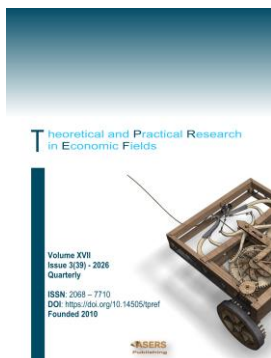


Foreign Direct Investment in Mining Industry and Fiscal Revenue Mobilization: Evidence from a Resource Abundant Country of the Democratic Republic of Congo



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Abstract: Foreign direct investment (FDI) in extractive industries is a major source of capital inflows for resource-rich developing economies; however, whether these investments translate into sustainable fiscal revenues remains contested. This study investigated the fiscal effects of mining FDI in the Democratic Republic of Congo (DRC) and examined the institutional and macroeconomic conditions shaping government revenue mobilization. A mixed-methods design was employed, combining documentary time-series econometric analysis, survey-based logistic regression, and qualitative institutional interpretation. Annual macroeconomic data for 1990–2023 were analyzed using an Autoregressive Distributed Lag (ARDL) model, complemented by logistic regression based on 545 stakeholder responses and qualitative evidence from 14 key informants. The ARDL results confirmed a stable long-run relationship between mining FDI and fiscal revenue (Bounds $F = 4.41$; ECM = -1.403 , $p < 0.01$), with excellent explanatory power ($R^2 = 0.986$). However, mining FDI exhibited a negative and only marginally significant long-run effect on fiscal revenue ($\beta = -0.850$, $p = 0.080$), indicating that investment inflows alone do not guarantee higher public revenues. By contrast, governance quality significantly enhanced fiscal revenue ($\beta = 0.392$, $p = 0.006$), whereas inflation exerted a significant adverse effect ($\beta = -0.00014$, $p = 0.013$). Survey findings corroborated these results, showing that base erosion risk (OR = 3.923, $p < 0.001$) and generous fiscal incentives (OR = 0.416, $p < 0.001$) substantially shaped perceived fiscal outcomes. The findings demonstrate that the fiscal benefits of mining FDI depend primarily on governance quality, institutional capacity, and fiscal regime design rather than investment volume alone. Strengthening fiscal governance and regulatory oversight is therefore essential for transforming mineral wealth into sustainable public revenue in resource-rich economies.

Keywords: foreign direct investment; mining fiscal revenue; resource governance; institutional quality; extractive industries; fiscal capacity.

JEL Classification: F21; H20; H25; O13; Q32.

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Introduction

Foreign direct investment (FDI) in extractive industries has become one of the most important sources of capital inflows for resource-rich developing economies. In particular, the mining sector plays a critical role in attracting foreign capital, facilitating technology transfer, and expanding export revenues (UNCTAD 2023).

In this context, the Democratic Republic of Congo (DRC) has emerged as a strategically important mining economy, as it holds some of the world's largest reserves of cobalt, copper, and coltan; minerals that are essential for global energy transition technologies and digital industries (IEA 2023). Consequently, foreign mining investment has expanded substantially over the past two decades, positioning the DRC as a key supplier within global mineral value chains. However, despite this rapid expansion of investment and production, an important policy question has persisted: to what extent have these mining investments translated into sustainable fiscal revenues for the state?

From a macroeconomic perspective, the fiscal implications of mining investment have become particularly significant for resource-dependent economies. Revenues derived from extractive industries; such as royalties, corporate income taxes, and production-based levies; often represent a substantial share of government income in mineral-rich countries.

When effectively mobilized, these revenues can finance public infrastructure, social services, and long-term development strategies (World Bank 2020). However, the resource economics literature increasingly emphasizes that the presence of abundant mineral resources and large inflows of foreign investment does not automatically translate into higher public revenues. Instead, fiscal outcomes depend critically on institutional quality, taxation regimes, and governance structures that determine the extent to which governments are able to capture resource rents (Bebbington *et al.* 2018).

In many developing economies, fiscal revenues from the mining sector remain significantly below their potential levels due to structural constraints such as tax incentives granted to investors, administrative weaknesses in tax collection, and aggressive tax planning by multinational corporations (IMF 2012). Despite the expanding body of research on natural resources and economic development, significant gaps remain in understanding the fiscal channels through which foreign mining investment translates into government revenue mobilization (Amedanou and Laporte 2024).

Much of the existing literature has focused predominantly on the relationship between natural resources and economic growth, while comparatively less attention has been given to how foreign investment in extractive industries shapes fiscal capacity in resource-rich economies (Coulibaly and Camara 2022). Furthermore, a large share of empirical studies relies on aggregate macroeconomic indicators, often overlooking critical institutional factors such as tax compliance, fiscal regime design, and administrative capacity that ultimately determine revenue outcomes (Bertinelli *et al.* 2022). These limitations are particularly pronounced in the Democratic Republic of Congo, a key global mining economy, where empirical evidence on the fiscal effects of foreign mining investment remains limited and fragmented (Asongu and Mosunga 2026).

Consequently, this study contributes to the literature by examining whether foreign mining investments translate into measurable fiscal gains for the Congolese government while simultaneously assessing the institutional conditions that shape this relationship (IMF 2021).

Against this background, this study addresses the following research question: Do foreign mining investments translate into measurable fiscal gains for the government of the Democratic Republic of Congo? More specifically, the study examined how foreign direct investment in the mining sector interacts with governance quality, macroeconomic conditions, and fiscal policy frameworks to influence mining revenue mobilization.

The underlying hypothesis is that although foreign investment may expand production and economic activity, the resulting fiscal benefits depend critically on institutional capacity and the design of fiscal regimes.

By combining documentary econometric analysis with survey-based evidence and qualitative institutional interpretation, this research provides a comprehensive assessment of the mechanisms through which mining investment influences fiscal outcomes in resource-rich economies. In doing so, the study contributes to the literature on resource governance by highlighting the conditional relationship between foreign investment and fiscal capacity (Ross, 2015).

The remainder of the article is organized as follows: First, the relevant theoretical and empirical literature is reviewed; Next, the methodological framework, data sources, and variables are presented; The empirical findings are then reported and discussed in light of the institutional and macroeconomic context of the Congolese mining sector; Finally, the article concludes by summarizing the main findings and outlining their policy implications.

1. Literature Review

1.1. Empirical Literature Review and Research Gap

1.1.1. Mining FDI, Resource Rents, and Fiscal Mobilization

Research on extractive-sector development is commonly situated within the resource-curse and institutional-governance traditions. The resource-curse perspective argues that mineral abundance may weaken economic and institutional performance when rent dependence encourages volatility, rent seeking, and limited economic diversification (van der Ploeg 2011). By contrast, the institutional perspective does not consider mineral wealth intrinsically detrimental; instead, it maintains that fiscal outcomes depend on the rules governing ownership, taxation, disclosure, enforcement, and revenue allocation. Thus, mining foreign direct investment (FDI) can enlarge production and the potential tax base, but it does not necessarily generate proportionate public revenue.

This distinction is particularly important in African mineral economies. Thus, Hatcher and Grégoire (2022) show that extractive-industry governance encompasses not only fiscal-regime design but also contractual negotiation, tax administration, state participation, and revenue management. Their framework is valuable because it moves the debate beyond the simple opposition between attracting investment and increasing taxation. Nevertheless, its broad institutional focus provides limited empirical evidence on the magnitude and timing of the revenue effects generated by foreign mining investment. Consequently, the direction of causality between FDI, institutional reform, and fiscal performance remains insufficiently established.

1.1.2. Transparency, Regulation, and Revenue Capture

A second strand of research emphasizes transparency and regulatory accountability. Then, Li *et al.* (2025) find that the Extractive Industries Transparency Initiative has improved disclosure across participating countries; however, disclosure has not produced an equivalent reduction in corruption. This finding challenges the assumption that transparency automatically strengthens fiscal governance. Disclosure may reveal payments and contracts, but revenue mobilization additionally requires auditing capacity, legal enforcement, and effective sanctions.

The Democratic Republic of Congo (DRC) literature reaches a comparable conclusion. In fact, Michel and Kime (2022) observe that the revised mining framework increased the formal obligations of mining companies toward local development. However, they also identify coordination and implementation difficulties that limit the translation of statutory commitments into effective development outcomes. Likewise, Rapanyane and Shai (2020) argue that foreign mining corporations, particularly Chinese enterprises, operate within unequal bargaining relationships that may constrain domestic value capture. Although their analysis highlights power asymmetries, its largely qualitative approach does not establish whether foreign investment causes measurable changes in aggregate fiscal revenue.

More recently, Mboringong *et al.* (2025) advocate anticipatory governance for critical-mineral investment in the western Congo Basin. Their contribution is significant because it links investment decisions to long-term social and environmental risks. Nevertheless, the emphasis on responsible investment gives comparatively little attention to taxation and revenue performance. Mosunga (2025), meanwhile, demonstrates that trade openness and trade-policy instruments affect fiscal policy in the DRC. Yet mining FDI is not isolated from other external-sector variables, leaving its specific contribution to government revenue unresolved.

1.1.3. Contradictions and Research Positioning

The literature therefore presents two competing interpretations. One view treats mining FDI as a mechanism for expanding exports, production, and taxable activity. The opposing view emphasizes profit shifting, bargaining asymmetries, weak enforcement, and regulatory fragmentation, which may disconnect investment growth from fiscal mobilization. Existing studies provide strong institutional explanations but rarely test this relationship directly over time.

Accordingly, the principal gap is not the absence of research on Congolese mining, but the limited integration of investment, fiscal, macroeconomic, and governance evidence. This study extends the literature by estimating the long-run and short-run relationship between mining FDI and fiscal revenue while examining the institutional mechanisms that condition that relationship. It therefore tests rather than assumes that increased foreign mining investment strengthens domestic revenue mobilization.

1.2. Theoretical Framework and Model Development

The relationship between foreign direct investment (FDI) in the mining sector and fiscal revenue is fundamentally mediated by the state's capacity to transform mineral rents into public resources. This study develops an integrated theoretical framework that combines the Political Resource Curse theory, optimal taxation of exhaustible resources,

and revenue mobilization theory to explain how foreign mining investment influences fiscal capacity in the Democratic Republic of Congo (DRC). Rather than assuming that mining investment automatically increases government revenue, the framework argues that fiscal outcomes depend on the interaction between investment, institutional quality, taxation, and revenue leakages.

The Political Resource Curse theory provides the conceptual foundation of the model. Unlike the traditional resource curse hypothesis, which associates natural-resource abundance with poor economic performance, the political resource curse emphasizes that fiscal outcomes depend on institutional quality and governance. In fact, resource-rich countries frequently experience weak tax administration, rent-seeking behaviour, corruption, and limited fiscal accountability, reducing the proportion of mineral rents effectively captured by the state (Karl 1997; Ross 2001; Mehlum, Moene, and Torvik 2006; van der Ploeg 2011). Consequently, foreign mining investment expands the potential fiscal base only when public institutions possess sufficient capacity to administer taxation, monitor production, and enforce mining legislation.

Following this perspective, mining production depends on foreign capital, institutional quality, and the available mineral stock. Let the stock of exhaustible resources evolve according to

$$\dot{S}(t) = -q(t), \quad S(0) = S_0 > 0 \quad (1)$$

where $S(t)$ denotes the remaining mineral stock and $q(t)$ represents extraction.

Mining output is expressed as

$$Q(t) = A(t) K(t)^\alpha S(t)^{1-\alpha}, \quad 0 < \alpha < 1 \quad (2)$$

where $K(t)$ denotes foreign mining capital and $A(t)$ represents institutional quality. Institutional quality enters multiplicatively because stronger governance enhances productivity, regulatory effectiveness, and compliance with fiscal obligations.

Mining rents are generated from production after deducting production costs,

$$\Pi(t) = p(t)Q(t) - cK(t) - \frac{\gamma}{2}q(t)^2 \quad (3)$$

where $p(t)$ denotes international mineral prices, c represents capital costs, and the quadratic extraction cost reflects increasing marginal extraction costs over time.

However, governments rarely capture the full value of mining rents. Administrative weaknesses, transfer pricing, tax avoidance, trade misinvoicing, contractual exemptions, and illicit financial flows reduce the effective fiscal contribution of mining investment. Rather than modelling these mechanisms separately, they are represented by a single institutional leakage parameter,

$$\varphi(t) = \varphi_0 - \varphi_1 A(t), \quad \varphi_1 > 0 \quad (4)$$

where stronger institutional quality reduces leakage intensity. Effective government revenue is therefore defined as

$$G(t) = \tau(t) [1 - \varphi(t)] \Pi(t) \quad (5)$$

where $\tau(t)$ denotes the effective fiscal take from mining activities.

This formulation implies that fiscal revenue depends not only on the size of mining rents but also on the institutional capacity to retain those rents within the public sector. Consequently, improvements in governance increase fiscal revenue both directly, through more efficient tax administration, and indirectly, by reducing revenue leakages associated with weak institutions.

This representation is consistent with contemporary evidence showing that governance quality significantly influences fiscal capture in extractive industries (Badeeb *et al.* 2017; Li *et al.* 2024).

The framework further recognizes that fiscal capacity extends beyond revenues generated directly by the mining sector. Resource-dependent economies often experience a fiscal substitution effect in which governments relying heavily on mineral revenues invest less effort in developing non-resource taxation (Moore 2004; Addison and Roe 2024). Total fiscal capacity is therefore represented as

$$T(t) = G(t) + R^{non}(t) \quad (6)$$

Where non-resource revenue is defined as

$$R^{non}(t) = e(t) Y(t), \text{ with } e(t) = \bar{e} - \delta G(t), \quad \delta > 0 \quad (7)$$

Where $e(t)$ denotes domestic tax effort, $Y(t)$ represents the non-resource tax base, and δ measures the extent to which dependence on mining revenue crowds out domestic revenue mobilization.

Substituting yields

$$T(t) = G(t) [1 - \delta Y(t)] + \bar{e} Y(t) \quad (8)$$

This formulation shows that expanding mining revenue does not necessarily maximize total fiscal capacity if greater dependence on extractive revenues weakens conventional taxation.

Combining the production, institutional, and fiscal components produce the central theoretical proposition of the study.

Differentiating total fiscal capacity with respect to foreign mining capital gives

$$\frac{dT}{dK} = (1 - \delta Y) \left[(1 - \phi) \frac{\partial \Pi}{\partial K} - \Pi \frac{\partial \phi}{\partial K} \right] \quad (9)$$

Foreign mining investment enhances fiscal capacity when

$$(1 - \delta Y) \left[(1 - \phi) \frac{\partial \Pi}{\partial K} - \Pi \frac{\partial \phi}{\partial K} \right] > 0 \quad (10)$$

This condition indicates that fiscal gains from mining FDI arise only when the productivity effects generated by additional investment exceed the fiscal losses associated with institutional leakages and the weakening of domestic tax effort.

Institutional quality therefore becomes the principal transmission mechanism through which mining investment affects fiscal performance. Strong governance reduces leakages, improves tax compliance, strengthens revenue administration, and increases the proportion of mining rents transferred to the public budget. Conversely, weak governance diminishes the fiscal returns to foreign investment even when production expands substantially.

The integrated framework provides the theoretical justification for the empirical specification adopted in this study. Mining fiscal revenue is expected to depend on four complementary mechanisms: (i) foreign mining investment, which expands the taxable production base; (ii) institutional quality, which determines the efficiency of fiscal capture; (iii) macroeconomic and international commodity-price conditions, which influence mining profitability and taxable income; and (iv) political and governance conditions, which shape the implementation of fiscal policy. These mechanisms directly motivate the explanatory variables included in the autoregressive distributed lag (ARDL) model and the complementary institutional analyses.

Furthermore, the theoretical framework suggests that foreign mining investment affects fiscal revenue through institutional and macroeconomic transmission mechanisms rather than through capital inflows alone.

Mining investment increases the potential tax base by expanding production and resource rents, but the realized fiscal effect depends on governance quality, fiscal administration, and the state's ability to limit revenue leakages. Consequently, the relationship between mining FDI and fiscal revenue is expected to be positive where institutional quality supports effective fiscal capture.

Accordingly, the study tests the following hypothesis:

H1: Foreign direct investment in the mining sector exerts a positive long-run effect on fiscal revenue mobilization in the Democratic Republic of Congo.

Because the theoretical model identifies institutional quality as the principal mechanism governing fiscal capture, the study further expects governance to reinforce the fiscal contribution of mining investment.

H2: Higher institutional quality strengthens the positive relationship between mining foreign direct investment and fiscal revenue mobilization.

2. Research Methodology

2.1. Research Design

This study adopted a mixed-method research design combining documentary time-series econometric analysis, a stakeholder survey, and qualitative institutional interpretation. The design was appropriate because the fiscal effects of foreign direct investment in mining involve both measurable macroeconomic relationships and institutional mechanisms that cannot be adequately captured through aggregate data alone. Mixed-method research is particularly suitable where quantitative evidence is required to establish empirical patterns and qualitative evidence is needed to explain the processes underlying those patterns (Creswell and Plano Clark 2018).

The documentary component estimated the short-run and long-run relationships between mining foreign direct investment, fiscal revenue, governance quality, and selected macroeconomic and sectoral variables in the Democratic Republic of Congo; while the survey component examined the institutional and fiscal conditions

associated with stakeholders' assessments of the revenue effects of mining FDI. Finally, qualitative evidence from key institutional actors was used to interpret the roles of fiscal incentives, administrative capacity, regulatory enforcement, inter-agency coordination, and tax-base erosion.

The three components were integrated at the interpretation stage. The time-series model identified aggregate temporal relationships, the survey model examined institutional correlates, and the qualitative analysis provided contextual explanations for convergence or divergence between the quantitative findings.

2.2. Data Sources and Variable Measurement

The documentary analysis used annual data covering 1990-2023, yielding a maximum of 34 observations. This period captures major changes in the Congolese mining sector, including post-conflict reconstruction, the expansion of foreign investment in copper and cobalt production, and reforms to the mining and fiscal frameworks.

Mining fiscal revenue, mining-sector activity, investment flows, and fiscal information were obtained from the Central Bank of Congo, the Ministry of Finance, the Ministry of Mines, and the Extractive Industries Transparency Initiative in the DRC. Macroeconomic indicators and international copper and cobalt prices; were drawn from the Central Bank of Congo, while institutional quality was measured using the Ibrahim Index of African Governance. Due to the fact that the governance index did not cover the entire study period, starting published in 2000 year; the earliest available observation was used as the baseline for preceding years. This procedure produced a continuous series but reduced observed variation during the earlier part of the sample and is therefore recognized as a measurement limitation. However, this is unlikely to affect the estimation results, as the quality of governance institutions is assumed to have remained relatively stable during the years preceding the first available observation.

The dependent variable was mining fiscal revenue, and the principal explanatory variable was foreign direct investment in the mining sector. Moreover, the control variables captured governance quality, inflation, mining activity, gross domestic product, international copper and cobalt prices, political stability, and political regime. Fiscal revenue, mining FDI, Gross Domestic Product (GDP), and international mineral prices were expressed in natural logarithms to reduce scale dispersion and facilitate elasticity interpretation where both dependent and explanatory variables were logged (Wooldridge 2020).

Table 1. Definition, Measurement, Transformation, and Role of Variables Used in the Empirical Analysis

Variable	Measurement	Transformation	Role
(LNFISCREV)	Government fiscal revenue	Natural logarithm	Dependent variable
(LNFDIMIN)	Foreign direct investment in the mining sector	Natural logarithm	Main explanatory variable
(GOVINDEX)	Ibrahim governance index	Level	Institutional control
(INFLARATE)	Annual inflation rate	Level	Macroeconomic control
(ITEAMIN)	Indicator of mining-sector economic activity	Level	Sectoral control
(LNGDP)	Gross domestic product	Natural logarithm	Macroeconomic control
(LNCULME)	International copper price	Natural logarithm	External-price control
(LNCBLME)	International cobalt price	Natural logarithm	External-price control
(POLSTAB)	Political-stability indicator	Level	Political control
(POLITREGIM)	Political-regime indicator	Level	Political control
(EXCHRATE)	CDF/US dollar exchange rate	Level	Preliminary specification only

Source: Author's compilation based on data from the Ministry of Finance of the Democratic Republic of the Congo, Banque Centrale du Congo, Mo Ibrahim Foundation.

The econometric estimation was conducted in Stata (16) and EViews (9), survey analysis in SPSS (28), and qualitative data organization in MAXQDA.

2.3. Documentary Econometric Strategy

2.3.1. Baseline Specification

The documentary analysis proceeded through descriptive statistics, correlation analysis, stationarity testing, preliminary ordinary least-squares estimation, multicollinearity assessment, ARDL estimation, bounds testing, and error-correction modelling.

The general empirical relationship was specified as:

$$\ln FISCREV_t = \alpha_0 + \alpha_1 \ln FDIMIN_t + \alpha_2 GOVINDEX_t + \alpha_3 INFLARATE_t + \alpha_4 ITEAMIN_t + \alpha_5 \ln COBLME_t + \alpha_6 \ln CULME_t + \alpha_7 \ln GDP_t + \alpha_8 POLSTAB_t + \alpha_9 POLITREGIM_t + \varepsilon_t.$$

Mining FDI was expected to expand the potential fiscal base, although its realized effect was assumed to depend on institutional and macroeconomic conditions. Also; Governance quality was expected to improve revenue capture, whereas inflation was expected to weaken fiscal performance. At last Mining activity, Gross Domestic Product (GDP), and commodity prices were included to control for production, economic activity, and international market conditions.

Ordinary least squares was used only as a preliminary benchmark. It provided initial information on coefficient direction and multicollinearity but was not treated as the principal estimator because a static model cannot adequately represent dynamic adjustment and long-run equilibrium relationships in annual macroeconomic data.

2.3.2. Stationarity and Model Selection

The integration properties of the variables were examined using the Augmented Dickey-Fuller test. The null hypothesis was that series contained a unit root, and lag lengths were selected using the Schwarz information criterion.

The tests classified inflation, Gross Domestic Product (GDP), and political stability as $I(0)$; while Mining fiscal revenue, mining FDI, governance quality, mining activity, copper price, cobalt price, and political regime were classified as $I(1)$. The exchange rate became stationary only after third differencing and was therefore excluded from the ARDL model. This exclusion was necessary because the ARDL bounds-testing procedure is valid only when the variables entering the model are integrated of order zero or one; but also, does not have significant effect to the dependent variable in this study.

The mixture of $I(0)$ and $I(1)$ variables justified the use of the autoregressive distributed lag framework developed by Pesaran, Shin, and Smith (2001). The approach is suitable for estimating both short-run dynamics and long-run relationships in relatively small samples, provided that none of the included variables is $I(2)$ or higher.

2.3.3. ARDL and Bounds-Testing Specification

Given the potential dynamic interactions between foreign mining investment, governance quality and fiscal revenue mobilisation, this study adopts the Autoregressive Distributed Lag (ARDL) modelling framework. Unlike a static regression model, the ARDL approach incorporates lagged values of both the dependent and explanatory variables, allowing the estimation of short-run dynamics together with long-run equilibrium relationships. This dynamic specification reduces contemporaneous simultaneity concerns by explicitly accounting for delayed responses among the variables and therefore provides a more appropriate framework for analysing the relationship between mining FDI, governance quality and fiscal revenue in the Democratic Republic of Congo.

The unrestricted error-correction representation was specified as:

$$\Delta \ln FISCREV_t = \beta_0 + \sum_{i=1}^{p-1} \beta_i \Delta \ln FISCREV_{t-i} + \sum_{j=1}^k \sum_{i=0}^{qj-1} \gamma_{ji} \Delta X_{j,t-i} + \lambda_1 \ln FISCREV_{t-1} + \sum_{j=1}^k \lambda_{j+1} X_{j,t-1} + u_t$$

where X_t denotes the vector of explanatory variables. The differenced terms capture short-run effects, whereas the lagged-level terms represent the long-run relationship.

The Akaike information criterion selected an ARDL (1,2,2,2,1,2,1,2,2,2) specification. Because the inclusion of distributed lags reduced the effective estimation sample, the final ARDL model was estimated using 32 observations drawn from the 1990–2023 dataset.

The existence of a long-run relationship was examined through the bounds test. The null hypothesis of no cointegration was:

$$H_0 : \lambda_1 = \lambda_2 = \dots = \lambda_{k+1} = 0.$$

Cointegration was established when the calculated F-statistic exceeded the relevant upper critical bound. Where cointegration was confirmed, the corresponding error-correction model was estimated as:

$$\Delta \ln FISCREV_t = \theta_0 + \sum_{i=1}^{p-1} \Delta \ln FISCREV_{t-i} + \sum_{j=1}^k \sum_{i=0}^{qj-1} \delta_{ji} \Delta X_{j,t-i} + \rho ECM_{t-1} + v_t$$

The coefficient ρ measures the speed and pattern of adjustment toward long-run equilibrium. A negative and statistically significant coefficient indicates that deviations from equilibrium are corrected over time.

2.3.4. Model Assessment

Model adequacy was assessed using overall significance, explanatory power, multicollinearity analysis, residual diagnostics, and parameter-stability analysis, while the Variance-inflation factors were used during the preliminary specification stage. Moreover, Parameter stability was examined using the cumulative sum of recursive residuals.

Also, the CUSUM statistic remained within the 5 percent critical boundaries, supporting stability of the estimated coefficients over the sample period.

Furthermore, Goodness-of-fit statistics were interpreted as measures of explanatory performance rather than as independent evidence of robustness. The ARDL estimates were therefore evaluated jointly with the cointegration test, residual behaviour, coefficient stability, and economic plausibility.

Because mining investment and fiscal capacity may influence one another, the estimated coefficients were interpreted as conditional short-run and long-run relationships rather than as experimental causal effects.

2.4. Survey-Based Econometric Analysis

The survey component comprised 545 responses from stakeholders involved in mining taxation, regulation, investment, administration, and governance. Respondents included tax-administration officials, mining-company representatives, regulatory institutions, and other public-sector actors with direct knowledge of the fiscal operation of the mining sector.

The questionnaire measured six institutional dimensions: institutional capacity, enforcement intensity, compliance behaviour, the economic contribution of FDI, base-erosion risk, and fiscal-policy generosity; and the responses were aggregated into corresponding composite indices.

The dependent variable distinguished between respondents who assessed the fiscal impact of mining FDI as positive and those who did not:

$$Y_i = \begin{cases} 1, & \text{positive impact on tax revenue,} \\ 0, & \text{otherwise} \end{cases}$$

Because the outcome was dichotomous, binary logistic regression was employed (Hosmer, Lemeshow, and Sturdivant 2013). The model was specified as:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 IC_i + \beta_2 EI_i + \beta_3 CB_i + \beta_4 FEC_i + \beta_5 BER_i + \beta_6 FPG_i$$

where IC denotes institutional capacity, EI enforcement intensity, CB compliance behaviour, FEC the economic contribution of FDI, BER base-erosion risk, and FPG fiscal-policy generosity.

The model was estimated by maximum likelihood; while the results were reported as coefficients, standard errors, Wald statistics, probability values, and odds ratios. An odds ratio greater than one (1) indicates higher odds of reporting a positive fiscal effect, whereas an odds ratio below one indicates lower odds, holding other variables constant.

Overall model significance was assessed through the likelihood-ratio chi-square statistic; and the calibration was evaluated using the Hosmer–Lemeshow test, while Cox–Snell and Nagelkerke pseudo- R^2 statistics summarized explanatory performance.

A leave-one-variable-out sensitivity analysis was used to examine the stability of the principal coefficients across alternative specifications. The survey model captured institutional perceptions and associations; it did not measure aggregate fiscal revenue. It was therefore interpreted as complementary to the documentary time-series analysis.

2.5. Qualitative Institutional Analysis

The qualitative component drew on evidence from 14 key informants with direct knowledge of mining investment, taxation, fiscal administration, regulation, and extractive-sector governance. Participants represented central and provincial public institutions, tax and customs administrations, mining companies, EITI-related bodies, civil society, investment-promotion institutions, economic and legal expertise, and the banking sector.

The analysis focused on the institutional mechanisms connecting mining FDI to fiscal revenue. Particular attention was given to fiscal incentives, contractual clauses, tax compliance, transfer-pricing practices, customs fraud, revenue leakages, regulatory enforcement, administrative capacity, and inter-agency coordination.

MAXQDA was used to organize the qualitative material and identify recurrent themes. The evidence was grouped into seven analytical dimensions: the FDI-revenue relationship, fiscal transmission mechanisms, governance quality, fiscal regimes and contracts, tax-base erosion, institutional enforcement capacity, and the gap

between formal rules and implementation. The qualitative component did not constitute a separate causal test. Its purpose was to explain and contextualize the mechanisms underlying the econometric and survey findings.

The three components were integrated through a convergent analytical framework. The documentary model assessed whether mining FDI was associated with fiscal revenue over time. The logistic model examined the institutional and policy conditions associated with stakeholders' assessments of that relationship. The qualitative evidence explained how fiscal incentives, governance weaknesses, administrative fragmentation, and base-erosion practices affected the conversion of investment into public revenue.

This integration distinguished investment expansion from effective fiscal capture and provided a coherent basis for evaluating both the magnitude and the institutional conditions of the FDI–revenue relationship.

3. Research Results

3.1. Empirical Results Based on Documentary Data

3.1.1. Descriptive Statistics

Table 2 presents the descriptive statistics of the study variables, summarizing their central tendency, dispersion, and range across 34 observations, thereby providing an overview of the dataset's characteristics.

Table 2. Descriptive Statistics of the Study Variables

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
LNFISCREV	34	21,03839	0,7118404	19,63262	22,67456
LNFDIMin	34	20,46539	0,5865276	19,18692	21,71492
GovINDEX	34	40,38125	1,603447	36,80000	43,30000
TAXROY	34	0,0226471	0,0058043	0,020000	0,035000
POLITREGIM	34	0,5294118	0,5066404	0,000000	1,000000
POLSTAB	34	0,5588235	0,5039947	0,000000	1,000000
LNCuLME	34	8,239342	0,6827624	7,16804	9,137694
LNCobLME	34	2,925821	0,37626	1,916923	3,663562
EXCHRATE	34	741,928	767,8022	0,000002	2821,641
ITEAMin	34	85,30529	52,00546	30,0000	221,9600
INFLARATE	34	1163,047	4609,94	-1,420882	26765,86
LNGDP	34	26,38125	7,892516	3,108629	32,77099

Source: Author's calculations using Stata 16.

Across 34 observations, fiscal revenue and foreign direct investment show stability with moderate variability. The Governance indicators remain steady, reflecting institutional consistency. Conversely, exchange rate and inflation exhibit marked volatility, highlighting macroeconomic instability. Overall, the statistics reveal balanced dispersion and provide a foundation for subsequent empirical analysis.

3.1.2. Correlation Matrix for Fiscal Revenue, Governance, and Macroeconomic Variables

Table 3 presents the pairwise correlation matrix among fiscal revenue, foreign direct investment, governance indicators, and macroeconomic variables.

Table 3. Pairwise Correlation Matrix of the Study Variables

VARIABLES	LNFISC-V	LNFDIMin	GovINDEX	TAXROY	POLITR-M	POLSTAB	LNCuLME	LNCobLME	EXCHRATE	ITEAMin	INFLAR-E	LNGDP
LNFISCREV	1											
LNFDIMin	0,1847	1										
GovINDEX	0,4956	0,5278	1									
TAXROY	0,6287	0,493	0,7381	1								
POLITREGIM	0,579	0,0622	0	0,4364	1							
POLSTAB	-0,3103	0,1082	-0,2112	-0,0548	0,1117	1						
LNCuLME	0,5702	0,0341	0,0288	0,464	0,9412	0,1134	1					
LNCobLME	0,0793	0,1173	0,0973	0,1884	0,1149	0,1054	0,1393	1				
EXCHRATE	0,792	0,3076	0,4927	0,8089	0,7797	-0,0942	0,7877	0,0845	1			
ITEAMin	0,6286	0,305	0,3152	0,6777	0,659	-0,0014	0,6552	0,068	0,8492	1		
INFLARATE	-0,4207	-0,2527	0	-0,117	-0,2682	0,1734	-0,2324	0,0849	-0,2472	-0,2256	1	
LNGDP	0,6289	-0,1892	0,0651	0,3521	0,6661	-0,2503	0,7529	-0,0301	0,642	0,3851	-0,301	1

Source: Author's calculations using Stata 16.

The correlation matrix shows fiscal revenue positively linked to tax royalties, exchange rate, trade, GDP, and governance indicators, while inflation and political stability correlate negatively. These associations highlight

key interdependencies without severe multicollinearity, reinforcing the robustness of subsequent empirical analysis on fiscal performance and institutional dynamics.

3.1.3. Stationarity and Unit Root Tests of the Variables

The stationarity properties of the variables have been examined using the Augmented Dickey–Fuller (ADF) unit root test. The results summarized in Table 3, have provided the basis for selecting the appropriate econometric methodology.

The Augmented Dickey–Fuller (ADF) test shows mixed integration orders. The variables Inflation Rate, Gross Domestic Product, and Political Stability are stationary at levels $I(0)$; while the Fiscal Revenue, Foreign Direct Investment in Mining, Governance Index, International Trade in Extractive Activities, Cobalt Price (London Metal Exchange), Copper Price (London Metal Exchange), and Political Regime are stationary after first differencing $I(1)$; and the Exchange Rate requires third differencing. This mix rules out Johansen cointegration, making the Autoregressive Distributed Lag (ARDL) model suitable for robust short- and long-run estimation.

Table 4. Unit Root Tests (Augmented Dickey–Fuller)

Variable	Test Equation	Lag Length	ADF Statistic	p-value	Integration Order
LN FISC_REV	Δ LN FISC_REV	0	-6.6449***	0	$I(1)$
LN FDI_MIN	Δ LN FDI_MIN	5	-4.5561***	0,0061	$I(1)$
EXCH_RATE	Δ^3 EXCH_RATE	6	-7.1746***	0	$I(3)$
GOV_INDEX	Δ GOV_INDEX	0	-5.0354***	0,0015	$I(1)$
INFLA_RATE	INFLA_RATE	5	-33.0260***	0	$I(0)$
ITEA_MIN	Δ ITEA_MIN	1	-5.3437***	0,0007	$I(1)$
LN COB_LME	Δ LN COB_LME	1	-7.3752***	0	$I(1)$
LN CU_LME	Δ LN CU_LME	0	-4.9270***	0,002	$I(1)$
LN GDP_PIB	LN GDP_PIB	8	-5.2317***	0,0015	$I(0)$
POL_STAB	POL_STAB	7	-6.0182***	0,0002	$I(0)$
POLIT_REGIM	Δ POLIT_REGIM	0	-5.5655***	0,0004	$I(1)$

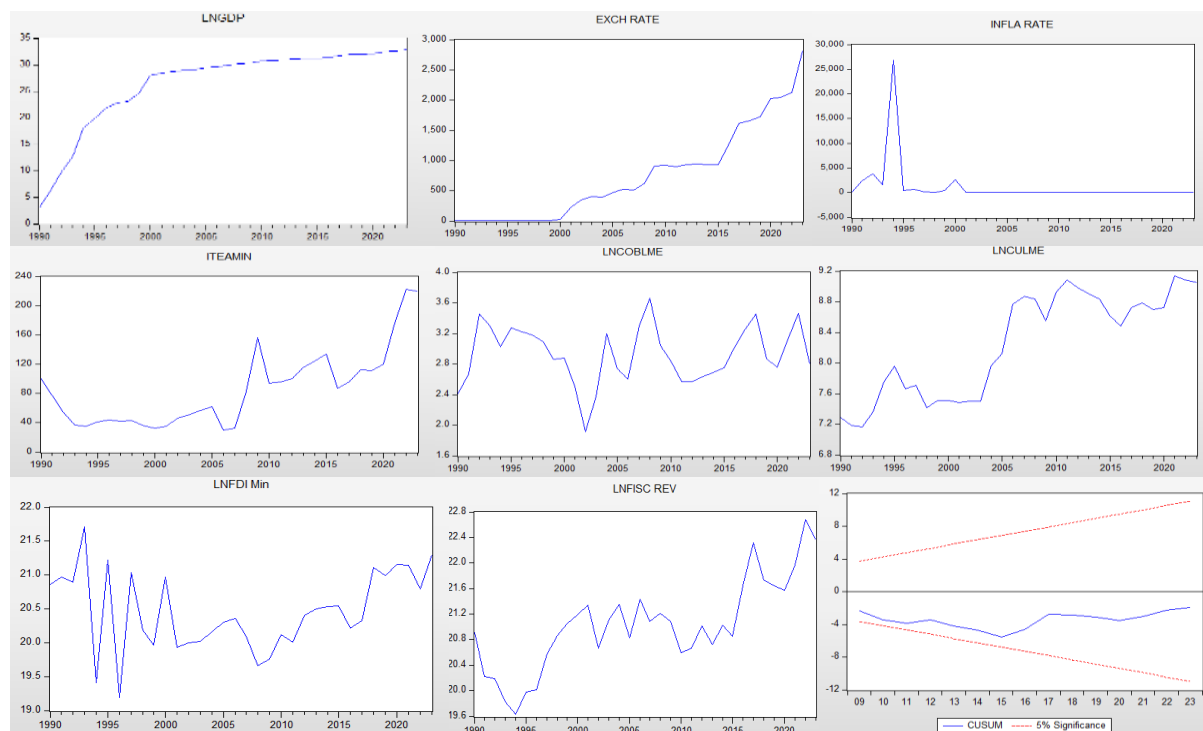
Notes: ADF tests include a constant and linear trend. Lag lengths were selected using the Schwarz Information Criterion (SIC).

The null hypothesis is that the series contains a unit root. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Source: Author's calculations based on econometric outputs using E-views 12.

Thus, the below graph presents trend of variables and CUSUM test results, illustrating parameter stability over time by comparing cumulative sums of recursive residuals against defined 5 %t significance boundaries.

Graph 1: Trend of variables and CUSUM Stability Test with 5% SB of Fiscal Mining Revenue Model



Source: Author's estimations; E-views 12.

The CUSUM line remains within the 5 % significance bounds throughout the observed period, indicating no structural instability. This suggests model parameters are stable, and there is no evidence of significant shifts or breaks affecting the reliability of the regression results.

3.1.4. Baseline Econometric Estimation

Following the stationarity analysis, which has confirmed a mixed order of integration among the variables, a baseline econometric specification has been estimated using Ordinary Least Squares (OLS). Table 5 has presented the preliminary results on the determinants of mining fiscal revenue.

Table 5. Determinants of Mining Fiscal Revenue: Baseline OLS Estimates

Variables	Coefficient	Std. Error	t-Statistic	p-value
LN FDI_MIN	-0,183977	0,170882	-1,0766	0,2923
GOV_INDEX	0.199901***	0,05976	3,3451	0,0027
INFLA_RATE	-0.000038**	0,000018	-2,1337	0,0433
ITEA_MIN	0.003803*	0,002066	1,8414	0,078
LN COB_LME	0,136831	0,191918	0,713	0,4827
LN CU_LME	-0,364541	0,390992	-0,9323	0,3604
LN GDP_PIB	0,030209	0,018434	1,6387	0,1143
POL_STAB	-0,126462	0,169279	-0,7471	0,4623
POLIT_REGIM	0,627466	0,423254	1,4825	0,1512
Constant	17.99605***	3,796862	4,7397	0,0001
Model Diagnostics				
Statistic				Value
Observations				34
R ²				0,777
Adjusted R ²				0,694
F-statistic				9.311***
Prob(F-statistic)				0,000006
Durbin–Watson				1,465
Notes:Standard errors are reported in the second column. *** $p<0.01$, ** $p<0.05$, * $p<0.10$. The exchange rate variable was excluded from the preferred specification due to severe multicollinearity detected through VIF				

Source: Author's calculations based on econometric estimations using E-views 12.

Baseline OLS estimates provide initial evidence on the determinants of mining fiscal revenue. Governance quality exerts a positive and statistically significant effect, indicating that stronger institutional frameworks enhance revenue mobilization capacity. The inflation is negatively associated with fiscal revenue, suggesting that macroeconomic instability undermines fiscal performance; while the Mining sector activity shows a positive contribution, highlighting the role of sectoral dynamics. In contrast, foreign mining investment is not statistically significant in the static specification. However, given the time-series nature of the data and the likelihood of dynamic adjustments and long-run relationships, the static OLS framework may be inadequate. Accordingly, the analysis proceeds using an ARDL approach.

3.1.5. Dynamic ARDL Results and Long-Run Relationship

Following the baseline OLS estimation, which has provided preliminary evidence on the determinants of mining fiscal revenue, the analysis has proceeded with a dynamic ARDL specification. Table 6 has presented the short-run dynamics, long-run coefficients, and cointegration results.

The ARDL results (Table 6) confirm both short-run dynamics and a stable long-run relationship among the variables. The bounds test indicates cointegration ($F = 4.4069$), rejecting the null of no long-run association. The error correction term is negative and highly significant (-1.4031 , $p < 0.01$), implying rapid adjustment toward equilibrium following short-term shocks. In the short run, changes in mining FDI and inflation significantly affect fiscal revenue, while GDP exhibits a weaker positive effect. In the long run, governance quality emerges as the most robust determinant, whereas inflation exerts a significant negative impact.

Table 6. ARDL Estimation and Cointegration Test Results

Dependent Variable: LN FISC_REV			
Selected Model: ARDL(1,2,2,2,1,2,1,2,2,2)			
Sample period: 1990–2023 Effective ARDL observations: 32			
Panel A. Short-Run Dynamics			
Variables	Coefficient	Std. Error	p-value
Δ LN FDI_MIN	-0.6848**	0,2403	0,0358
Δ INFLA_RATE	-0.000094**	0,000028	0,0192
Δ LN GDP_PIB	0.2897*	0,116	0,0547
ECM (-1)	-1.4031***	0,3223	0,0073
Panel B. Long-Run Estimates			
Variables	Coefficient	Std. Error	p-value
LN FDI_MIN	-0.8495*	0,3875	0,0799
GOV_INDEX	0.3922***	0,0858	0,006
INFLA_RATE	-0.000140**	0,000037	0,0131
POL_STAB	-0.7209*	0,3274	0,0789
Panel C. Bounds Test for Cointegration			
Test Statistic	Value		
F-statistic	4,4069		
k (number of regressors)	9		
Decision	Cointegration confirmed		
Model Diagnostics			
Statistic	Value		
Observations	32		
R²	0,986		
Adjusted R²	0,913		
F-statistic	13.495***		
Durbin-Watson	3,494		
Notes:Δ denotes first differences. ECM (-1) represents the error-correction term. *** p<0.01, ** p<0.05, * p<0.10. The ARDL model has been selected using the Akaike Information Criterion (AIC). Full distributed-lag			

Source: Author's calculations based on ARDL estimation result using STATA (16).

3.2. Survey-Based Evidence on the Institutional and Fiscal Effects of Foreign Direct Investment in the Mining Sector

Survey evidence on mining-sector FDI's institutional and fiscal effects, based on 545 stakeholder responses; tax officials, companies, institutions; analysed econometrically to assess governance, revenue generation, and macroeconomic implications.

3.2.1. Institutional Dynamics and Fiscal Performance in the Mining Sector

The descriptive evidence highlights a structurally constrained fiscal environment in the mining sector, characterized by strong public-sector dominance, high dependence on foreign capital, and persistent governance frictions. The sample is largely composed of fiscal authorities, with tax administration representing 20.2% of respondents, and a mid-to-senior experience profile (~9 years). Furthermore, Mining activity is geographically concentrated (44% in Haut-Katanga and Lualaba), while firms exhibit substantial reliance on foreign direct investment (FDI), with an average share of 72% and 76% of firms reporting FDI levels above 75%.

Despite this capital intensity, institutional inefficiencies remain pronounced. Approximately 79.8% of respondents report frequent tax disputes, 86.6% indicate intensive audit practices and 69.2% perceive weak inter-agency coordination. Governance risks are also pervasive: 86.8% and 91.7% of respondents highlight corruption and customs fraud, respectively, while 95.6% report widespread use of derogatory fiscal clauses. These patterns suggest a fragmented fiscal environment that may weaken revenue mobilization efficiency.

Notably, although 75–89% of respondents perceive the fiscal framework as stable, the coexistence of regulatory stability with high dispute frequency and weak coordination reveals a structural paradox, likely constraining fiscal resilience and long-term revenue performance

3.2.2. Determinants of the Fiscal Impact of FDI: Evidence from Logistic Regression

Table 7 presents logistic regression estimates identifying key determinants of FDI's impact on tax revenues, highlighting institutional, economic, and policy factors influencing the likelihood of positive outcomes.

The model is jointly significant ($\chi^2(6)=62.111$, $p<0.001$) with good fit (Hosmer–Lemeshow $p=0.797$) and moderate explanatory power (Nagelkerke $R^2=0.15$). The institutional capacity (OR=0.551) and compliance (OR=0.624) are negatively associated with positive FDI tax effects, while economic contribution (OR=1.735) and base erosion risk (OR=3.923) show positive effects. At last, Fiscal policy generosity reduces the likelihood (OR=0.416), whereas enforcement intensity is not significant.

Table 7. Logistic Regression Results Predicting the Impact of FDI on Tax Revenues

Variable	B	S.E.	Wald χ^2	OR (Exp(B))	p-value
Institutional Capacity Index	-0,595	0,225	7,001	0,551	0.008**
Enforcement Intensity Index (Audit Effectiveness)	0,092	0,082	1,276	1,097	0,259
Compliance Behavior Index	-0,472	0,224	4,441	0,624	0.035*
FDI Economic Contribution Index	0,551	0,18	9,41	1,735	0.002**
Base Erosion Risk Index	1,367	0,256	28,587	3,923	<0.001***
Fiscal Policy Generosity Index	-0,877	0,162	29,456	0,416	<0.001***
Constant	-2,081	1,022	4,15	0,125	0.042*
Model Fit Statistics					
Statistic					Value
Model χ^2 (6 df)					62.111***
-2 Log Likelihood					629,356
Cox & Snell R ²					0,108
Nagelkerke R ²					0,15
Hosmer–Lemeshow χ^2 (8 df)					4.622 (p = 0.797)
Classification Accuracy (Step 0 baseline)					0,67
Notes: Dependent variable: Impact of FDI on Tax Revenues (1 = positive impact, 0 = otherwise). p < 0.05; ** p < 0.01; *** p < 0.001					

Source: Author's calculations based on SPSS (28) estimation results.

Table 8: Leave-one-variable-out sensitivity analysis

Panel A. Coefficients (B) with Standard Errors					
Variable	Model A (-Inst. Cap.)	Model B (-Enf. Int.)	Model C (-Compl)	Model D (-FDI Econ.)	Model E (-Fiscal Policy)
Institutional Capacity Index	-	-0.578** (0.224)	-0,122304	-0.640** (0.223)	-0,105996
Enforcement Intensity Index	0.077 (0.081)	-	0.082 (0.081)	0.064 (0.081)	0.112 (0.079)
Compliance Behavior Index	-0.407† (0.222)	-0,102368	-	-0.412† (0.221)	-0.667** (0.214)
FDI Economic Contr.Index	0.579** (0.177)	0.527** (0.178)	0.518** (0.178)	-	0.532** (0.172)
Base Erosion Risk Index	1.263*** (0.249)	1.390*** (0.254)	1.334*** (0.252)	1.252*** (0.248)	0.572** (0.194)
Fiscal Policy Generosity Index	-0.835*** (0.158)	-0.887*** (0.162)	-0.910*** (0.158)	-0.864*** (0.159)	-
Constant	-3.198** (0.923)	-1.813† (0.991)	-2.889** (0.948)	0.191 (0.704)	-1.800† (0.983)
Panel B. Model Fit Statistics					
Statistic	Model A	Model B	Model C	Model D	Model E
Model χ^2 (df = 5)	54.897***	60.827***	57.618***	52.552***	28.197***
P-value	0,0000	0,0000	0,0000	0,0000	0,0000
-2 Log Likelihood	636,57	630,64	633,849	638,915	663,27
Cox & Snell R^2	0,096	0,106	0,100	0,092	0,050
Nagelkerke R^2	0,133	0,147	0,140	0,128	0,070
Hosmer–Lemeshow p-value	0,089	0,147	0,522	0,039	0,018
Notes: Standard errors are reported in parentheses. Dependent variable: Impact of FDI on Tax Revenues (binary).					
† $p < 0.10$; $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$					

Source: Author's calculations based on SPSS (28) estimation results.

The model is jointly significant ($\chi^2(6)=62.111$, $p<0.001$) with good fit (Hosmer–Lemeshow $p=0.797$) and moderate explanatory power (Nagelkerke $R^2=0.15$). The institutional capacity ($OR=0.551$) and compliance ($OR=0.624$) are negatively associated with positive FDI tax effects, while economic contribution ($OR=1.735$) and base erosion risk ($OR=3.923$) show positive effects. At last; Fiscal policy generosity reduces the likelihood ($OR=0.416$), whereas enforcement intensity is not significant.

Table 8 reports robustness checks of the model regression and analysis.

Robustness checks using a leave-one-variable-out sensitivity analysis confirm stable results across specifications. Base erosion risk and FDI economic contribution remain positive and significant, while fiscal policy generosity is consistently negative. The institutional capacity and compliance show weaker, model-dependent effects, and enforcement intensity remains insignificant. All models are jointly significant ($p<0.05$) with moderate explanatory power (Nagelkerke $R^2=0.07–0.147$). Overall, the main predictors remain robust.

3.3. Stakeholder Insights from Qualitative Interviews: Explaining the FDI–Revenue Disconnect

Table 9 presents a theory-integrated synthesis of qualitative findings from stakeholder interviews in the DRC mining sector, analysed using MAXQDA, linking empirical evidence to institutional and economic explanations.

Table 9. Theory-Integrated Synthesis of Empirical Findings on Foreign Mining Investment and Fiscal Revenue Mobilization in the DRC

Dimension	Empirical Finding	Theoretical Interpretation	Key Insight
FDI–Revenue Nexus	FDI increased production but not proportional fiscal revenue	Resource curse / institutional theory	Investment $\neq$ fiscal gains
Fiscal Transmission Mechanism	Weak linkage between production, exports, and tax collection	Rent capture / fiscal sociology	Value not captured
Governance Quality	Institutional strength determined revenue outcomes	Institutional economics	Institutions matter more than FDI
Fiscal Regime & Contracts	Tax incentives and stability clauses constrained revenue	Political economy / contract theory	Locked-in fiscal limitations
Tax Base Erosion	Transfer pricing, misinvoicing, and exemptions reduced taxable income	Illicit financial flows / tax base erosion theory	Hidden revenue losses
Institutional Capacity & Enforcement	Weak coordination, monitoring, and enforcement capacity	State capacity / regulatory theory	Low enforcement effectiveness
Policy Implementation Gap	Disconnect between legal frameworks and actual practice	Implementation theory	Policy $\neq$ practice

Source: Author's elaboration based on qualitative interviews and MAXQDA analysis

The table highlights a structural disconnect between foreign mining investment and fiscal outcomes in the DRC. Although FDI enhances production and exports, weak governance, limited institutional capacity, and significant tax base erosion constrain revenue mobilization. These findings emphasize that fiscal performance depends primarily on effective institutions, coherent policy implementation, and enforcement mechanisms rather than the scale of investment inflows alone.

4. Discussion of Results

4.1. Do Foreign Mining Investments Translate into Fiscal Gains? Evidence from Governance and Macroeconomic Dynamics in the DRC.

The ARDL results show that foreign mining investment has not yielded immediate fiscal gains in the Democratic Republic of Congo (DRC). In the short run, a 1% rise in mining FDI corresponds to a 0.68% decline in mining fiscal revenue, while in the long run the effect remains negative at 0.85%. This aligns with literature indicating that extractive-sector investment does not automatically generate public revenues in resource-rich developing countries due to tax incentives, profit repatriation, and weak fiscal regimes (IMF 2012).

Evidence from the DRC confirms that despite rapid cobalt and copper expansion, fiscal capture of mining rents has remained limited because of generous incentives and governance challenges (Geenen 2022a). Thus, large mining inflows may expand production without proportionately enlarging the government's taxable fiscal space.

By contrast, the positive long-run coefficient on governance quality indicates that stronger institutions significantly improve revenue mobilization. This finding is consistent with evidence that institutional quality and

regulatory effectiveness determine whether natural resources generate fiscal benefits (Bebbington *et al.*, 2018; Ross, 2020). In the DRC, foreign investment becomes revenue-enhancing only when institutions enforce contracts, monitor production, and limit rent leakages. Research further shows that improvements in oversight and transparency initiatives in the Congolese mining sector can strengthen domestic revenue mobilization (Radley & Vogel, 2023).

The negative coefficient on inflation in both the short and long run highlights how macroeconomic instability undermines fiscal extraction from mining. This supports evidence that volatility weakens fiscal contributions by eroding real revenues and complicating fiscal planning (IMF 2012). However, it contrasts with sector-specific findings that commodity price increases can temporarily boost nominal mining revenues (Amedanou & Laporte, 2024). In the DRC, inflation appears to operate mainly through instability and fiscal erosion rather than higher nominal receipts.

Similarly, the positive short-run effect of Gross Domestic Product (GDP) aligns with evidence that economic growth supports resource-sector fiscal revenues through increased production, exports, and improved tax collection (Bebbington *et al.*, 2018). In the DRC, where mining dominates exports and fiscal receipts, economic expansion naturally raises mining output and government revenue. The rapid growth of cobalt production illustrates how global demand for energy-transition minerals has amplified the sector's macroeconomic importance (Sovacool, Hook, Martiskainen, & Brock, 2020).

Interestingly, political stability shows a negative long-run coefficient. This may reflect the political economy of resource governance: periods of consolidation often coincide with renegotiations of contracts, regulatory reforms, or fiscal concessions aimed at sustaining investment flows. Thus, stability does not necessarily yield stronger fiscal outcomes when enforcement remains weak (Ross, 2020). In the DRC, historical governance challenges and concession-based regimes may explain why stability alone fails to guarantee fiscal performance.

The significant and negative error-correction term confirms a stable long-run equilibrium between fiscal revenue, mining investment, and institutional variables. The rapid adjustment speed suggests that shocks; such as investment fluctuations or macroeconomic changes; are quickly corrected as the system converges toward equilibrium.

Overall, the results demonstrate that foreign mining investment alone is insufficient to generate fiscal gains in the DRC. In fact, Fiscal benefits depend critically on governance quality and macroeconomic stability. This conclusion reinforces broader literature emphasizing that institutional capacity and regulatory effectiveness determine whether resource wealth translates into sustainable fiscal development (Radley & Vogel, 2023). Taken together, the findings highlight that mining inflows do not guarantee increased fiscal revenue. Instead, the state's ability to capture fiscal benefits depends on institutional quality, governance effectiveness, and macroeconomic stability. Strengthening regulatory frameworks, improving transparency, and enhancing fiscal administration are therefore essential to ensure that mining investments translate into tangible public revenues.

4.2. Determinants of the Fiscal Impact of Foreign Direct Investment: Survey-Based Logistic Regression Evidence

The final logistic regression model is statistically significant ($\chi^2(6) = 62.111$, $p < .001$), while the non-significant Hosmer–Lemeshow statistic ($p = .797$) indicates satisfactory calibration. Although explanatory power is moderate (Nagelkerke $R^2 = .15$), this is typical for perception-based institutional surveys where fiscal outcomes reflect complex administrative and political factors. The model thus highlights the direction and relative importance of mechanisms through which foreign direct investment (FDI) is perceived to influence tax revenue in the Democratic Republic of Congo (DRC).

A first notable result is the negative effect of institutional capacity (OR = 0.551, $p = .008$). A one-unit increase reduces the probability that respondents perceive a positive FDI tax impact by 44.9%. While counterintuitive, this may reflect the DRC's governance context: stronger institutions often expose fiscal leakages linked to exemptions, stability clauses, or opaque profit declarations. Consequently, actors within stronger institutions may adopt more critical assessments of FDI's fiscal benefits. This contrasts with literature linking stronger institutions to better resource-revenue outcomes (Ross, 2020), but aligns with evidence that reforms in the Congolese mining sector frequently reveal weaknesses in revenue capture (Geenen 2022b; Radley & Vogel, 2023).

Similarly, compliance behavior shows a negative coefficient (OR = 0.624, $p = .035$), suggesting that stronger compliance norms reduce perceived fiscal gains from FDI. Rather than signaling weaker tax systems, this likely reflects more realistic assessments of the gap between gross mining activity and net fiscal capture, particularly where monitoring is more rigorous.

By contrast, the FDI economic contribution index is positive and significant ($OR = 1.735$, $p = .002$). Thus, stronger production expansion and economic activity increase the likelihood of positive tax outcomes. This finding supports studies showing that extractive investment enhances fiscal performance when it expands the real production base and domestic linkages (Chisanga *et al.*, 2025).

The strongest effect concerns the base erosion risk index ($OR = 3.923$, $p < .001$). In fact, greater exposure to transfer-pricing risks and profit-shifting concerns is associated with stronger perceptions of FDI's fiscal effects. This does not imply base erosion is beneficial; rather, it underscores the tension between large-scale mining investment and persistent risks of tax-base leakage. Recent research confirms that profit shifting and aggressive tax planning significantly erode extractive revenues in African economies (Bertinelli, *et al.* 2022; IMF 2021).

Finally, the fiscal policy generosity index is strongly negative ($OR = 0.416$, $p < .001$), indicating that more generous regimes reduce the likelihood of positive FDI tax outcomes by 58.4%. This reinforces the argument that extensive tax incentives dilute fiscal gains from mining investment. Consistent with extractive governance literature, generous concessions weaken domestic revenue mobilization in resource-rich states where bargaining asymmetries favor multinational firms (IMF 2012). Meanwhile, enforcement intensity is not statistically significant, suggesting that audits alone are insufficient when structural weaknesses stem from fiscal regime design.

Overall, the findings indicate that in the DRC the fiscal effects of mining FDI depend less on investment volumes than on the interaction between economic contribution, institutional oversight, base-erosion risks, and fiscal-policy design. FDI can expand the taxable base, but its net fiscal payoff remains conditional on stronger governance and more balanced fiscal regimes.

4.3. Interpreting the FDI–Revenue Disconnect: Institutional Weakness, Fiscal Regime Design, and Governance Dynamics

The qualitative findings reveal a persistent disconnect between foreign mining investment and fiscal revenue in the DRC. While FDI expanded production and exports, fiscal gains remained constrained by weak governance, tax incentives, and revenue leakages. This supports evidence that resource wealth does not translate into effective revenue mobilization without strong institutions (van der Ploeg, 2011).

Survey results further show that institutional quality exerted a stronger influence on fiscal outcomes than FDI itself. Weak inter-agency coordination limited administrative capacity, and lack of transparency undermined enforcement, consistent with Mehlum *et al.* (2006), who argued that resource-rich countries benefit only under robust institutional frameworks. Similarly, IMF (2012) highlighted that poorly designed regimes and excessive incentives erode governments' ability to capture rents.

The study also confirmed that base erosion mechanisms; such as transfer pricing and export misinvoicing; substantially reduced the taxable base, reinforcing the gap between economic output and fiscal capture. These echoes van der Ploeg (2011), who emphasized that without sound governance, natural resource wealth does not automatically yield public revenue.

Overall, the findings demonstrate that FDI alone is insufficient to ensure effective revenue mobilization. Fiscal outcomes are primarily conditioned by governance quality, institutional capacity, and fiscal regime design. Strengthening these structural factors is therefore essential for transforming mining investment into sustainable public revenue in the DRC.

4.4. Convergence of Mixed-Method Evidence on the FDI-Revenue Nexus

The three methodological approaches converged toward a consistent and robust conclusion: foreign mining investment has not translated into proportional fiscal revenue gains in the DRC.

The documentary econometric results showed that, despite increased production and export expansion, FDI remained statistically insignificant or negatively associated with fiscal revenue.

Similarly, survey-based evidence identified governance quality, fiscal regime design, and base erosion risks as key determinants limiting revenue outcomes.

Qualitative interviews further confirmed that weak institutional capacity, tax incentives, enforcement gaps, and coordination failures constrained effective revenue capture.

Collectively, these findings revealed a coherent pattern in which the fiscal impact of FDI is systematically mediated by institutional and governance factors rather than the scale of investment inflows alone.

Conclusion and Further Research

This study investigated whether foreign direct investment (FDI) in the mining sector contributes to fiscal revenue mobilization in the Democratic Republic of Congo (DRC), while examining the institutional and macroeconomic conditions that shape this relationship.

Using a mixed-method approach that combined documentary time-series econometric analysis, survey-based logistic regression, and qualitative institutional evidence, the study provides a comprehensive assessment of the mechanisms through which mining investment influences fiscal performance.

The documentary econometric analysis confirms the existence of a stable long-run relationship between mining FDI and fiscal revenue, as evidenced by the ARDL bounds test and the statistically significant error-correction mechanism, indicating rapid adjustment toward long-run equilibrium following short-run disturbances.

However, the long-run coefficient of mining FDI is negative and only marginally significant ($\beta = -0.850$, $p = 0.080$), demonstrating that increased foreign investment in the mining sector does not automatically translate into higher government revenue. In contrast, governance quality exerts a positive and statistically significant effect on fiscal revenue ($\beta = 0.392$, $p = 0.006$), while inflation significantly undermines fiscal performance ($\beta = -0.00014$, $p = 0.013$). These findings indicate that institutional effectiveness and macroeconomic stability are more decisive determinants of fiscal revenue mobilization than the volume of foreign investment alone.

This study contributes to the literature on resource governance and fiscal capacity by integrating dynamic econometric evidence with institutional and survey-based analysis in the context of the Democratic Republic of Congo. Its principal contribution is to demonstrate that the fiscal benefits of foreign mining investment are not automatic, but depend substantially on governance quality, institutional capacity and fiscal-policy effectiveness. The findings therefore provide relevant empirical and policy insights for strengthening fiscal resilience and extractive-sector governance in mineral-dependent economies.

Therefore, the hypothesis that foreign direct investment in the mining sector exerts a positive long-run effect on fiscal revenue mobilization is not supported. The ARDL long-run estimates indicate that mining FDI has a negative and only marginally significant effect on fiscal revenue, suggesting that investment inflows alone do not guarantee higher government revenue. Moreover, the hypothesis that higher institutional quality strengthens fiscal revenue mobilization is supported. Governance quality exhibits a positive and statistically significant long-run effect on fiscal revenue, while the survey and qualitative findings consistently demonstrate that effective institutions, stronger fiscal administration, and reduced revenue leakages enhance the fiscal benefits derived from mining investment.

The survey and qualitative findings reinforce these econometric results. In fact, stakeholders identified tax-base erosion and profit-shifting practices as major constraints on fiscal revenue mobilization, while generous fiscal incentives were perceived to reduce the government's capacity to capture mining rents.

Together, the quantitative and qualitative evidence suggests that weaknesses in tax administration, regulatory enforcement, and fiscal governance limit the extent to which mineral wealth is transformed into sustainable public revenue.

These findings have important policy implications for resource-rich economies. Policies aimed solely at attracting foreign mining investment are unlikely to maximize fiscal returns unless accompanied by stronger governance institutions, transparent fiscal regimes, effective tax administration, and robust monitoring of mining activities. Strengthening institutional capacity, reducing illicit financial flows, improving compliance with mining taxation, and periodically reviewing fiscal incentives should therefore constitute central priorities for enhancing domestic revenue mobilization and ensuring that mineral resources contribute more effectively to sustainable development.

Beyond DRC, the study contributes to the broader literature on resource governance by demonstrating that the fiscal benefits of extractive-sector FDI are conditional rather than automatic. The results support the view that institutional quality mediates the relationship between natural-resource investment and fiscal capacity, thereby extending empirical evidence on revenue mobilization in resource-dependent developing economies.

Notwithstanding these contributions, the study has several limitations. The documentary analysis relied on annual data covering the period 1990–2023, and the governance indicator required extending the earliest available observations to previous years because of limited historical coverage. In addition, the analysis focused primarily on aggregate fiscal outcomes and did not distinguish between specific mining taxes such as royalties, corporate income tax, export duties, and other fiscal instruments. Nevertheless, these limitations are unlikely to affect the study's main conclusions. The 1990–2023 dataset adequately captures the major structural changes in the DRC's mining sector, while the governance data adjustment ensured a consistent time series. Moreover, aggregate fiscal revenue is an appropriate measure for assessing the overall fiscal contribution of mining FDI, consistent with the study's macroeconomic objective.

Future research should therefore examine the fiscal effects of mining FDI using disaggregated tax categories and firm-level administrative data where available. Comparative studies across resource-rich African economies would also improve understanding of how different institutional and fiscal regimes influence revenue mobilization.

Finally, future work could investigate the roles of contract design, beneficial ownership transparency, digital tax administration, and international tax cooperation in strengthening fiscal capacity within the extractive sector.

Declarations

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Credit Authorship Contribution Statement

Wakwinga Wabenga Clément-Francois: Conceptualization, Investigation, Methodology, Design, Project administration, Software, Formal analysis, Writing- original draft, Data curation, Writing-review and editing, Funding, lead in the development and writing of the research.

Paul Sensira Nahayo: Supervision, Critical review, Methodological, Structural and Theoretical Guidance, Visualization, and Validation during the preparation and revision phases.

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Cyriaque Nziroera: Supervision, Critical review, Methodological, Structural and Theoretical Guidance, Visualization, and Validation during the preparation and revision phases.

All authors review and approve the final version of the manuscript.

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Declaration of Use of Generative AI and AI-assisted Technologies: The authors affirm that generative AI was not employed for content generation, data analysis, or interpretation of results. However; Copilot-assisted technology was used exclusively for language refinement and enhancement of readability.

Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

References

- Addison, T., & Roe, A. (2024). Extractive industries: Transforming states and improving economic management (UNU-WIDER Working Paper 2024/33). United Nations University World Institute for Development Economics Research. <https://www.econstor.eu/handle/10419/298083>
- Amedanou, I., & Laporte, B. (2024). Is the conventional wisdom on resource taxation correct? Mining evidence from African countries' tax legislations. *World Development*.
- Asongu, S. A., & Mosunga, G. M. (2026). Extractive industries, government revenue and female economic participation: Evidence from the Democratic Republic of Congo. *International Journal of Social Economics*, 53(1), 15–30. <https://doi.org/10.1108/IJSE-07-2024-0593>
- Badeeb, R. A., Lean, H. H., & Clark, J. (2017). The evolution of the natural resource curse thesis: A critical literature survey. *Resources Policy*, 51, 123–134. <https://doi.org/10.1016/j.resourpol.2016.10.015>
- Banque Centrale du Congo. (n.d.). Rapport annuels 1990–2023. <https://www.bcc.cd/>
- Bebbington, A., Abdulai, A.-G., Humphreys Bebbington, D., Hinfelaar, M., & Sanborn, C. (2018). *Governing extractive industries: Politics, histories, ideas*. Oxford University Press. <https://doi.org/10.1093/oso/9780198820930.001.0001>
- Bertinelli, L., Bourgain, A., & Zanaj, S. (2022). Taxes and declared profits: Evidence from gold mines in Africa. *Resources Policy*, 77, 102688.

- Chisanga, B., Phiri, J., Osabuohien, E., & Johnson, L. (2025). Macroeconomic factors and natural resource management in Africa: Evidence from copper value addition in Zambia. *Discover Sustainability*, 6, Article 531. <https://doi.org/10.1007/s43621-024-00531-9>
- Coulibaly, S., & Camara, A. (2022). The end of tax incentives in mining? Tax policy and mining foreign direct investment in Africa. *African Development Review*, 34(4), 587–599. <https://doi.org/10.1111/1467-8268.12651>
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE.
- Geenen, S. (2022a). *African artisanal mining and the global economy*. Cambridge University Press. <https://doi.org/10.1017/9781108949864>
- Geenen, S. (2022b). Dispossession, displacement and resistance: Artisanal miners in a large-scale gold concession in the Democratic Republic of Congo. *The Extractive Industries and Society*, 9, 101026. <https://doi.org/10.1016/j.exis.2021.101026>
- Hatcher, P., & Roy Grégoire, É. (2022). Governance of extractive industries. In *Handbook on governance and development*. Edward Elgar Publishing. <https://www.elgaronline.com/edcollchap/book/9781789908756/book-part-9781789908756-29.xml>
- Hosmer, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression* (3rd ed.). Wiley. <https://doi.org/10.1002/9781118548387>
- Initiative pour la Transparence dans les Industries Extractives – République Démocratique du Congo (ITIE-RDC). (n.d.). Rapport ITIE-RDC 2000–2023. <https://itierdc.net/>
- International Energy Agency. (2023). Critical minerals market review 2023. <https://www.iea.org/reports/critical-minerals-market-review-2023>
- International Monetary Fund. (2012). *Fiscal regimes for extractive industries: Design and implementation*.
- International Monetary Fund. (2021a). Democratic Republic of the Congo: Selected issues (IMF Country Report No. 21/260).
- International Monetary Fund. (2021b). *Tax avoidance in Sub-Saharan Africa's mining sector*.
- Karl, T. L. (1997). *The paradox of plenty: Oil booms and petro-states*. University of California Press.
- Li, J., He, W., & Li, G. (2024). Natural resources, economic complexity and growth nexus: Role of digital governance in addressing the resource curse. *Resources Policy*, 90, 104370. <https://doi.org/10.1016/j.resourpol.2024.104370>
- Li, Y., Umair, M., Guliyeva, S., & Shakaraliyeva, Z. (2025). The Extractive Industries Transparency Initiative: Achieving disclosure, but falling short on corruption reduction. *The Extractive Industries and Society*, 22, 101602. <https://www.sciencedirect.com/science/article/pii/S2214790X24001989>
- Mboringong, F. A., Riggs, R. A., Langston, J. D., et al. (2025). Anticipatory governance for responsible investment in energy transition minerals in the Western Congo Basin. *The Extractive Industries and Society*. <https://www.sciencedirect.com/science/article/pii/S2214790X25001388>
- Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. *The Economic Journal*, 116(508), 1–20. <https://doi.org/10.1111/j.1468-0297.2006.01045.x>
- Michel, S.-L., & Kime, M.-B. (2022). Roadmap for increasing the Congolese mining industry involvement in local community development. *Community Development Journal*, 57(3), 509–527. <https://academic.oup.com/cdj/article-abstract/57/3/509/6207344>
- Moore, M. (2004). Revenues, state formation, and the quality of governance in developing countries. *International Political Science Review*, 25(3), 297–319. <https://doi.org/10.1177/0192512104043018>
- Mosunga, G. M. (2025). Trade openness and fiscal policy in the Democratic Republic of the Congo: Does trade policy instrument matter? *African Journal of Business and Economic Research*, 20(1). <https://doi.org/10.31920/1750-4562/2025/v20n1a4>

- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>
- Radley, B., & Vogel, C. (2023). Fighting windmills in the Congo: The ambiguous impact of mining reforms in the Democratic Republic of Congo. *The Extractive Industries and Society*, 13, 101173. <https://doi.org/10.1016/j.exis.2023.101173>
- Rapanyane, M. B., & Shai, K. B. (2020). China's multinational corporations in the Democratic Republic of Congo's mining industry: An Afrocentric critique. *Journal of Public Affairs*. <https://doi.org/10.1002/pa.2046>
- Ross, M. L. (2020). The politics of the resource curse: A review. *Annual Review of Political Science*, 23, 241–256. <https://doi.org/10.1146/annurev-polisci-050718-032619>
- Sovacool, B. K., Hook, A., Martiskainen, M., & Brock, A. (2020). The decarbonisation divide: Contextualizing landscapes of low-carbon exploitation and toxicity in Africa. *Global Environmental Change*, 60, 102028. <https://doi.org/10.1016/j.gloenvcha.2019.102028>
- United Nations Conference on Trade and Development. (2023). World investment report 2023: Investing in sustainable energy for all. United Nations. <https://unctad.org/publication/world-investment-report-2023>
- van der Ploeg, F. (2011). Natural resources: Curse or blessing? *Journal of Economic Literature*, 49(2), 366–420. <https://doi.org/10.1257/jel.49.2.366>
- Wooldridge, J. M. (2020). *Introductory econometrics: A modern approach* (7th ed.). Cengage.
- World Bank. (2020). Minerals for climate action: The mineral intensity of the clean energy transition. <https://www.worldbank.org/en/topic/extractiveindustries/publication/minerals-for-climate-action>

APPENDIX

Appendix A. Extended Analytical Matrix of Qualitative Findings

Theme	Institutional Mechanism	Main Finding	Fiscal Implication
FDI–Revenue Relationship	Weak fiscal transmission	Increased mining investment has not generated proportional fiscal revenues.	Limited fiscal gains from FDI alone.
Governance Quality	Institutional weakness	Weak enforcement reduces effective revenue collection.	Lower fiscal capture of mining rents.
Fiscal Regime	Tax incentives and exemptions	Fiscal concessions reduce the effective tax base.	Reduced government revenue.
Tax Base Erosion	Transfer pricing and trade misinvoicing	Profit shifting and illicit financial flows reduce taxable income.	Significant revenue leakages.
Institutional Coordination	Fragmented administrative responsibilities	Limited coordination among revenue institutions weakens monitoring.	Lower tax compliance.
Policy Implementation	Gap between legislation and enforcement	Existing mining legislation is not fully implemented.	Reduced fiscal effectiveness.
Transparency and Accountability	Limited disclosure and audit capacity	Weak transparency constrains oversight and accountability.	Lower revenue mobilization.

Source: Author's elaboration based on qualitative interviews and MAXQDA analysis

Appendix B. Summary of Econometric Model Validation

Diagnostic	Result	Interpretation
Unit root tests	Variables integrated of order $I(0)$ and $I(1)$; exchange rate $I(3)$ excluded	ARDL specification appropriate
Bounds test	F-statistic = 4.4069	Long-run cointegration confirmed
Error correction term	ECM = -1.4031 ($p < 0.01$)	Rapid adjustment toward long-run equilibrium
Serial correlation	Not detected	Residual independence satisfied
Heteroskedasticity	Not detected	Constant variance assumption satisfied
Residual normality	Accepted	Residuals approximately normally distributed
Parameter stability	CUSUM within 5% critical bounds	Stable coefficients throughout the sample

Source: Author's estimations; E-views 12.