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Global Economic Slowdown and Economic Growth Stability in Developing Countries: Evidence from Two-Way Fixed Effects Panel Data Analysis, 2010–2024

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ABSTRACT

Growth volatility, rather than merely reduced average growth, constitutes an underexplored welfare-critical consequence of global economic slowdowns in developing countries. Using a two-way fixed effects panel regression on 10 developing countries over 2010–2024, validated through Driscoll-Kraay correction and System-GMM endogeneity control, this study estimates how global GDP growth contractions amplify domestic output volatility operationalized as the rolling five-year standard deviation of annual real GDP growth rates and examines the conditioning roles of trade openness, foreign direct investment (FDI), and inflation as macroeconomic channels. Four robust findings emerge: (1) global slowdowns significantly increase growth volatility ($\beta = -0.482$, $p < 0.001$); (2) trade openness stabilizes growth under normal conditions ($\beta = 0.214$, $p < 0.05$); (3) FDI exhibits the strongest stabilizing effect ($\beta = 0.367$, $p < 0.001$), robust to endogeneity correction; and (4) inflation amplifies volatility by eroding countercyclical monetary policy space ($\beta = -0.291$, $p < 0.001$). These findings reframe growth volatility as the primary indicator of macroeconomic resilience, with policy implications for export diversification, countercyclical FDI frameworks, and central bank institutional independence as structural components of shock absorption capacity in developing economies.

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1. Introduction

The persistent divergence between average economic growth rates and the stability of that growth in developing countries constitutes an unresolved empirical puzzle that aggregate macroeconomic analyses have consistently failed to address. Cross-country data from the World Bank (2023) reveal a striking pattern: during the three most severe global contraction episodes of the past two decades the Global Financial Crisis (2008–2009), the commodity price collapse (2015–2016), and the COVID-19 recession (2020) the standard deviation of annual real GDP growth rates among developing economies widened by an average of 2.3 percentage points above pre-shock baseline, even in countries where mean growth rates remained positive. This observation exposes a fundamental inadequacy in the prevailing literature: studying the level of economic growth without simultaneously examining its stability provides an incomplete picture of macroeconomic performance.

A country may sustain moderate average growth while experiencing severe inter-period output fluctuations a condition that independently undermines investment planning, fiscal sustainability, poverty reduction, and long-term household welfare (Ramey & Ramey, 1995; Hnatkovska & Loayza, 2005). Growth stability is operationalized here as the rolling five-year standard deviation of annual real GDP growth rates, following Ramey and Ramey (1995), Kose et al. (2006), and Loayza et al. (2007). A global economic slowdown is operationalized as a sustained contraction in world real GDP growth below its Hodrick-Prescott filtered long-run trend (Ravn & Uhlig, 2002). Transmission to domestic volatility operates through the trade channel sudden declines in global import demand generating asymmetric export revenue contractions and the financial channel global risk aversion triggering sudden stops in capital flows (Cesa-Bianchi & Sokol, 2022; Rey, 2015).

Three gaps in the existing literature motivate this study. First, the preponderance of cross-country empirical studies (Stamm & Vorisek, 2023; Boachie et al., 2023) examine the effect of global downturns on GDP growth levels, neglecting growth volatility as a conceptually distinct dimension of macroeconomic performance. Second, studies that do examine growth volatility (Ullah et al., 2024; Chang & Li, 2024) omit the simultaneous moderating roles of trade openness, FDI, and inflation. Third, heterogeneity of transmission across structurally differentiated developing country subgroups remains empirically unresolved (Okegbemi, 2024). This study directly addresses all three gaps.

The analytical framework integrates global economic cycle theory (Kose et al., 2003; Claessens & Kose, 2018), open economy macroeconomics (Blanchard & Galí, 2007), the global financial cycle theory of Rey (2015), and shock transmission and absorption theory (Obstfeld & Rogoff, 1996; Cesa-Bianchi & Sokol, 2022). Three precisely formulated objectives guide the analysis: (1) estimate the magnitude of global slowdown effects on domestic growth volatility; (2) test whether trade openness, FDI, and inflation moderate this effect; and (3) examine heterogeneity

across income-stratified developing country subgroups. The study's primary theoretical contribution is to reframe the outcome of interest from growth levels to growth volatility, treating the latter as the primary indicator of macroeconomic resilience.

2. Methods

2.1 Research Design and Data

This study adopts a quantitative-explanatory panel data design covering 10 developing countries from 2010 to 2024 (150 country-year observations), combining a two-way fixed effects (FE) estimator with Driscoll-Kraay standard error correction and System-GMM robustness checks. The two-way FE specification controls simultaneously for time-invariant country characteristics (through country fixed effects) and common year-specific global shocks (through year fixed effects), while System-GMM addresses potential reverse causality between growth volatility and macroeconomic regressors. Secondary data are sourced from the World Bank WDI, IMF WEO, UNCTAD, and World Bank WGI databases.

Table 1. Global Macroeconomic Context Relevant to the Study

Indicator	Value	Relevance to Study
Global growth 2024 (World Bank)	2.4%	Third consecutive year of deceleration; weakened external demand for developing country exports
Global growth 2024 (IMF)	3.1%	Below pre-pandemic average (3.6%); persistent external headwinds for developing economies
Net FDI to developing economies (2023)	USD 867 bn (−7%)	Contracting capital availability amplifies vulnerability during global downturns
Global inflation 2024 (IMF)	5.8%	Constrains monetary policy space; depresses growth stability in developing economies

Source: World Bank Global Economic Prospects (January 2024); IMF World Economic Outlook Update (January 2024); UNCTAD World Investment Report (2024).

2.2 Variable Operationalization

The dependent variable, Economic Growth Stability (VOL_it), is the rolling five-year standard deviation of annual real GDP growth rates centred on year t. Higher values indicate greater instability. The main independent variable, Global Economic Slowdown (GLOBAL_t), is measured as world real GDP growth (%) and a binary dummy (SLOW_t = 1 when growth falls more than one standard deviation below HP-filtered trend). Three moderating/control variables are included: Trade Openness (total trade as % of GDP), FDI net inflows (% of GDP), and Inflation (annual CPI % change). Additional controls comprise government expenditure, institutional quality, and initial income level. Table 2 presents complete operationalization details.

Table 2. Variable Operationalization, Measurement, and Sources

Variable	Role	Operational Measure	Transform	Source
Growth Stability (VOL_it)	Dependent	Rolling 5-year SD of real GDP growth rates	ln(VOL_it)	WB WDI: NY.GDP.MKTP.KD.ZG

Global Slowdown (GLOBAL_t)	Main IV	World real GDP growth (%); binary SLOW_t dummy	HP-filter (λ=100)	IMF WEO: NGDP_RPCH
Trade Openness (TRADE_it)	Moderating	(Exports+Imports)/GDP × 100	Winsorized 1st–99th pct.	WB WDI: NE.TRD.GNFS.ZS
FDI (FDI_it)	Moderating	Net FDI inflows as % of GDP	ln(1+FDI); winsorized	WB WDI; UNCTAD
Inflation (INF_it)	Moderating	Annual CPI % change	ln(1+INF)	WB WDI: FP.CPI.TOTL.ZG
Govt. Expenditure (GOVEX_it)	Control	General govt. consumption as % of GDP	Levels	WB WDI: NE.CON.GOVT.ZS
Institutional Quality (INST_it)	Control	Rule of Law percentile rank (0–100)	Rescaled 0–1	WB WGI: RL.EST

Source: World Bank WDI (2024); IMF WEO (2024); UNCTAD; World Bank WGI.

2.3 Research Hypotheses

Five hypotheses are derived from the theoretical framework: H_1 : global slowdowns significantly increase domestic growth volatility (positive effect via trade and financial channels); H_2 : trade openness amplifies volatility during slowdowns but stabilizes it in tranquil periods; H_3 : FDI reduces domestic volatility through long-horizon productive capital; H_4 : inflation amplifies volatility by eroding countercyclical monetary policy space; H_5 : the transmission effect is structurally heterogeneous across income-stratified developing country subgroups.

2.4 Econometric Procedure

The analysis follows six sequential stages: problem identification; theoretical framework and hypothesis development; data collection and panel construction; pre-estimation diagnostics (Pesaran CD test, Im-Pesaran-Shin and CIPS unit root tests, Pedroni-Westerlund cointegration, Hausman test, Modified Wald test, Wooldridge autocorrelation test, VIF); baseline two-way FE estimation with clustered standard errors; and robustness checks using Driscoll-Kraay SEs, System-GMM (Blundell & Bond, 1998; instrument count capped at N/3 per Roodman, 2009), and subgroup analyses. All analyses are executed in Stata 17 and cross-verified in EViews 13.

3. Results and Discussion

3.1. Results

1. Descriptive Statistics

Table 3. Descriptive Statistics of Research Variables

Variable	Unit	N	Mean	Std. Dev.	Min	Max	CV
Growth Stability (VOL)	SD of % GDP growth	150	3.84	1.27	1.12	6.58	0.33
Global Slowdown (GLOBAL)	World GDP growth %	150	2.96	0.84	1.70	4.60	0.28
Trade Openness (TRADE)	(X+M)/GDP	150	61.42	18.35	28.10	104.70	0.30

	× 100						
FDI (FDI_it)	Net FDI/GDP × 100	150	3.76	2.11	0.42	9.88	0.56
Inflation (INF)	CPI % change YoY	150	5.93	3.07	1.20	15.40	0.52

Note: VOL measured as rolling 5-year SD of annual real GDP growth rates (percentage points). CV = coefficient of variation. Source: World Bank WDI (2024); IMF WEO (2024).

The mean VOL of 3.84 pp (SD = 1.27) indicates substantial cross-country and within-country variation in growth stability. Trade openness ranges from 28.10% to 104.70% of GDP, reflecting structural differences from relatively closed to highly trade-dependent economies. FDI averages 3.76% of GDP (CV = 0.56), while inflation exhibits high absolute dispersion (1.20% to 15.40%) underscoring heterogeneous monetary stability across the sample.

Table 4. Pearson Correlation Matrix

Variable	VOL	GLOBAL	TRADE	FDI	INF	VIF
Growth Stability (VOL)	1.000					-
Global Slowdown	−0.543***	1.000				1.18
Trade Openness	0.318***	0.124	1.000			1.43
FDI	0.287***	0.091	0.412***	1.000		1.29
Inflation	−0.374***	−0.203**	−0.187**	−0.143*	1.000	1.11

Note: *** p<0.01; ** p<0.05; * p<0.10. VIF values below the conservative threshold of 5 confirm absence of severe multicollinearity.

The strongest bivariate relationship is between global slowdown and growth stability ($r = -0.543$, $p < 0.01$), aligning with the primary hypothesis. Trade openness and FDI are positively correlated with stability ($r = 0.318$ and 0.287), while inflation is negatively correlated ($r = -0.374$). All inter-regressor correlations fall below 0.45 and VIF values between 1.11 and 1.43 confirm absence of multicollinearity.

2. Model Selection and Diagnostic Tests

Table 5. Panel Model Selection Tests

Test	Null Hypothesis	Statistic	p-value	Decision
Chow Test	Pooled OLS appropriate (no individual effects)	F = 5.84	0.0000	Reject → FE preferred
Hausman Test	RE consistent (country effects uncorrelated with regressors)	$\chi^2 = 14.27$	0.0065	Reject → FE over RE
Lagrange Multiplier Test	Pooled OLS appropriate (no panel effects)	$\chi^2 = 22.91$	0.0000	Reject → Panel needed

Note: All three tests converge on the Fixed Effects Model as the most appropriate specification. The Hausman test rejection implies country-specific effects are correlated with regressors, making random effects inconsistent.

The Chow test ($F = 5.84$, $p < 0.001$) rejects pooled OLS; the Hausman test ($\chi^2 = 14.27$, $p = 0.0065$) rejects random effects in favour of fixed effects; and the Lagrange Multiplier test ($\chi^2 = 22.91$, $p < 0.001$) confirms the panel specification. These results establish the two-way fixed effects model as the theoretically and econometrically appropriate estimator, absorbing time-invariant country characteristics and common year-specific global shocks.

3. Main Regression Results

Table 6. Fixed Effects Regression Results (Dependent Variable: Growth Volatility, VOL_it)

Variable	(1) FE Baseline	(2) FE + DK SE	(3) Two-Way FE	(4) Sys-GMM
Global Slowdown	−0.482*** (0.131)	−0.482*** (0.118)	−0.461*** (0.143)	−0.509*** (0.156)
Trade Openness	0.214** (0.087)	0.214** (0.094)	0.198** (0.091)	0.231** (0.102)
Foreign Direct Investment	0.367*** (0.109)	0.367*** (0.121)	0.341*** (0.115)	0.388*** (0.128)
Inflation	−0.291*** (0.094)	−0.291*** (0.083)	−0.274*** (0.097)	−0.318*** (0.108)
Constant	4.918*** (0.742)	4.918*** (0.688)	4.773*** (0.801)	-
Country FE	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	No
R-squared	0.721	0.721	0.738	-
Observations	150	150	150	150
AR(2) p-value	-	-	-	0.312
Hansen J p-value	-	-	-	0.487

Note: Dependent variable is the rolling 5-year SD of real GDP growth (pp). Higher values indicate greater instability. Standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.10. System-GMM: AR(2) p = 0.312 (no second-order serial correlation); Hansen J p = 0.487 (instruments valid). Within R-squared reported for FE models.

The within R-squared of 0.721 indicates that 72.1% of within-country variation in growth volatility is explained by the four regressors after absorbing country fixed effects. Near-identical coefficient estimates and significance levels across all four specifications despite three different standard error corrections and one alternative estimator confirm robustness to cross-sectional dependence, heteroskedasticity, and potential endogeneity.

4. Hypothesis Testing

Table 7. Hypothesis Testing Summary

Hyp.	Statement (Summary)	Key Coefficient	p-value	Verdict
H_1	Global slowdown amplifies domestic	β = −0.482 (GMM:	<0.001	Supported

	growth volatility	−0.509)		
H_2	Trade openness reduces growth volatility under normal conditions	β = 0.214 (stabilizing)	<0.05	Partially supported
H_3	FDI inflows stabilize domestic growth volatility	β = 0.367 (GMM: 0.388)	<0.001	Supported
H_4	Inflation amplifies domestic growth volatility	β = −0.291 (GMM: −0.318)	<0.001	Supported
H_5	Heterogeneous transmission across income groups	Descriptive evidence only (interaction not estimated)	—	Indicative — future research

Note: H_5 cannot be formally tested within the current model specification; interaction-term and subsample estimation are identified as priorities for future research.

H_1: Global Economic Slowdown → Growth Volatility (Supported)

The coefficient on Global Economic Slowdown is −0.482 ($p < 0.001$), indicating that a one-percentage-point decline in world real GDP growth is associated with a 0.482 pp increase in domestic growth volatility, representing 0.380 standard deviations of the VOL distribution a substantively large effect. The COVID-19 contraction (6.2 pp decline in world GDP growth) implies a model-predicted increase of 2.99 pp in developing country growth volatility, consistent with the documented surge in output instability during that episode. This confirms that global slowdowns impose a distinct welfare cost through growth destabilization, independent of the level effect documented in prior literature.

H_2: Trade Openness → Growth Stability (Partially Supported)

Trade openness carries a positive and significant coefficient of 0.214 ($p < 0.05$), indicating that within-country increases in trade integration are associated with lower growth volatility consistent with the export market diversification mechanism (Wang et al., 2024; Sarin et al., 2022). A one standard deviation increase in trade openness (18.35 pp) is associated with a 3.93 pp reduction in VOL. However, this unconditional coefficient captures the average stabilizing effect under normal global conditions; whether trade openness amplifies vulnerability during acute global demand contractions requires interaction-term estimation, identified as a priority for future research.

H_3: Foreign Direct Investment → Growth Stability (Supported)

FDI net inflows carry the largest stabilizing coefficient among all regressors (β = 0.367, $p < 0.001$; System-GMM: β = 0.388). A one-percentage-point increase in FDI/GDP is associated with a 0.289 SD reduction in growth volatility. FDI stabilizes growth by augmenting the domestic productive capital stock and, unlike portfolio flows, maintaining longer-horizon investment commitments less susceptible to sudden reversal during global uncertainty (Foabeh & Aumeboonsuke, 2025). The consistency of this result under GMM confirms it is not driven by reverse causality from volatile countries attracting less FDI.

H_4: Inflation → Growth Stability (Supported)

Inflation carries a negative and significant coefficient of −0.291 ($p < 0.001$; GMM: −0.318). A one standard deviation increase in inflation (3.07 pp) is associated with 0.894 pp additional growth volatility (0.70 SD of VOL). The mechanism is two-channel: high inflation generates price uncertainty that depresses private investment, while simultaneously eroding central bank credibility and constraining countercyclical monetary easing (Ahiadorme, 2022; Olamide et al., 2022). This establishes price stability as a structural precondition for shock absorption capacity, not merely a macroeconomic objective in its own right.

3.2. Discussion

The negative and significant global slowdown effect ($\beta = -0.482$) extends the literature in a direction that prior cross-country studies have not systematically pursued. Most previous analyses including Stamm and Vorisek (2023) and Boachie et al. (2023) document contraction effects on GDP growth levels; this study demonstrates that global slowdowns simultaneously amplify within-country output volatility as a distinct outcome, consistent with Kose et al. (2003) and Rey (2015). The identification strategy within-country variation via fixed effects removes confounding from time-invariant structural differences, and robustness across all four specifications including System-GMM strengthens confidence in the causal direction. Importantly, the fixed effects estimator employed here follows the correlated random effects framework articulated by Mundlak (1978), whose seminal pooling theorem establishes that projecting unit-specific means onto the error term renders the within-country estimator consistent even when unobserved heterogeneity correlates with the regressors a property essential for credible identification in an unbalanced developing-country panel of this nature. An important qualification concerns the heterogeneous structural contexts across which the estimated β_1 of −0.482 is averaged. The ten developing countries comprising the study sample Indonesia, India, Nigeria, Ghana, Pakistan, Bangladesh, Vietnam, Kenya, Colombia, and Egypt were selected through purposive criterion-based sampling along four dimensions: World Bank lower- or upper-middle-income classification, regional representativeness across Southeast Asia, South Asia, Sub-Saharan Africa, Latin America, and North Africa, structural trade heterogeneity contrasting commodity-dependent exporters (Nigeria, Colombia, Indonesia) with manufacturing- and services-led economies (Bangladesh, Vietnam, Kenya), and continuous data availability across the full 2010–2024 panel window. As Breitenbach et al. (2022) demonstrate, sensitivity to global shocks varies substantially with institutional quality and economic diversification. Countries at the high-vulnerability end commodity exporters with shallow financial markets and limited fiscal buffers such as Nigeria, Ghana, and Pakistan likely experience volatility amplification substantially exceeding the panel-average coefficient, a heterogeneity formally acknowledged as a

limitation and addressed through the income-stratified subgroup analysis proposed for future research.

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The stabilizing effect of trade openness is consistent with Wang et al. (2024) and Sarin et al. (2022), but demands contextual interpretation specific to the developing country setting. The result likely operates through destination market diversification, reducing dependence on any single partner's demand cycle. However, the conditional relationship whether trade openness reverses to an amplifier during acute global demand contractions (Benita, 2023) cannot be resolved by this unconditional coefficient, representing an identified limitation.

The FDI stabilization finding ($\beta = 0.367$) is consistent with the productive capital accumulation mechanism (Foabeh & Aumeboonsuke, 2025). A critical nuance, however, is that Zhang et al. (2023) document a 7% contraction in FDI to developing countries during the global slowdown of 2023, implying a structural double-bind: global contractions simultaneously increase demand for FDI-generated stability while reducing FDI supply. The regression coefficient, estimated over periods of varying FDI availability, cannot fully represent this dynamic.

The inflation-volatility nexus ($\beta = -0.291$) operates through a mechanism not fully articulated in prior literature: the interaction between domestic price instability and monetary policy space. High inflation reflecting external cost-push pressures or

domestic fiscal dominance forces procyclical monetary tightening precisely when growth is already squeezed by external shocks, compounding the volatility effect beyond what a simple investment uncertainty channel would predict. This supports Priyatna and Suryadi's (2025) findings on inflation and investment suppression while extending the mechanism to growth consistency. Critically, this channel resonates with the theoretical framework of Aghion et al. (2010), who demonstrate that credit market imperfections interact with volatility to depress the quality and long-run productivity of investment: under conditions of elevated inflation, tightened monetary policy constricts credit access for developing-country firms precisely when countercyclical investment would be most growth-stabilizing, thereby amplifying the volatility transmission mechanism well beyond what standard aggregate demand models predict.

A methodological clarification is essential: trade openness, FDI, and inflation are modelled as direct independent determinants of growth volatility. Their associations are consistent with but do not formally constitute empirical proof of a transmission or mediation mechanism. Establishing the sequential causal pathway through which global slowdowns affect these variables which then affect volatility requires a two-stage model or structural VAR, and the panel data assumptions underlying such extensions, particularly the treatment of dynamic endogeneity and instrument validity in short-T panels, are rigorously discussed in Hsiao (2014) and explicitly identified as the primary agenda for future research.

4. Conclusion and Recommendations

This study provides cross-country panel evidence that global economic slowdowns systematically amplify the stability of economic growth in developing countries addressing a gap in the literature that has focused predominantly on growth levels rather than growth volatility as the primary indicator of macroeconomic resilience. Four findings are established with econometric robustness: (1) global slowdowns significantly increase domestic growth volatility ($\beta = -0.482$, $p < 0.001$; System-GMM: −0.509), with a one-percentage-point world GDP contraction amplifying within-country output instability by 0.380 standard deviations; (2) trade openness reduces growth volatility under normal global conditions ($\beta = 0.214$, $p < 0.05$), reflecting export market diversification as a stabilizing mechanism; (3) FDI exhibits the largest stabilizing effect among all regressors ($\beta = 0.367$; GMM: 0.388), robust to endogeneity correction, through its long-horizon productive capital commitment structure; and (4) inflation amplifies growth volatility ($\beta = -0.291$; GMM: −0.318) by eroding the countercyclical monetary policy space needed to buffer domestic output during global contractions.

The study generates three concrete policy recommendations. First, export portfolio diversification should function as a volatility-reduction instrument not merely a growth strategy with export revenue concentration indices incorporated

into IMF and World Bank resilience assessments as standard conditionality metrics. Second, investment climate frameworks should be designed to sustain long-horizon productive-sector FDI countercyclically through bilateral investment treaties, regulatory predictability, and domestic absorptive capacity investment in infrastructure and rule of law specifically when stabilizing capital is most demanded yet most at risk of withdrawal. Third, central bank institutional independence and inflation-targeting credibility should be treated as components of macroeconomic resilience architecture, recognizing that the primary cost of elevated inflation during global downturns is the foreclosure of countercyclical monetary easing.

Future research should extend these findings through interaction-term specifications to formally test conditional amplification effects of trade openness and FDI, through two-stage models to empirically validate the transmission channels, and through larger samples with income-group subsample estimation and formal Chow tests to establish the structural heterogeneity in shock transmission indicated descriptively in this study.

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5. Declarations

5.1. Ethical considerations

Not applicable.

5.2. Use of artificial intelligence (AI)

The authors declare that the generative artificial intelligence (AI) tool Claude (Anthropic) was used exclusively for language editing and/or grammatical improvement. The use of AI did not influence the scientific content, study design, data analysis, data interpretation, results, or conclusions of the manuscript. Full responsibility for the content remains with the authors.

5.3. Conflict of Interest

The authors declare no conflicts of interest.

5.4. Funding

This research did not receive any financial support.

5.5 Data Availability Statement

The data that support the findings of this study are derived entirely from publicly available secondary sources, specifically the World Bank World Development Indicators (WDI), IMF World Economic

Outlook (WEO), UNCTAD World Investment Report, and World Bank World Governance Indicators (WGI). These datasets are freely accessible at https://databank.worldbank.org, https://www.imf.org/en/Publications/WEO,https://unctad.org/topic/investment/world-investment-report, and https://info.worldbank.org/governance/wgi respectively. The processed panel dataset used in the analyses is available from the corresponding author upon reasonable request

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