FISCAL REVENUE VOLATILITY AND CONCENTRATION AS DRIVERS OF BUDGETARY RISK: EVIDENCE FROM THE REPUBLIC OF MOLDOVA (2005–2024)

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Abstract: *This study explores whether fiscal revenue volatility and the concentration of revenue sources contribute to budgetary risk in the Republic of Moldova over the period 2005–2024. The issue is particularly relevant for small open economies, where external shocks, shifts in tax structure, and limited revenue diversification may affect the stability of budget execution. Against this background, the article assesses the extent to which fluctuations in fiscal revenues and their concentration across a narrow set of categories are associated with deviations between planned and executed deficit outcomes.*
The analysis draws on annual State Budget data for 2005–2024 and uses additional information from Ministry of Finance reports, approved budget laws, IMF Government Finance Statistics, Court of Accounts reports, and National Bureau of Statistics GDP series. Revenue volatility is captured through a rolling three-year standard deviation of log revenue growth, while revenue concentration is measured by the Herfindahl–Hirschman Index calculated across seven revenue categories. Budgetary risk is proxied by deficit execution deviations expressed as a share of GDP. The empirical approach combines descriptive statistics and correlation analysis with OLS estimations using Newey–West heteroskedasticity and autocorrelation consistent standard errors.
The results suggest that revenue volatility is positively associated with deficit execution deviations in the baseline specifications. By contrast, revenue concentration does not display the expected positive effect; in multivariate models, its coefficient is negative and statistically significant. The interaction between volatility and concentration remains positive, although this result is not robust across all specifications. Taken together, the findings suggest that revenue diversification alone is unlikely to reduce budgetary risk without stronger medium-term fiscal planning and more consistent revenue forecasting practices..

Keywords: *fiscal revenue volatility; revenue concentration; budgetary risk; Herfindahl–Hirschman Index; fiscal discipline; Republic of Moldova*

JEL: H62, H20, E62, H11

Introduction

Stable fiscal revenues are a necessary condition for credible public expenditure planning and for maintaining the budget deficit within bounds compatible with fiscal policy objectives. In economies with a narrow tax base or a heavily concentrated revenue structure, budget execution becomes vulnerable to macroeconomic shocks, shifts in taxpayer behaviour, import or consumption fluctuations, and fiscal administration risks (*IMF, 2018*). The Republic of Moldova exemplifies these challenges: a small, open, lower-middle-income economy that has undergone repeated macroeconomic shocks (2009 financial crisis, 2014–2015 banking sector collapse, 2020 COVID-19 pandemic, 2022 energy price shock) and several structural tax reforms, each of which has reshaped the composition and stability of State Budget revenues.

The central idea of this article is that high revenue volatility and heavy dependence on a small number of tax categories amplify fiscal risk, reflected through: (i) larger variations in the budget deficit, and (ii) frequent and sizable deviations from revenue and deficit targets established in medium-term fiscal

policy documents. While this hypothesis is theoretically well grounded (*Afonso & Jalles, 2012; Beetsma & Giuliodori, 2010*), empirical evidence for small transition economies with limited data availability remains scarce.

This article makes two contributions. Methodologically, it operationalises budgetary risk through observable execution deviation indicators and proposes a coherent set of volatility and concentration measures. Empirically, it applies this framework to a 20-year annual time series for the Republic of Moldova (2005–2024), estimating correlations and OLS regressions with Newey–West HAC standard errors. Findings are reported transparently, including where results are partial or inconsistent with hypotheses, and limitations arising from small sample size and structural data breaks are explicitly flagged.

Literature Review and Conceptual Framework

The literature on fiscal risk and its management consistently highlights the role of revenue uncertainty in generating deviations from fiscal targets and in increasing financing requirements. A recurring dimension is the pro-cyclical character of revenues, particularly indirect taxes and corporate income taxes, which tend to amplify fluctuations in the fiscal balance (*Beetsma & Giuliodori, 2010*). Another dimension is revenue source concentration: the greater the share of revenues derived from few categories, the more exposed the budget becomes to shocks specific to those tax bases.

Afonso & Jalles (2012) document that fiscal volatility is associated with lower economic growth and weaker fiscal discipline across a broad panel of countries, with the relationship intensifying during financial crises. Kopits & Symansky (1998) argue that fiscal rules require credible and predictable revenue forecasting as a prerequisite for effectiveness. The *IMF (2018) Fiscal Transparency Handbook* and the *European Commission (2023)* European Economic Forecast both emphasise medium-term fiscal frameworks as instruments for managing revenue uncertainty.

In this article, budgetary risk is operationalised as the gap between realised budget outcomes and planned trajectories (revenue and deficit targets) established in the annual budget law and medium-term fiscal framework. Revenue volatility and concentration on particular tax types act as risk factors that can disrupt budget execution even in the absence of deliberate policy changes.

Methodology

Research Design and Hypotheses

This study uses an annual time-series design based on State Budget data for the Republic of Moldova covering the period 2005–2024. The fiscal year serves as the unit of analysis. The main purpose is to examine whether two characteristics of the revenue system—its volatility over time and its concentration across a limited number of revenue categories—are associated with instability in budget execution.

The analysis starts from a simple assumption drawn from the fiscal risk literature: when revenues are unstable and rely heavily on a narrow set of sources, fiscal planning becomes more exposed to forecasting errors and deviations between planned and actual outcomes. In this perspective, revenue volatility reflects short-term fiscal uncertainty, while revenue concentration captures a more structural source of vulnerability linked to shocks affecting particular tax bases. The empirical analysis therefore considers both the separate and the combined association of these revenue-side characteristics with deficit execution deviations.

At the same time, the study is shaped by the limitations of the available data. The number of annual observations is small, and the revenue series is affected by a structural break related to changes in revenue classification. For this reason, the article should be read as an applied empirical assessment rather than as a strict confirmatory test. The aim is not only to identify statistically significant relationships, but also to examine their direction, stability, and substantive meaning in the fiscal context of the Republic of Moldova. This approach is appropriate for a small open economy exposed to repeated shocks, institutional adjustments, and changes in fiscal reporting practice.

Data Sources

The empirical analysis relies on annual State Budget data for the Republic of Moldova covering the period 2005–2024. The main sources are the annual budget execution reports and approved budget laws issued by the Ministry of Finance. These are complemented by Budgetary Central Government data from the IMF Government Finance Statistics database, audit reports of the Court of Accounts of the Republic of Moldova, and nominal GDP series published by the National Bureau of Statistics. Taken together, these materials provide the basis for constructing the main variables used in the study. For the purpose of analysing revenue structure, fiscal revenues are grouped into seven categories: income taxes, property taxes, net value-added tax, net excises, road taxes, external trade taxes, and a residual group covering other taxes. Planned deficit values are taken from approved annual budget laws. Data on planned fiscal revenues are available only for part of the period, specifically for 2011–2012 and 2016–2023, which limits the possibility of examining revenue execution deviations over the full sample.

One important data issue concerns a break in revenue classification beginning in 2013. For 2005–2012, total fiscal revenues are identified at the strict State Budget level using Ministry of Finance reports and IMF GFS data. From 2013 onward, the corresponding series is derived indirectly from broader public revenue aggregates after excluding social insurance and health insurance components. This change affects the comparability of the series, particularly by increasing the recorded share of income taxes and producing a visible shift in the concentration index. To reduce the influence of this discontinuity on the empirical results, a structural-break dummy is introduced in selected model specifications, and 2013 is excluded from dedicated robustness tests. Revenue data for 2013–2015 should therefore be treated with caution, as they are partly estimated rather than directly confirmed from primary State Budget sources.

Variable Construction

The empirical analysis uses three groups of variables: measures of revenue volatility, measures of revenue concentration, and indicators of budget execution deviations. Together, they are intended to capture both the sources of fiscal instability and the way these are reflected in budget outcomes.

Revenue volatility is represented by a rolling three-year measure of variation in the growth of total fiscal revenues. The purpose of this indicator is to reflect short-term instability in revenue dynamics without making the analysis overly sensitive to isolated annual fluctuations. Higher values indicate a less stable revenue path over time. Revenue concentration is measured by the Herfindahl–Hirschman Index calculated across seven revenue categories. In practical terms, higher values point to a stronger dependence on a limited number of revenue sources, whereas lower values indicate a more diversified revenue structure.

The main dependent variable is the deviation between the executed and the planned budget deficit, expressed relative to GDP. In the context of this study, this measure is used as an indicator of budgetary risk in execution terms, since larger deviations from planned fiscal outcomes suggest weaker predictability in budget implementation. Positive values indicate that the executed deficit was smaller in absolute terms than initially planned, while negative values reflect a less favourable fiscal outcome. A secondary indicator is also considered for deviations between realised and planned fiscal revenues, again expressed relative to GDP. Its use is more limited, however, because the corresponding data on planned revenues are available only for part of the sample period.

Econometric Approach

The empirical analysis combines correlation analysis with regression-based estimation in order to examine how revenue volatility and revenue concentration are associated with deficit execution deviations. Pearson and Spearman coefficients are used at the first stage to explore the direction and strength of the bivariate relationships among the main variables. This makes it possible to identify not only linear associations, but also broader monotonic patterns in the data.

The main estimates are obtained from OLS regressions with Newey–West heteroskedasticity and autocorrelation consistent standard errors. This choice is appropriate for a short annual time series, where residual autocorrelation cannot be ruled out and conventional standard errors may lead to misleading inference. The baseline models examine the separate association of revenue volatility and revenue concentration with deficit execution deviations, while the extended specifications also consider their combined association through an interaction term. Additional models include nominal GDP growth and a dummy variable for the structural break in revenue classification from 2013.

The stability of the estimated relationships is examined through several robustness checks. These include the use of an alternative volatility measure based on a five-year rolling window, the exclusion of 2013 and 2020, and the estimation of specifications with lagged regressors. Diagnostic tests are also applied to assess autocorrelation, heteroskedasticity, stationarity, and multicollinearity. Given the size of the sample, these procedures are used mainly to evaluate the consistency of the results and the limits of their interpretation, rather than to support strong causal claims. The effective regression sample includes 17 annual observations for the period 2008–2024, reflecting the availability of the rolling volatility indicator.

Empirical Results

Descriptive Analysis

The descriptive analysis provides an initial overview of the main variables used in the empirical assessment and helps situate the econometric results within the broader fiscal context of the Republic of Moldova. Particular attention is given to the distribution of revenue volatility, revenue concentration, and budget execution deviations, as well as to their movement over time.

For the main regression sample covering 2008–2024 (N = 17), revenue volatility, measured by $VolR_3$, ranges from 0.038 in 2008 to 0.245 in 2009, with a mean of 0.112 and a positively skewed distribution. The concentration index (HHI) varies between 0.332 and 0.557, with an average value of 0.414. Deficit execution deviations (DevD) have a mean of 0.010 of GDP and remain positive in most observations, indicating that the executed deficit was frequently more favourable than initially planned. Nominal GDP growth also displays substantial variation over the sample period. The corresponding descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics for the Main Regression Sample (2008–2024)

Variable	N	Mean	SD	Min	Max	Skewness
$VolR_3$ (rolling 3-yr SD)	17	0.112	0.068	0.038	0.245	+0.93
HHI (Herfindahl index)	17	0.414	0.078	0.332	0.557	+1.03
DevD (% of GDP)	17	0.010	0.010	-0.006	0.028	+0.14
gPIB (log nominal)	17	0.107	0.072	-0.047	0.206	-0.91

Source: *Authors' calculations based on Ministry of Finance RM and IMF GFS data.*

Over the period 2005–2024, the two indicators follow distinct but related trajectories. Revenue volatility increases sharply during the global financial crisis, when fiscal instability reaches its highest level, and rises again in the post-pandemic years. A further episode of elevated variation is visible around 2013–2015, although this interval should be interpreted with caution because of the structural break in revenue classification. By contrast, the concentration index shifts downward markedly from 2013 onward and then remains comparatively more stable. Taken together, these developments reflect both changes in the composition of fiscal revenues and the methodological discontinuity affecting the series, as shown in Figure 1.

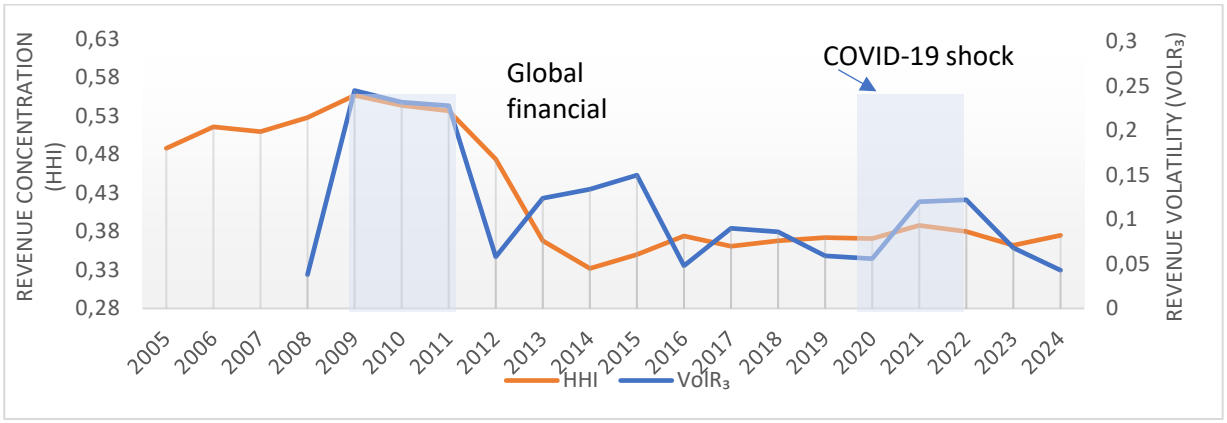

Figure 1. Evolution of Revenue Volatility (VolR₃) and Fiscal Concentration (HHI), Republic of Moldova, 2005–2024

Source: *Authors' calculations based on Ministry of Finance RM and IMF GFS data. Note: Bars (left axis) = VolR₃; Line with markers (right axis) = HHI. Shaded areas: 2009–2011 financial crisis; 2020 COVID-19. Dashed vertical line: 2013 structural break.*

Across the period under review, deficit and revenue execution deviations do not follow a uniform pattern. The DevD series remains predominantly positive, which suggests that, in most years, the executed deficit was more favourable than initially planned. The largest positive deviations are recorded in 2010 and 2021, while negative values are comparatively rare and appear mainly in 2007, 2008, 2011, and 2013. This distribution points to an asymmetry in fiscal execution, with deviations tending more often toward outperformance than toward deterioration relative to the plan. The DevR indicator is available for a smaller number of years only, yet it still provides useful additional evidence on the extent to which realised revenues diverged from planned fiscal targets. Taken together, these developments indicate that fiscal execution deviations were not evenly distributed over time, but became more visible during periods marked by macroeconomic stress or institutional adjustment, as shown in Figure 2.

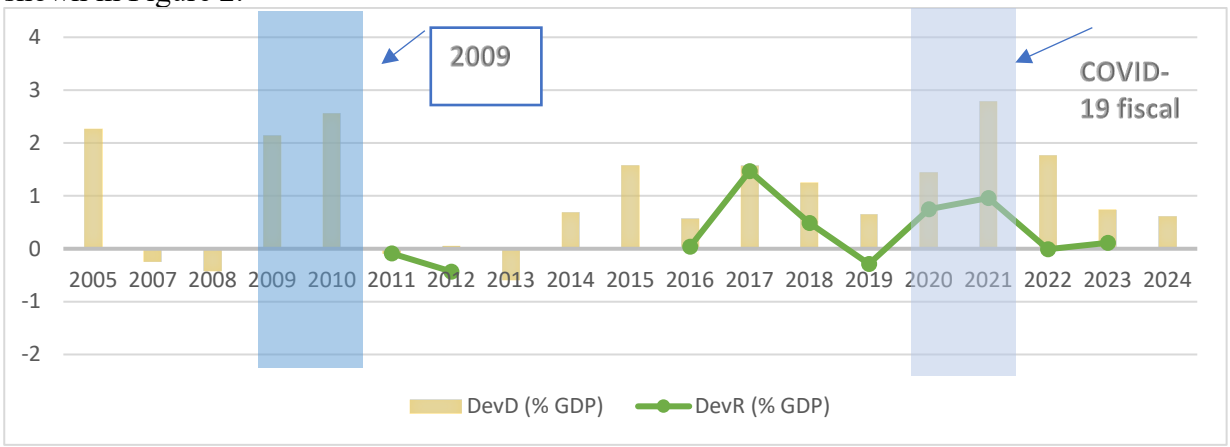

Figure 2. Deviations from Fiscal Targets: DevD and DevR, Republic of Moldova, 2005–2024

Source: Authors' calculations based on MF RM annual budget execution reports.

Correlation Analysis

The correlation matrix provides a first indication of how the main variables are related before turning to the regression estimates. As shown in Table 2, revenue volatility is positively associated with deficit execution deviations in both Pearson and Spearman terms. The Pearson coefficient remains below conventional significance thresholds, whereas the Spearman coefficient is somewhat stronger

and reaches significance at the 10 per cent level. This difference suggests that the relationship is more clearly monotonic than strictly linear and offers an initial indication that higher revenue volatility tends to coincide with larger deviations in deficit execution.

The relationship between revenue concentration and DevD is much weaker. Both correlation coefficients are close to zero, which points to the absence of a clear bivariate association over the period examined. By contrast, the interaction term combining volatility and concentration displays a stronger positive relationship with deficit execution deviations, particularly in rank terms. This result does not by itself establish a stable joint effect, but it suggests that the two revenue-side characteristics may become more relevant when considered together than when treated separately.

Table 2. Correlation Matrix (N=17, 2008–2024)

	VolR₃	**HHI**	**VolR₃×HHI**	**DevD**
VolR₃	1.000	0.543**	0.970***	0.397
HHI	[0.108]	1.000	0.710***	0.003
VolR₃×HHI	[0.961***]	[0.257]	1.000	0.351
DevD	[0.458*]	[0.042]	[0.520**]	1.000

Source: *Authors' calculations. Pearson r — upper triangle; Spearman ρ in brackets — lower triangle. *** p<0.01, ** p<0.05, * p<0.10.*

At the same time, the matrix reveals relatively strong associations among the explanatory variables themselves, especially between VolR₃ and the interaction term, and to a lesser extent between VolR₃ and HHI. This pattern is analytically important because it already points to the possibility of multicollinearity in the subsequent regressions. For that reason, the correlation analysis is best interpreted as an exploratory step: it helps clarify the direction and broad structure of the relationships, but it does not yet allow firm conclusions regarding their individual contribution to deficit execution deviations. The corresponding coefficients are reported in Table 2.

Regression Results

The regression estimates refine the patterns already visible in the descriptive and correlational analysis. Table 3 reports five OLS (Ordinary Least Squares) specifications estimated with Newey–West heteroskedasticity and autocorrelation consistent standard errors. In the baseline model, revenue volatility enters with a positive and statistically significant coefficient, indicating that higher volatility is associated with larger deficit execution deviations. The coefficient remains positive and significant when revenue concentration is added as an additional regressor, which suggests that the link between volatility and fiscal execution instability is not merely a bivariate one.

The picture becomes less clear once the interaction term is introduced. In these specifications, the coefficient on revenue volatility loses significance and changes sign, while the interaction term remains positive but statistically fragile. This shift is best read in connection with the strong association among the explanatory variables already noted in the correlation matrix. In a small sample, where the regressors overlap to a considerable extent, it becomes difficult to isolate their separate effects with precision. For that reason, the loss of significance should not be read too quickly as evidence of no relationship.

A more persistent result concerns revenue concentration. In the multivariate specifications, the HHI (Herfindahl–Hirschman Index) coefficient is consistently negative and statistically significant, which runs against the expected sign. This finding should be interpreted cautiously. Rather than pointing to a straightforward mitigating effect of concentration, it is more likely to reflect the structure of the sample itself, including the contrast between the pre-2013 period of higher concentration and relatively favourable deficit deviations, and the post-2013 period of lower concentration combined with a different fiscal and reporting environment. In this sense, the coefficient appears to capture not only differences in revenue structure, but also the influence of a period marked by methodological discontinuity and changing macro-fiscal conditions.

Table 3. OLS Regression Results — Dependent Variable: DevD (% of GDP), 2008–2024 (N=17)

	M1	M2	M3	M4	M5
Dep. var.: DevD	*H1 baseline*	*+HHI*	*+Interaction*	*+gPIB*	*+D2013*
Constant	+0.0037 (0.0037)	+0.0168 (0.0113)	+0.0432** (0.0157)	+0.0496*** (0.0127)	+0.0423*** (0.0106)
VolR$_3$	+0.0580* (0.0288)	+0.0820** (0.0341)	−0.1329 (0.2068)	−0.2090 (0.1719)	−0.0836 (0.1535)
HHI	—	−0.0382 (0.0270)	−0.0966** (0.0324)	−0.1153*** (0.0248)	−0.1005*** (0.0211)
VolR$_3$×HHI	—	—	+0.4452 (0.3875)	+0.6002* (0.3214)	+0.3676 (0.3041)
gPIB	—	—	—	+0.0212 (0.0237)	+0.0187 (0.0232)
D2013	—	—	—	—	−0.0200*** (0.0037)
R^2	**0.158**	**0.222**	**0.260**	**0.279**	**0.498**
Adj. R^2	**0.102**	**0.111**	**0.090**	**0.039**	**0.270**
Durbin–Watson	**1.336**	**1.457**	**1.682**	**1.739**	**1.929**

*Source: Authors' calculations. Newey–West HAC SE (maxlags=2) in parentheses. *** p<0.01, ** p<0.05, * p<0.10. D2013 = structural break dummy (revenue reclassification 2013).*

The interaction term remains positive across specifications, which is broadly in line with the view that volatility and concentration may reinforce one another. Even so, the result is not sufficiently stable to support a strong conclusion, since significance appears only in one specification and does not carry over to the robustness checks discussed below. Overall, the regression results suggest that revenue volatility has the clearest association with deficit execution deviations in the more parsimonious models, while the role of concentration remains more sensitive to model structure and to the particular features of the sample. The estimated coefficients are reported in Table 3.

Robustness Tests and Diagnostics

The regression results were further examined through a set of robustness checks designed to assess their stability under alternative specifications. Replacing the three-year volatility measure with a five-year rolling indicator weakens the estimated relationships, as the coefficients lose statistical significance. This outcome is not surprising given the further reduction in sample size and the smoother profile of the longer-window measure, which absorbs part of the short-term variation captured in the baseline models.

A more informative pattern emerges when potentially disruptive years are excluded from the analysis. When 2013 is removed, the coefficient on revenue concentration remains negative and statistically significant, while the volatility and interaction terms are no longer significant. A similar result is obtained when 2020 is excluded. Taken together, these checks suggest that the negative association between concentration and deficit execution deviations is more stable than the corresponding estimates for volatility or for the interaction term, although its interpretation remains constrained by the structural characteristics of the sample.

The lagged specifications provide little additional support for delayed effects, as none of the coefficients remains statistically significant. This points to a relationship that appears more contemporaneous than lagged, at least within the limits of the annual data used here. The diagnostic tests are broadly reassuring. Residual autocorrelation does not emerge as a major concern, the White test does not indicate significant heteroskedasticity, and most variables satisfy standard stationarity conditions. The main exception is VolR$_3$, which appears only borderline stationary, a result that is not unusual for rolling volatility measures in short samples. For this reason, the diagnostic evidence should be read as supportive but not definitive. Overall, the robustness analysis reinforces the view that the results are informative, though more suggestive than conclusive.

Conclusions

This article examined the relationship between fiscal revenue volatility, revenue concentration and budgetary risk in the Republic of Moldova over the period 2005–2024. Based on annual State Budget data, the analysis combined descriptive evidence, correlation analysis and OLS regressions with Newey–West standard errors to assess whether instability in the revenue base is reflected in deficit execution deviations.

The results indicate a clearer role for revenue volatility than for revenue concentration. In the more parsimonious specifications, higher revenue volatility is associated with larger deficit execution deviations, which suggests that unstable revenue dynamics may complicate fiscal execution. The evidence for revenue concentration is less straightforward. Contrary to the initial expectation, the HHI coefficient is negative and statistically significant in the multivariate regressions. This outcome appears to be closely linked to the structure of the Moldovan data, especially the difference between the pre-2013 and post-2013 periods and the break in revenue classification. The interaction between volatility and concentration remains positive, but its statistical support is not stable enough to justify a strong conclusion.

The findings also reflect several limits of the analysis. The effective sample is small, the revenue series is affected by a methodological discontinuity after 2013, and planned revenue data are not available for the whole period. These constraints reduce the possibility of testing revenue execution deviations over the full sample and limit the strength of the econometric conclusions. The models also do not include institutional or political factors that may influence budget execution.

Overall, the results show that revenue diversification, although important, is not sufficient by itself to reduce budgetary risk. For the Republic of Moldova, the more relevant issue seems to be the combination of revenue instability, forecast accuracy and continuity in fiscal reporting. This interpretation is consistent with public financial management approaches that link budget credibility to fiscal planning, execution control, revenue forecasting and explicit monitoring of fiscal risks (MEFMI, 2023). In this sense, budgetary risk depends not only on the composition of revenues, but also on the quality of planning and on the institutional capacity to monitor deviations during execution.

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