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Tax Revenue Responsiveness and Tax-to-GDP Ratio Dynamics in Indonesia: Evidence from Tax Buoyancy Analysis, 2010–2025

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Abstract

This study assesses the contemporaneous responsiveness of Indonesian central government tax revenue to nominal gross domestic product (GDP) and explains why a tax buoyancy coefficient greater than unity does not necessarily imply an increasing tax-to-GDP ratio. Using 16 annual observations covering 2010–2025 from the author-audited Dataset 4, tax revenue is defined as central government tax receipts, excluding non-tax state revenue (Penerimaan Negara Bukan Pajak, PNBP), while GDP is measured at current prices. Augmented Dickey–Fuller (ADF) tests are conducted with an intercept, a maximum of two lags, and lag-length selection based on the Akaike Information Criterion (AIC), supplemented by fixed-lag sensitivity checks. A first-differenced logarithmic ordinary least squares (OLS) regression model is estimated using conventional, heteroskedasticity-consistent (HC1), and heteroskedasticity and autocorrelation-consistent (HAC) standard errors. The null hypothesis of proportional responsiveness ($\beta = 1$) is also tested. Under the reported primary specification, the ADF tests reject the null hypothesis of a unit root in the first differences of the logarithmic series but fail to reject it in their logarithmic levels. The estimated tax buoyancy coefficient is 2.4485 (OLS 95% confidence interval [CI]: 1.8290–3.0680; $p = 0.000222$ for H_0: $\beta = 1$), with an intercept of −0.1235 and an R^2 of 0.8487, based on 15 annual changes. When the 2020 observation is excluded, the estimated coefficient remains relatively stable at 2.4640. Despite this estimated responsiveness, the tax-to-GDP ratio decreases from 10.54% in 2010 to 10.02% in 2025, representing a decline of 0.52 percentage points. By jointly examining the estimated tax buoyancy coefficient, the regression intercept, and the accounting dynamics underlying changes in the tax-to-GDP ratio, this study contributes an updated, explicitly delimited empirical assessment of tax revenue mobilization in Indonesia. The 2025 tax revenue figure is drawn from the table published by Badan Pusat Statistik (BPS; Statistics Indonesia), updated in August 2026, in which the figure is classified as an outlook estimate. The findings should be interpreted as evidence of statistical associations rather than causal relationships or long-run equilibrium effects.

INTRODUCTION

Domestic revenue mobilization is fundamental to the allocation, distribution, and stabilization functions of the state (Apeti & Edoh, 2023; Gupta et al., 2022). However, an expansion in nominal economic output does not necessarily translate into a proportional increase in realized tax revenue (Hill et al., 2022). Tax legislation, exemptions, the composition of economic activity, tax administration practices, refunds, and discretionary fiscal policy changes influence the relationship between aggregate economic activity and actual government revenue (Aida, 2023; Cornevin et al., 2024). Consequently, tax buoyancy and the tax-to-GDP ratio represent related but conceptually distinct dimensions of fiscal performance. Tax buoyancy measures the responsiveness of tax revenue to changes in GDP, incorporating the effects of both automatic revenue responses and discretionary policy measures, whereas the tax-to-GDP ratio measures the proportion of national economic output collected as tax revenue (De Pascale et al., 2021; Wijaya et al., 2025). Distinguishing these indicators is essential for evaluating revenue performance, particularly when short-term revenue responsiveness differs from longer-term developments in the tax burden.

Indonesia provides a relevant empirical setting for examining these relationships over the 2010–2025 period, which encompasses changes in economic conditions, fiscal policy adjustments, the COVID-19 pandemic, and the subsequent economic recovery (Rohima et al., 2022; Saptono & Khozen, 2022). Throughout this period, Indonesia faced persistent challenges in strengthening domestic revenue mobilization, broadening the tax base, improving tax compliance, and maintaining fiscal sustainability amid evolving expenditure requirements (Khozen & Setyowati, 2023). Changes in the composition of tax revenue, economic activity, and administrative practices may have influenced the relationship between nominal GDP growth and government tax receipts. These developments underscore the importance of examining tax revenue responsiveness alongside changes in the tax-to-GDP ratio rather than treating the two indicators as interchangeable measures of fiscal performance. This study employs a consistent, author-audited national dataset covering central government tax revenue, rather than receipts administered exclusively by the Directorate General of Taxes (Direktorat Jenderal Pajak, DJP), and excludes non-tax state revenue (Penerimaan Negara Bukan Pajak, PNBP). The 2025 revenue figure is obtained from the revenue table published by Statistics Indonesia (Badan Pusat Statistik, BPS), updated on August 28, 2026, and retains its original classification as an outlook estimate (Badan Pusat Statistik, 2026).

Previous research has examined the responsiveness of government revenue to economic activity and the implications of tax buoyancy for fiscal performance. Dudine and Jalles (2017) investigated tax revenue responsiveness across countries, highlighting the importance of economic conditions and structural characteristics in explaining differences in revenue performance. Cornevin et al. (2023) further contributed to the literature on tax revenue mobilization and the factors influencing revenue outcomes, while Sinaga et al. (2023) provided relevant insights into taxation and fiscal performance in the Indonesian context. Collectively, these studies establish an important foundation for understanding the relationship between economic growth and tax revenue. Nevertheless, the present study addresses a more specific analytical issue: the

interpretation of an estimated tax buoyancy coefficient in relation to the observed evolution of the tax-to-GDP ratio. In particular, a coefficient greater than unity does not necessarily imply that the tax-to-GDP ratio increased over the entire observation period, because the estimated regression intercept, annual growth patterns, and cumulative revenue dynamics must also be considered. This distinction provides the basis for the research gap addressed in the present analysis.

The urgency of addressing this research gap has increased amid Indonesia's fiscal consolidation priorities, growing public expenditure requirements, and the normalization of government revenue following the COVID-19 pandemic. These developments have intensified policy concerns regarding whether economic expansion generates sufficient additional tax revenue to support fiscal sustainability (Alfathan & Arifin, 2025; Hill et al., 2025). The novelty of this study lies in explicitly reconciling two indicators that are frequently interpreted together without sufficient attention to their distinct analytical properties: the estimated tax buoyancy coefficient and the observed tax-to-GDP ratio trajectory. By integrating an updated annual dataset for 2010–2025, a parsimonious first-differenced logarithmic regression specification, multiple approaches to statistical inference, and transparent sensitivity analyses, the study provides an empirically grounded and appropriately bounded assessment of Indonesian tax revenue responsiveness. This approach also recognizes that the estimated coefficient reflects contemporaneous statistical associations rather than causal effects or long-run equilibrium relationships.

The purpose of this study is to estimate the contemporaneous responsiveness of Indonesian central government tax revenue to nominal GDP growth and explain why a tax buoyancy coefficient greater than unity does not necessarily indicate an increasing tax-to-GDP ratio. Specifically, the study seeks to (i) examine the stationarity properties of the tax revenue and nominal GDP series; (ii) estimate the tax buoyancy coefficient and test the null hypothesis of proportional responsiveness ($\beta = 1$); and (iii) reconcile the estimated coefficient with the observed trajectory of the tax-to-GDP ratio during 2010–2025. Accordingly, the research addresses three central questions: What are the stationarity characteristics of Indonesia's tax revenue and nominal GDP series? How responsive is central government tax revenue to changes in nominal GDP? Why might an estimated tax buoyancy coefficient exceeding unity coexist with a declining tax-to-GDP ratio over the observation period? The study contributes an updated national estimate, a methodological clarification regarding the interpretation of tax buoyancy coefficients, and a transparent framework for assessing the robustness of the findings. Its practical significance lies in supporting more informed fiscal policy evaluation by distinguishing the responsiveness of tax revenue to economic growth from the broader dynamics of domestic revenue mobilization.

METHOD

Data, definitions and source status

The study used an author-verified dataset comprising 16 annual observations from 2010 to 2025. Tax revenue data were obtained from the Badan Pusat Statistik (BPS) national revenue statistics, based on Ministry of Finance records, and represented central government tax receipts excluding non-tax state revenue (Penerimaan Negara Bukan Pajak, PNBP). Nominal gross

domestic product (GDP) was measured at current prices, with both variables expressed in trillions of Indonesian rupiah (IDR). The 2025 tax revenue figure of IDR 2,387.28 trillion was classified as an outlook estimate in the BPS data updated on August 28, 2026, and was therefore treated as provisional.

The analysis calculated the annual tax-to-GDP ratio, tax revenue growth, and nominal GDP growth to examine fiscal performance over the observation period. Descriptive tax buoyancy was calculated from the ratio of annual percentage changes in tax revenue to those in nominal GDP, excluding observations with zero GDP growth. For the econometric analysis, both variables were transformed into natural logarithms and expressed as first differences to estimate the responsiveness of tax revenue to changes in nominal economic output.

Stationarity, estimation and inference

The augmented Dickey–Fuller (ADF) unit-root test is applied to ln(TAX), ln(GDP), Δln(TAX), and Δln(GDP). The primary test includes an intercept, allows up to two augmentation lags, and selects the lag using the Akaike Information Criterion (AIC). Fixed-lag specifications with zero and one augmentation lag are reported as sensitivity checks. Failure to reject a unit root is not proof that a series is integrated of order one; with 16 observations, ADF tests have limited power.

The baseline model is $\Delta\ln(TAX_t) = \alpha + \beta\Delta\ln(GDP_t) + \varepsilon_t$, estimated by OLS on 15 annual changes. Inference reports conventional OLS standard errors, heteroskedasticity-robust HC1 standard errors and HAC standard errors with one lag. The formal test of proportional responsiveness is H_0: $\beta = 1$ against H_1: $\beta \neq 1$. Residual diagnostics include Breusch–Pagan, Breusch–Godfrey (lag 1), Jarque–Bera and Ljung–Box (lag 1). A sensitivity model excludes the 2020 change observation; the full 2010–2025 sample remains the primary analysis.

The model is deliberately parsimonious given the small sample. It does not identify the causal effect of GDP, isolate discretionary tax changes, estimate long-run cointegration, or separately measure tax effort. Consequently, the regression slope is referred to as an estimated contemporaneous buoyancy association.

RESULT AND DISCUSSION

Descriptive patterns

Table 1. Central Government Tax Revenue, Nominal GDP, and Tax-to-GDP Ratio in Indonesia (2010 and 2025)

Indicator	2010	2025	Change
Central-government tax revenue (IDR trillion)	723.30	2387.28	—
Nominal GDP (IDR trillion)	6864.13	23821.10	—
Tax-to-GDP ratio (%)	10.54	10.02	-0.52 pp

The endpoint tax-to-GDP ratio decreases by approximately 0.52 percentage points, from 10.54% in 2010 to 10.02% in 2025. This is a modest endpoint decline, not evidence that the ratio

fell monotonically in every year. The 2025 revenue figure follows the latest author-selected BPS publication and is designated outlook in the source.

Annual tax-to-GDP ratio dynamics: 2010–2025

Table 2. Annual Tax Revenue, Nominal GDP Growth, and Tax-to-GDP Ratio Dynamics in Indonesia, 2010–2025

Year	TAX (IDR tn)	GDP (IDR tn)	Ratio (%)	Δ ratio (pp)	TAX growth (%)	GDP growth (%)
2010	723.30	6,864.13	10.537	—	—	—
2011	873.87	7,831.73	11.158	+0.621	+20.82	+14.10
2012	980.52	8,615.70	11.381	+0.222	+12.20	+10.01
2013	1,077.31	9,546.13	11.285	-0.095	+9.87	+10.80
2014	1,146.86	10,569.71	10.850	-0.435	+6.46	+10.72
2015	1,240.40	11,526.33	10.761	-0.089	+8.16	+9.05
2016	1,284.97	12,401.73	10.361	-0.400	+3.59	+7.59
2017	1,343.52	13,589.83	9.886	-0.475	+4.56	+9.58
2018	1,518.79	14,838.76	10.235	+0.349	+13.05	+9.19
2019	1,546.14	15,832.66	9.766	-0.470	+1.80	+6.70
2020	1,285.13	15,434.00	8.327	-1.439	-16.88	-2.52
2021	1,547.84	16,976.75	9.117	+0.791	+20.44	+10.00
2022	2,034.55	19,588.46	10.386	+1.269	+31.44	+15.38
2023	2,154.20	20,892.31	10.311	-0.076	+5.88	+6.66
2024	2,309.85	22,138.99	10.433	+0.122	+7.23	+5.97
2025	2,387.28	23,821.10	10.022	-0.412	+3.35	+7.60

The tax-to-GDP ratio increases in 6 annual transitions (2011, 2012, 2018, 2021, 2022, 2024) and decreases in 9 (2013, 2014, 2015, 2016, 2017, 2019, 2020, 2023, 2025). The endpoint difference is -0.516 percentage points, which should not be interpreted as a monotonic decline. By construction, the ratio increases in a year exactly when the proportional growth of TAX exceeds that of GDP. This annual decomposition is an accounting description, not an estimate of the effects of tax policy.

1) 2020: TAX grew -16.88% while nominal GDP grew -2.52%; the tax ratio changed -1.439 percentage points to 8.327%. The pandemic contraction must not be mistaken for improved tax mobilisation when both variables fall.
2) 2021: TAX grew +20.44% while nominal GDP grew +10.00%; the tax ratio changed +0.791 percentage points to 9.117%. This descriptive pattern alone cannot establish a tax-reform effect.
3) 2022: TAX grew +31.44% while nominal GDP grew +15.38%; the tax ratio changed +1.269 percentage points to 10.386%. This descriptive pattern alone cannot establish a tax-reform effect.
4) 2023: TAX grew +5.88% while nominal GDP grew +6.66%; the tax ratio changed -0.076 percentage points to 10.311%. This descriptive pattern alone cannot establish a tax-reform effect.
5) 2024: TAX grew +7.23% while nominal GDP grew +5.97%; the tax ratio changed +0.122 percentage points to 10.433%. This descriptive pattern alone cannot establish a tax-reform effect.

6) 2025: TAX grew +3.35% while nominal GDP grew +7.60%; the tax ratio changed -0.412 percentage points to 10.022%. This descriptive pattern alone cannot establish a tax-reform effect.

Because the ratio is calculated using central-government tax receipts rather than only DJP collections, its levels should not be conflated with differently defined official tax-ratio measures. The 2025 TAX value remains designated outlook in the cited BPS table.

Table 3. Augmented Dickey–Fuller (ADF) Unit Root Test Results

Series	ADF stat.	AIC p	Lag	N eff.	Lag 0 p	Lag 1 p
ln(TAX)	-1.1390	0.6993	0	15	0.6993	0.8663
ln(GDP)	-1.4903	0.5383	2	13	0.4422	0.7571
Δln(TAX)	-3.9773	0.0015	1	13	0.0102	0.0015
Δln(GDP)	-3.4681	0.0088	1	13	0.0136	0.0088

Under the AIC-selected specification, the ADF test fails to reject a unit root for the log levels of both variables ($p = 0.6993$ for tax revenue; $p = 0.5383$ for GDP). It rejects the unit-root null for their first log differences ($p = 0.0015$ and $p = 0.0088$, respectively). The fixed-lag sensitivity checks lead to the same 5% reject/non-reject pattern. This provides support for estimating the reported change-on-change model, without establishing a definitive integration order or a long-run equilibrium relationship.

Table 4. Estimated Tax Buoyancy Coefficients under Conventional OLS, HC1 Robust, and HAC Standard Errors

Statistic	OLS	HC1 robust	HAC (lag 1)
β on Δln(GDP)	2.4485	2.4485	2.4485
SE(β)	0.2868	0.1906	0.1916
95% CI for β	1.8290–3.0680	2.0369–2.8602	2.0345–2.8625
t for H_0: β = 1	5.0514	7.6018	7.5588
p for H_0: β = 1	0.000222	0.000004	0.000004
Intercept α	-0.1235	-0.1235	-0.1235
R^2	0.8487	0.8487	0.8487
Regression N	15	15	15

The fitted equation is $\Delta\ln(TAX_t) = -0.1235 + 2.4485\Delta\ln(GDP_t) + \varepsilon_t$. The estimated slope exceeds one; the conventional OLS 95% confidence interval is 1.8290–3.0680. The two-sided proportionality test yields $t = 5.0514$ and $p = 0.000222$, rejecting H_0: $\beta = 1$ at 5%. The result remains statistically significant under HC1 and one-lag HAC inference. Alternative standard errors change uncertainty estimates, not the OLS coefficient itself. The R^2 of 0.8487 is an in-sample fit measure, not evidence of causal identification or out-of-sample forecasting accuracy.

Table 5. Residual Diagnostic Test Results

Test	p-value	Interpretation at 5%
Breusch–Pagan	0.3053	No rejection of homoskedasticity
Breusch–Godfrey (lag 1)	0.2525	No rejection of no serial correlation
Jarque–Bera	0.7955	No rejection of residual normality
Ljung–Box (lag 1)	0.2172	No rejection of no lag-1 autocorrelation

Table 6. Sensitivity Analysis of Tax Buoyancy Estimates with and without the 2020 Observation

Model	N	β	R^2	p for H_0: β = 1 (OLS)
Main sample (2010–2025 changes)	15	2.4485	0.8487	0.000222
Exclude change observation 2020	14	2.4640	0.6850	0.010371

The diagnostic tests do not reject their respective null hypotheses, but low power in a 15-observation regression prevents treating these outcomes as proof that the assumptions hold. Removing the 2020 change observation yields β = 2.4640, close to the full-sample estimate of 2.4485; however, R^2 falls from 0.8487 to 0.6850. This single exclusion check does not establish robustness to all structural changes or influential years.

Additional robustness: endpoint sensitivity and leave-one-year-out influence

Table 7. Robustness Analysis of Tax Buoyancy Estimates Based on Alternative Sample Specifications

Specification	N	Intercept	β	R^2	p: H_0 β=1
Full sample	15	-0.1235	2.4485	0.8487	0.000222
Exclude 2020	14	-0.1250	2.4640	0.6850	0.010371
Exclude 2025 outlook	14	-0.1209	2.4368	0.8501	0.000388
Exclude 2020 and 2025	13	-0.1181	2.4075	0.6712	0.018208

The 2025-outlook exclusion is a sensitivity check, not a replacement for the author-approved baseline. Excluding an annual change observation retains the remaining observed growth pairs and does not reconstruct a synthetic two-year growth interval. The joint exclusion of 2020 and 2025 is reported only as a diagnostic comparison, given the further loss of degrees of freedom.

Table 8. Leave-One-Year-Out Sensitivity Analysis of Tax Buoyancy Estimates

Excluded change year	N	β	R^2	p: H_0 β=1
2011	14	2.4787	0.8349	0.000564
2012	14	2.4452	0.8474	0.000415
2013	14	2.4836	0.8569	0.000278
2014	14	2.5126	0.8788	0.000113
2015	14	2.4505	0.8495	0.000385
2016	14	2.4380	0.8496	0.000394
2017	14	2.4737	0.8708	0.000171
2018	14	2.4405	0.8537	0.000342
2019	14	2.4317	0.8466	0.000440
2020	14	2.4640	0.6850	0.010371
2021	14	2.3989	0.8823	0.000130
2022	14	2.2672	0.8177	0.001472
2023	14	2.4711	0.8521	0.000337
2024	14	2.5182	0.8688	0.000167
2025	14	2.4368	0.8501	0.000388

Across the 15 leave-one-year-out regressions, β ranges from 2.2672 (excluding 2022) to 2.5182 (excluding 2024). The largest conventional p-value for H_0: β = 1 is 0.010371 when excluding 2020. These are sensitivity results and must not be used to select a preferred sample post hoc.

Influence diagnostics identify 2022 as the observation with the largest Cook's distance (0.275; leverage 0.244). The heuristic 4/N threshold equals 0.267; exceeding it warrants inspection but is not an automatic deletion rule. Influence measures are descriptive and are especially sensitive in this small sample.

Interpreting the intercept, buoyancy and revenue ratio

The slope β = 2.4485 means that, within the fitted contemporaneous log-change specification, a one-percentage-point increase in nominal GDP log growth is associated with approximately 2.45 percentage points higher tax-revenue log growth, conditional on the model. It is neither a year-by-year descriptive buoyancy ratio nor a causal estimate of what a GDP intervention would produce. The negative intercept α = −0.1235 is the fitted log-revenue change when nominal GDP log change equals zero. It should not be interpreted as a structural annual decline in taxation: zero nominal GDP growth may lie outside the economically relevant support of the sample, and omitted factors may contribute to the intercept.

The exact identity $\Delta\ln(R_t) = \Delta\ln(T_t) - \Delta\ln(G_t)$, where $R_t = T_t/G_t$, yields $\Delta\ln(R_t) = -0.1235 + 1.4485\Delta\ln(G_t) + \varepsilon_t$ for the fitted model. The negative intercept can offset the above-unity slope at ordinary growth rates; annual residuals also affect the realised ratio. Ignoring residuals only for illustration, the fitted ratio change turns positive at nominal GDP log growth of approximately 0.0853 (8.53 log-percentage points). This is a model-derived threshold, not a policy target or a forecast. Thus the above-unity slope is fully compatible with the observed endpoint ratio decline of approximately 0.52 percentage points.

The difference is also visible from cumulative log changes: the full-period change in ln(TAX/GDP) is approximately −0.0502. A regression slope is estimated from annual co-movement around the fitted intercept, whereas the ratio path aggregates realised growth differences over time. Conflating these distinct objects would exaggerate the implications of $\beta > 1$ for fiscal capacity.

Comparison with earlier evidence and theoretical implications

The positive above-unit slope is broadly consistent with the proposition in Dudine and Jalles (2017) and Cornevin et al. (2023) that observed tax revenue can respond strongly to output changes, although their multi-country and dynamic estimands are not directly numerically comparable with this short national regression. The sensitivity checks respond to their methodological caution about estimator dependence. In relation to Setyoningrum and Purwanti (2020), the present study does not estimate the effects of corruption, economic composition or reform; it offers an updated Indonesia-specific aggregate association. Relative to Iskandar et al. (2021), it concerns central rather than local taxes. Unlike Sinaga et al. (2023), it does not estimate tax-specific or provincial long-run coefficients. Hill et al. (2025) underscores the importance of

the pandemic context, addressed here by retaining 2020 in the main sample and conducting a transparent exclusion sensitivity check.

The findings fit Musgrave's (1959) public finance framing by illustrating that fiscal revenue mobilisation must be assessed in relation to economic scale, not simply through the estimated elasticity-like coefficient. Ramsey (1927) and Diamond and Mirrlees (1971a, 1971b) clarify why tax structure and behavioural margins can mediate the translation of output into collections; the present bivariate regression does not estimate those mechanisms. The study therefore contributes a bounded empirical interpretation rather than a test of optimal-tax theory.

CONCLUSION

This study examined the contemporaneous relationship between central government tax revenue growth and nominal gross domestic product (GDP) growth in Indonesia from 2010 to 2025. The findings indicated that tax revenue responded more than proportionately to changes in nominal GDP, as reflected in an estimated tax buoyancy coefficient greater than unity. However, this responsiveness did not translate into a sustained increase in the tax-to-GDP ratio, which declined from 10.54% in 2010 to 10.02% in 2025, representing a decrease of 0.52 percentage points. This apparent divergence demonstrated that strong estimated revenue responsiveness did not necessarily indicate an improvement in cumulative tax revenue mobilization relative to economic output. The findings further highlighted the importance of considering the regression intercept, annual GDP growth patterns, and unexplained revenue fluctuations when interpreting tax buoyancy estimates. Although the results remained statistically significant under alternative standard error estimators and were relatively stable after excluding the 2020 observation, they represented statistical associations rather than evidence of causality or long-run tax elasticity.

The findings provided practical implications for evaluating tax revenue performance and informing fiscal decision-making in Indonesia. Policymakers should assess tax buoyancy alongside the tax-to-GDP ratio, revenue composition, and administrative performance rather than relying on a single indicator to evaluate fiscal capacity. A tax buoyancy coefficient exceeding unity should not automatically be interpreted as evidence of successful tax reform or sustainable revenue mobilization. Instead, fiscal assessments should distinguish between short-term revenue responsiveness and persistent improvements in the government's capacity to collect taxes relative to economic activity. The analysis was limited by the relatively short observation period, potential omitted variables, possible structural changes, and the provisional classification of the 2025 tax revenue figure. Future research should prioritize extending the observation period using consistent historical data, disaggregating tax revenue by major tax categories, and applying structural-break tests to account for economic disruptions and fiscal policy changes. Subsequent studies could also incorporate explicit tax reform indicators to distinguish automatic revenue responses from discretionary policy effects. These improvements would strengthen the interpretation of tax revenue dynamics and provide a more comprehensive empirical foundation for sustainable fiscal policy planning.

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