractive sector is needed to support the regional structural transformation process.

Keywords: Mining Dependency; Non-mining GRDP; Public Spending; Structural Transformation

Abstrak

Penelitian ini menganalisis pengaruh ketergantungan pada sektor tambang dan belanja publik daerah terhadap proses transformasi struktural ekonomi di tingkat kabupaten/kota dengan menggunakan data panel 13 kabupaten/kota di Provinsi Sulawesi Tengah selama periode 2013–2023. Analisis dilakukan menggunakan model Fixed Effects dua-arah dengan cluster-robust standard errors untuk mengontrol perbedaan karakteristik wilayah dan perubahan antarwaktu. Hasil penelitian menunjukkan bahwa ketergantungan pada sektor tambang berpengaruh negatif dan signifikan terhadap kinerja ekonomi non-tambang per kapita ($\beta = -3{,}35$; $p < 0{,}01$). Temuan ini mengindikasikan adanya tekanan struktural

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yang muncul akibat dominasi sektor ekstraktif pada level daerah. Jumlah penduduk sebagai proksi aglomerasi ekonomi berpengaruh positif dan signifikan (β = 1,91; p < 0,01), yang mencerminkan peran skala ekonomi dalam memperkuat aktivitas non-tambang. Variabel belanja publik menunjukkan arah koefisien yang relevan secara ekonomi. Model interaksi menunjukkan bahwa belanja modal berpotensi memitigasi dampak negatif ketergantungan tambang, namun efeknya bersifat marginal (p < 0,10). Hasil penelitian menegaskan bahwa daerah yang bergantung pada sektor tambang cenderung menghadapi hambatan dalam penguatan basis ekonomi non-tambang. Reorientasi belanja publik yang lebih produktif dan berfokus pada pengembangan sektor non-ekstraktif diperlukan untuk mendukung proses transformasi struktural daerah.
Kata Kunci: Belanja Publik; Ketergantungan tambang; PDRB Non-Tambang; Transformasi Struktural

INTRODUCTION

Over the past decade, several regions in Indonesia have experienced increased dependence on the extractive sector, particularly mining. Nationally, the mining and quarrying sector still plays a significant role in the Indonesian economy. Official data from the Central Statistics Agency shows that this sector contributed around 10.5 percent to the national GDP in 2023, after previously increasing during a period of high commodity prices (BPS, 2014). In addition, according to a report by the Extractive Industries Transparency Initiative (EITI), the extractive industry makes an important contribution not only to economic output, but also to state revenue and national exports, with the extractive sector contributing more than 36% to national exports in recent years ((EITI), 2023). Although this contribution demonstrates the strategic role of the mining sector, the dynamics of international commodity prices and the volatility of extractive sector output indicate that economic dependence on this sector has the potential to create structural risks for long-term development.

The literature on resource dependence and the resource curse confirms that regions rich in natural resources often experience less sustainable growth compared to regions poor in natural resources (Auty, 2007; Sachs & Warner, 2001). This phenomenon suggests that extractive wealth can act as a barrier to long-term economic development due to dependence on volatile commodities and poor governance (Mehlum et al., 2006). The dominance of the mining sector hinders structural transformation, primarily through the Dutch Disease mechanism, in which a surge in revenue from the mining sector triggers an appreciation of the real exchange rate or a rise in the prices of local inputs, which in turn erodes the competitiveness of non-extractive tradable sectors such as agriculture and manufacturing (Yusuf et al., 2021). In addition, a crowding-out effect occurs, whereby capital and skilled labor are disproportionately absorbed by the mining sector due to higher wage premiums, leaving the non-mining sector with weak production capacity and stagnant innovation (Hilmawan & Clark, 2021; Martawardaya & Hanafi, 2020). This has led to structural transformation—which should have been a process of expanding a more productive and sustainable non-extractive economic base—occurring unevenly and being hindered in regions with high levels of mining activity (Kim et al., 2022; Skott, 2021).

On the other hand, local governments have important fiscal instruments in the form of public spending, both capital and non-capital expenditures. Capital expenditure has the potential to strengthen regional economic capacity through the provision of productive infrastructure and support for non-mining economic activities, while non-capital expenditure plays a role in improving public services and the quality of human resources (Bisai et al., 2021; Sasongko & Wibowo, 2022). However, the effectiveness of public spending in converting mining rents

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into the strengthening of the non-extractive sector remains an empirical question, particularly at the district/city level in Indonesia (Hidayat et al., 2024). This is particularly relevant for regions such as Central Sulawesi Province, which in recent years has seen a rapid increase in nickel and mineral mining activities, yet simultaneously faces the challenge of strengthening its non-mining economic base. According to Anisa Trinata et al. (2024), the Central Sulawesi Provincial Government has issued 113 mining permits (IUP OP) for nickel ore, with no fewer than 45 of these permits located in Morowali Regency. This is due to proven reserves totaling 9.68 million tons and total nickel ore resources amounting to 32.29 million tons. The Gross Regional Domestic Product (GRDP) data for districts and cities, published annually by the Central Statistics Agency (BPS), is used as a tool for regional development planning and highlights the importance of sectoral structure in understanding regional economic dynamics (BPS, 2024).

Most studies on mining dependency in Indonesia still focus on the national or provincial level and use aggregate growth indicators without separating the contributions of the mining and non-mining sectors (Hilmawan & Clark, 2021; Ridena et al., 2021). Similarly, studies on regional public spending generally analyze the relationship between capital expenditure and economic growth in aggregate terms, without positioning it as a policy channel that has the potential to mitigate the impact of mining sector dependence on non-mining economic performance (Bisai et al., 2021). Thus, there is still a research gap regarding how mining dependence and public spending policies interact in influencing the process of regional economic structural transformation at the district/city level.

This study aims to fill this gap by analyzing the relationship between dependence on the mining sector, regional public spending, and economic structural transformation in 13 districts/cities in Central Sulawesi Province during the period 2013–2023. Specifically, this study: (1) examines the effect of the mining sector share on non-mining GRDP per capita as a proxy for structural transformation; (2) assesses the role of capital expenditure, non-capital expenditure, and human development indicators in explaining the dynamics of non-mining sector performance; and (3) analyzes whether capital expenditure functions as a moderating mechanism for the impact of mining dependence on regional economic growth. The empirical approach used is a two-way Fixed Effects panel model with clustered robust standard errors at the district/city level, in line with the empirical approach in sub-national resource dependence studies in Indonesia.

METHODOLOGY

Research Framework and Hypothesis

The literature on resource dependence explains that the dominance of natural resource-based sectors can produce economic dynamics that are not always in line with long-term development. Dependence on the mining sector has the potential to trigger the Dutch disease phenomenon, whereby the expansion of the extractive sector encourages the reallocation of resources to rent-oriented sectors, thereby weakening the productivity of non-extractive sectors (Hilmawan & Clark, 2021; Ridena et al., 2021). At the sub-national level, dependence on commodity-based revenues is often correlated with stagnant performance in the non-mining sector and limited regional economic diversification.

The line of reasoning for this study is presented in Figure 1, which also explains the research hypotheses, including:

1. Hypothesis 1 (H1) that dependence on the mining sector (mining share) has a negative effect on non-mining GRDP per capita in the region.

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2. Hypothesis 2 (H2) that capital expenditure per capita has a positive effect on non-mining GRDP per capita.
3. Hypothesis 3 (H3) states that non-capital expenditure per capita has a positive effect on non-mining GRDP per capita, although with a relatively weaker intensity of influence than capital expenditure.
4. Hypothesis 4 (H4) states that capital expenditure acts as a moderating mechanism that weakens the negative influence of mining dependence.

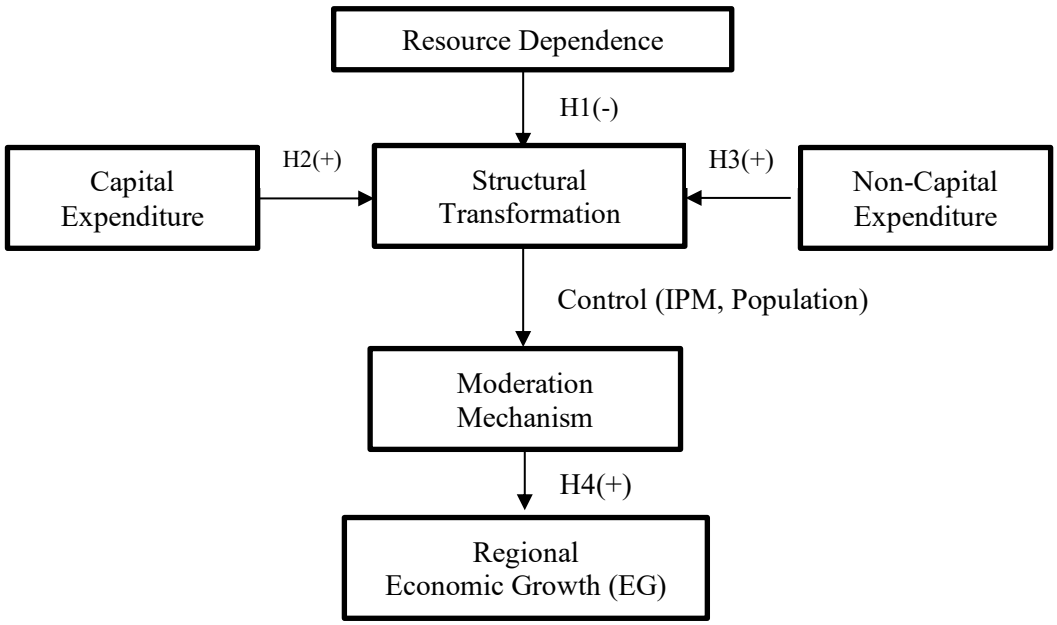

Figure 1. Research Framework

Analysis Unit and Observation Period

The unit of analysis in this study is 13 districts/cities in Central Sulawesi Province that have different economic structures, particularly in terms of the dominance of mining activities and the dynamics of the non-mining sector. The observation period used covers 2013–2023, forming a balanced panel at the regional level. The selection of this period is based on two methodological reasons. First, this period represents a phase of accelerated expansion of the mineral mining sector, particularly nickel, in Central Sulawesi, which is empirically relevant for examining the relationship between mining dependence and non-extractive economic dynamics. Second, the availability of official statistical data at the regency/city level is relatively consistent and comparable over time, thereby increasing the validity of the panel analysis. The use of the district/city level of analysis is considered appropriate because fiscal decision-making, public expenditure allocation, and the dynamics of the regional economic sectoral structure take place at this level of government.

Data Source

This study uses secondary data sourced entirely from official government statistical publications to ensure methodological consistency, traceability of figures, and validity of comparisons between regions and over time. The main data on Gross Regional Domestic Product (GRDP) by business field at the district/city level was obtained from the Central Statistics Agency (BPS) and used to construct variables for the mining and non-mining sectors as a reflection of the regional economic

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structure, which formed the basis for the structural transformation analysis (BPS, 2024). Regional public expenditure data, which includes capital expenditure and non-capital expenditure, was obtained from the Directorate General of Fiscal Balance (DJPK) and local government financial reports, as these variables represent the orientation of fiscal policy in the utilization of natural resource rents and are commonly used in regional public finance studies. In addition, population data and the Human Development Index (HDI) from BPS were used as proxies for economic scale/agglomeration and human development quality, respectively, which have the potential to affect production capacity and non-extractive economic performance.

Definition of Variable

The variables used in this study are classified into dependent variables, primary independent variables, fiscal policy variables, control variables, and interaction terms. The following table provides the operational definitions and their respective roles in the models.

Table 1.
Research Variables and Operational Definitions

No.	Variable Symbol	Operational Definition	Unit/Scale	Role in Model
1.	$ln\_PDRBNT\_pc_{it}$	Dependent Variable: Natural logarithm of non-mining GRDP per capita.	Natural Log (IDR)	Dependent variable in Equation (1). Proxy for structural transformation.
2.	EG_{it}	Dependent Variable: Economic growth of the non-mining sector.	Percentage/Index	Dependent variable in Equation (2) to test growth dynamics.
3.	$Share\_Mining_{it}$	Main Independent Variable: The share of mining sector GRDP to total GRDP.	Percentage (%)	Primary explanatory variable to test the Dutch Disease effect.
4.	$ln\_BM\_Pc_{it}$	Fiscal Variable: Natural logarithm of capital expenditure per capita.	Natural Log (IDR)	Productive fiscal instrument and a component of the interaction term.
5.	$ln\_BMN\_Pc_{it}$	Fiscal Variable: Natural logarithm of non-capital expenditure per capita.	Natural Log (IDR)	Operational fiscal instrument focused on public services.
6.	IPM_{it}	Control Variable: Human Development Index (HDI).	Index (0-100)	Controls for human capital quality.
7.	ln_Pop_{it}	Control Variable: Natural logarithm of total population.	Natural Log (People)	Proxy for market size and agglomeration economies.
8.	$(Share\_Mining \times ln\_BM\_Pc)_{it}$	Interaction Term	Product of variables	Tests Hypothesis 4 regarding the mitigating role of capital expenditure.

Source: Author 2025

Econometric Model Specifications

This study uses a panel data regression model with a Fixed Effects (FE) approach. This model was chosen based on the argument that it can control for inter-regional heterogeneity that does not change over time (Wooldridge, 2025). Given the variation in fiscal capacity among districts/cities in Central Sulawesi, this study also applies Robust Standard Error to address potential problems of heteroscedasticity and inter-section dependence (Hoechle, 2007). This approach is consistent with empirical frameworks evaluating the effectiveness of regional public

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expenditure in driving structural transformation and non-mining economic performance within resource-dependent economies (Irandoust, 2019).

This approach was taken due to the relatively short length of the district-level panel data in Central Sulawesi (short panel) and the existence of structural differences between districts/cities that are difficult to observe directly, such as geographical proximity to mining concessions, the diversity of non-mining economic bases, and regional institutional capacities. The main empirical model in this study is formulated as follows.

$$Y_{\{it\}} = \alpha_i + \lambda_t + \beta X_{\{it\}} + \gamma Z_{\{it\}} + \varepsilon_{\{it\}}$$

In the context of this study, as illustrated by the empirical model referenced above, $Y_{\{it\}}$ denotes the dependent variable representing the regional economic indicators for district i in year t. The terms α_i and λ_t represent the fixed effects for districts and years, respectively, which account for unobserved time-invariant characteristics and common macroeconomic shocks. $X_{\{it\}}$ is a vector of primary independent variables, including mining dependency and regional fiscal instruments, while $Z_{\{it\}}$ serves as a vector of control variables comprising human development and demographic indicators. Finally, $\varepsilon_{\{it\}}$ signifies the idiosyncratic error term capturing the unobserved factors affecting the dependent variable.

The structural transformation model was used to test the determinants of non-mining economic performance, proxied by the logarithm of non-mining GRDP per capita, with the following specifications:

$$ln\_PDRBNT\_pc_{it} = \alpha_i + \lambda_t + \beta_1 Share\_Mining_{it} + \beta_2 ln\_BM\_Pc_{it} + \beta_3 ln\_BMN\_Pc_{it} + \gamma_1 IPM_{it} + \gamma_2 ln\_Pop_{it} + \varepsilon_{\{it\}}$$

The moderation model is designed to test whether capital expenditure acts as a policy mechanism that moderates the impact of mining dependence on regional economic growth, with the following specifications:

$$EG_{it} = \alpha_i + \lambda_t + \beta_1 Share\_Mining_{it} + \beta_2 ln\_BM\_Pc_{it} + \beta_3 ln\_BMN\_Pc_{it} + \beta_4 (Share\_Mining \times ln\_BM\_Pc)_{it} + \gamma_1 IPM_{it} + \gamma_2 ln\_Pop_{it} + \varepsilon_{\{it\}}$$

The interaction parameter β_4 interpreted as the degree of moderation of capital expenditure in regions with higher mining dependence (Hilmawan & Clark, 2021; Skott, 2021).

Both models were estimated using the FE approach based on the theoretical assumption that regional characteristics are correlated with the explanatory variables. To ensure the statistical validity of this choice, the study follows a sequential model selection procedure. First, a Chow Test is conducted to determine the superiority of the FE model over the Pooled OLS (Common Effects) estimator. Second, the Hausman Test is employed to verify the consistency of the FE model against the Random Effects (RE) approach. This rigorous verification process follows common empirical practices in sub-national resource dependence studies (Hidayat et al., 2024).

DISCUSSION AND FINDINGS

Model Selection Justification

Prior to the main analysis, a series of specification tests were conducted to ensure the validity of the estimates. The Chow Test was first performed to determine the suitability of the Fixed Effects (FE) model over the Pooled OLS (Common Effects) model. Subsequently, the Hausman Test results (p-value < 0.05) confirmed the superiority of the FE model over the Random Effects (RE) approach, indicating that time-invariant unobserved regional

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characteristics are correlated with the independent variables. To account for potential shared shocks and ensure a more robust estimation, the model was estimated using a Two-Way Fixed Effects framework to control for both regional heterogeneity and time-specific shocks. Furthermore, the estimation employs Cluster-Robust Standard Errors (at the district/city group level), which effectively handles potential heteroscedasticity and serial correlation, ensuring that the reported significance levels are valid and unbiased (Hoechle, 2007). The results of these model selection tests are summarized in Table 2.

Table 2.
Panel Data Model Selection Tests

Test Type	Model 1: Structural Transformation	Model 2: Moderation Model	Result / Decision
Chow Test (F-stat)	28.416 (p<0.001)	2.4928 (p=0.0009)	Reject Pooled OLS (Use FE)
Hausman Test (χ2)	16.792 (p=0.0049)	3.9888 (p=0.6782)*	FE is preferred / more consistent

*Note: For Model 2, the Fixed Effects specification is maintained to ensure consistency across models and to account for the unobserved structural characteristics of the 13 districts/cities in Central Sulawesi, which represent the entire regional population.

Source: Secondary data processed using Rstudio

Structural Transformation Model Estimation

The results of the two-way Fixed Effects Model estimation show that the Share_Mining variable has a negative and significant effect on non-mining economic performance per capita. The mining share coefficient of −3.355 with a significance level of 1 percent indicates that increased dependence on the mining sector is associated with a decline in non-extractive economic capacity. Substantively, these findings are consistent with the arguments of resource dependence and Dutch disease, whereby the expansion of the extractive sector tends to drive resource reallocation, weaken the production base of the non-mining sector, and limit the process of regional economic diversification (Hilmawan & Clark, 2021; Ridena et al., 2021). The model estimation results are presented in Table 3, while the statistical summary is presented in Table 4.

Table 3.
Structural Transformation Model Estimation Results

Variable	Coefficient	Std. Error	t-value	p-value
Share_Mining	-3.3554	0.9960	-3.3688	0.0010 **
ln_BM_Pc	-0.0243	0.0677	-0.3594	0.7200
ln_BMN_Pc	0.2864	0.1577	1.8168	0.0719
IPM	0.0849	0.0928	0.9140	0.3627
ln_Pop	1.9146	0.5879	3.2566	0.0015 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Secondary data processed using Rstudio

Table 4.
Statistical Summary

Statistics Model	Value
Fixed Effects	Districts/cities + Year
R-squared (within)	**0.646**
N (observation)	143
N (districts/cities)	**13**
Estimator	FE Two-Way + Cluster-Robust (group)

Source: Secondary data processed using Rstudio

These findings also reinforce empirical evidence that commodity-based growth does not

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always translate into long-term economic strengthening, especially when dependence on mining is not balanced by capacity building in alternative sectors (Hidayat et al., 2024). Thus, these results support Hypothesis 1 (H1) that mining dependence has a negative impact on the performance of the non-extractive sector.

Meanwhile, the variable of capital expenditure per capita (ln_BM_Pc) does not show a statistically significant effect on non-mining GRDP per capita. This indicates that regional capital expenditure has not directly resulted in the strengthening of the non-mining economy, or that the impact of capital expenditure is delayed and more structural in the long term. This condition is in line with the findings of previous studies which show that the effectiveness of capital expenditure is greatly influenced by project orientation, implementation quality, and the ability of the region to link public investment with productive economic activities (Bisai et al., 2021; Skott, 2021). Thus, Hypothesis 2 (H2) is not fully confirmed in the basic estimation results.

The per capita non-capital expenditure variable (ln_BMN_Pc) shows a positive coefficient with significance at the 10 percent level (p-value ≈ 0.07). Although its influence is relatively moderate, this result indicates that non-capital expenditures such as public services, apparatus, and administrative financing can contribute indirectly to strengthening the non-mining sector, particularly through improved service functions and regional institutional stability (Haryati, 2025; Sasongko & Wibowo, 2022). Thus, Hypothesis 3 (H3) receives partial empirical support.

Furthermore, the population variable (ln_Pop) has a positive and significant effect at the 1 percent level, indicating that regions with larger economies and greater agglomeration potential tend to have stronger non-mining sector performance. This finding is in line with the economic agglomeration literature, which emphasizes the role of population scale, market networks, and the local economic activity base in the expansion of non-extractive activities. Conversely, the HDI variable is not statistically significant, indicating that improvements in human quality have not been directly converted into strengthened non-mining economic capacity within the analysis time horizon.

Moderation Model Estimation: The Role of Capital Expenditure in Mining-Rich Regions

The results of this model estimate show that the interaction variable between Share_Mining and capital expenditure per capita has a positive and significant effect at the 10 percent level. The interaction coefficient of 36.95 indicates that capital expenditure plays a moderating role in regions with higher mining dependence. Substantively, this finding means that the effect of mining dependence on economic growth becomes more positive in regions that allocate relatively larger capital expenditures. The model estimation results are presented in Table 5, while the statistical summary is presented in Table 6.

Table 5.
Results of Capital Expenditure Moderation Model Estimates

Variable	Coefficient	Std. Error	t-value	p-value
Share_Mining	-506.3151•	270.1196	-1.8744	0.0635
ln_BM_Pc	1.1420	4.3537	0.2623	0.7936
ln_BMN_Pc	-0.7815	1.7618	-0.4436	0.6582
Share_Mining × ln_BM_Pc	36.9466•	20.4599	1.8058	0.0736
IPM	1.9647	3.1830	0.6172	0.5383
ln_Pop	-12.2745	12.0080	-1.0222	0.3089

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Source: Secondary data processed using RStudio

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Table 6.
Statistics Summary Capital Expenditure Moderation Model

Statistics Model	Value
Fixed Effects	Districts/cities + Year
R-squared (within)	**0.040**
N (observation)	143
N (districts/cities)	**13**
Estimator	FE Two-Way + Cluster-Robust (group)

Source: Secondary data processed using RStudio

As presented in Table 6, the Within R-squared for the moderation model is 0.040. While this value appears relatively low, it is consistent with regional economic panel studies utilizing the Fixed Effects (FE) estimator. In a FE framework, the within R-squared only measures the variation within each district over time, after purging the substantial variation between districts (which is captured by the fixed effects themselves). Therefore, the primary focus of this analysis is not the model's total predictive power, but rather the statistical significance and direction of the coefficients—particularly the interaction term—as evidence of the policy mechanism's existence.

These findings provide empirical support for the argument that capital expenditure can serve as a mechanism for converting mining rents into productive economic capacity, for example through basic infrastructure, economic connectivity, and public facilities that support non-extractive sector activities (Hilmawan & Clark, 2021; Skott, 2021). Thus, these results provide evidence for Hypothesis 4 (H4) that capital expenditure acts as a policy channel that mitigates the risk of mining dependency.

However, the main coefficient of Share_Mining in Model 3 remains negative and is at the statistical significance threshold. This confirms that mining dependence structurally still has the potential to pose a risk to sustainable growth, and that capital expenditure can only reduce, not eliminate, this negative impact. In other words, without the support of an effective capital expenditure design, mining expansion does not automatically result in the strengthening of the regional economic base.

The per capita capital expenditure variable (ln_BM_Pc) as a direct effect is insignificant, indicating that the role of capital expenditure is stronger through its interaction with the mining economic structure than as a single determinant of growth. This is consistent with the view that new public investment only generates economic impact when linked to the sectoral structure and production base capacity of the region, rather than solely through increased fiscal spending (Bisai et al., 2021).

Meanwhile, non-capital expenditure (ln_BMN_Pc) does not show a significant effect in Model 3, which means that the effect of administrative and public service expenditure on economic growth is relatively limited in the short term. The HDI variable is also insignificant, indicating that the accumulation of human capital has not been directly converted into annual growth dynamics, although its role may be more important in the long term. The ln_Pop variable is negative and insignificant, which may indicate limitations in the agglomeration capacity of some mining-based regions.

Discussion of Findings Synthesis and Policy Implications

Empirical results from both models show that dependence on the mining sector is negatively associated with non-mining economic performance, while capital expenditure acts as a moderating mechanism that can reduce some of these negative effects. Conceptually, these combined findings confirm that the resource dependence mechanism does not work solely

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through aggregate growth channels, but through the structure of resource allocation and regional development incentives. In other words, mining sector expansion generates rent-based growth that does not automatically translate into strengthening of the non-extractive sector, unless there is fiscal policy intervention capable of directing rent extraction into productive investment (Hilmawan & Clark, 2021; Skott, 2021).

The findings of Model 2 indicate that non-mining GRDP per capita weakens in regions with a higher share of mining, reflecting a constrained process of economic diversification. This condition typically manifests through three primary mechanisms: (i) the reallocation of labor and capital toward the rent-oriented extractive sector, often referred to as the 'crowding out' effect (Hilmawan & Clark, 2021; Sachs & Warner, 2001); (ii) weak backward–forward linkages between the mining enclaves and local economic sectors, which limits the multiplier effect (Yusuf et al., 2021); and (iii) limited regional institutional capacity to effectively convert commodity-based revenues into productive, long-term investments (Mehlum et al., 2006; Ridena et al., 2021). Consequently, the non-mining economic base fails to develop endogenously in mining-rich regions, as the 'enclave' nature of the extractive industry creates a disconnect from the broader regional economy (Humphrey et al., 2007).

On the other hand, the results of Model 3 show that capital expenditure increases the ability of regions to utilize mining activities as a catalyst for growth, but this effect is conditional. This means that capital expenditure is effective when directed towards economic infrastructure, connectivity, supply chain support, and public facilities that are relevant to the local economic activity base. This is consistent with the literature which states that the role of fiscal policy in extractive economies is not in the amount of expenditure, but in the quality of allocation and the suitability of public investment functions to the regional economic structure (Bisai et al., 2021; Hidayat et al., 2024).

In addition, the results of the study also confirm that mine-based development strategies require explicit structural transformation policies, not only through infrastructure projects, but also through strengthening non-mining economic capacity, improving the quality of human resources, and strengthening regional fiscal governance. Thus, the policy implications that can be drawn include:

1. There is a need to reposition capital expenditure as an instrument for converting mining rents into long-term productive economic assets, rather than merely financing physical projects that are unrelated to the capacity of the non-extractive sector.
2. While the national downstreaming strategy aims to increase value-added, the results of this study suggest that without intentional regional fiscal intervention, downstreaming may remain an 'enclave' with minimal impact on the broader non-mining economy. Regional spending should be prioritized toward logistics, industrial support services, and MSME integration within the mining value chain to ensure that value-added stays within the region.
3. Fiscal planning in mining-rich regions needs to be based on a structural risk mitigation framework, including economic diversification, strengthening fiscal institutional capacity, and controlling dependence on commodity-based revenues.
4. In the long term, regional economic transition strategies based on mining must be designed gradually, through a combination of fiscal policies, alternative sector development, and strengthening human capital as the foundation for structural transformation.

Overall, the results of this study reinforce the view that resource-based regional development requires a more nuanced and economically structured policy design, rather than simply expanding extractive activities. By synchronizing the four-pillar strategy—repositioning capital expenditure, localizing the downstreaming (hilirisasi) process, mitigating fiscal risks, and facilitating a gradual labor transition—mineral-rich regions have a strategic opportunity to break the 'enclave' cycle. Placing capital expenditure as a primary policy lever allows these

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regions to bridge the gap between extractive wealth and the non-mining sector, ultimately reducing the risks of resource dependence and fostering a more resilient and sustainable structural transformation process.

CONCLUSION

This study analyzes the relationship between mining sector dependence, regional public spending, and economic structural transformation in 13 districts/cities in Central Sulawesi Province during the period 2013–2023 using a two-way Fixed Effects panel model. Two main findings were obtained from the estimation results.

First, the Structural Transformation Model results show that dependence on the mining sector has a negative and significant effect on non-mining GRDP per capita. This finding indicates that the expansion of mining activities does not automatically contribute to strengthening non-extractive economic capacity and may even potentially hinder the process of regional economic diversification. Thus, commodity-based growth in resource-rich regions tends to result in structurally fragile economic performance if it is not balanced with policies to strengthen alternative sectors.

Second, the results of the Moderation Model show that capital expenditure does not have a direct effect on economic growth but plays a significant moderating role when interacting with the level of mining dependency. This means that capital expenditure can function as a policy mechanism that converts mining rents into productive economic capacity, especially when directed towards economic infrastructure and connectivity that is relevant to the local economic activity base. In other words, the effectiveness of fiscal policy in mining-rich regions is conditional on the design and orientation of capital expenditure allocation.

Overall, the results of this study confirm that structural transformation in mining-based regions does not occur automatically but requires targeted fiscal policy intervention based on the regional economic structure. Mining dependence without a rent conversion strategy has the potential to reinforce the risk of resource dependence, while strategically designed capital expenditure can be a policy lever to strengthen the non-extractive sector and increase regional economic resilience.

This study recommends that regional governments in Central Sulawesi shift their fiscal orientation from traditional infrastructure spending toward 'strategic-integrative' capital expenditure. Policy interventions should prioritize the development of logistics networks and processing hubs that specifically link mining industrial zones, such as those in Morowali, with the agricultural and MSME supply chains in surrounding districts. Furthermore, local authorities should establish a robust institutional framework for a sub-national wealth fund or regional resilience fund to manage mining revenue volatility and reinvest it into human capital and non-extractive technology. By synchronizing the national downstreaming (hilirisasi) agenda with regional fiscal capacity-building, Central Sulawesi can transform its current extractive windfall into a sustainable foundation for long-term structural transformation

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