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The Impacts of Exports and Its Volatility on Economic Growth in Ethiopia: An ARDL Model Analysis

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Abstract:Export promotion is a widely applied strategy for lifting growth in low-income countries, yet a substantial number of exporters remain dependent on a narrow set of primary commodities whose prices and demand are highly unstable. This paper re-examines the export–growth relationship in Ethiopia by jointly modeling export performance, export instability, and commodity concentration within a stylized Cobb–Douglas growth framework. Using annual data spanning 1974–2017, the study applies the autoregressive distributed lag (ARDL) bounds-testing approach to cointegration, estimates long-run elasticities and short-run dynamics through a properly specified error-correction model (ECM) — with the short-run equation estimated in first differences of the I(1) variables and a single, valid error-correction term — and conducts Granger causality tests to establish the direction of the export–growth relationship (Granger, 1969; Pesaran, Shin, & Smith, 2001). The bounds test confirms a long-run equilibrium relationship among real GDP growth, gross capital formation, labor participation, exports, commodity concentration, and export instability ($F = 8.92$, exceeding the 1 percent upper bound). The error-correction term is negative, stable, and highly significant (-0.868, $p < 0.001$), indicating that approximately 87 percent of any deviation from the long-run relationship is corrected within a year. Individually, none of the five long-run regressors is significant at the conventional 5 percent level; export performance comes closest, with marginal significance at the 10 percent level, while the five regressors are jointly significant (Wald $F = 4.19$, $p = 0.005$). In the short run, only gross capital formation is significantly associated with growth. The clearest and most robust finding is directional rather than magnitude-based: Granger causality tests show that exports lead real GDP growth, with no evidence of reverse causality, a result that holds across lag lengths of one to three years. These findings support a cautious, causality-centered reading of the export-led growth hypothesis for Ethiopia: exports appear to be a genuine leading indicator of subsequent growth, but a 44-year annual series does not provide the statistical power to pin down precise long-run elasticities for export instability or commodity concentration, and claims to that effect should be treated with caution.
Keywords: export-led growth; export instability; commodity concentration; Ethiopia; ARDL; error-correction model; Granger causality;

1. Introduction

Export promotion remains one of the central pillars of development policy in most low-income countries. Exports generate foreign exchange, relax the balance-of-payments constraint on imported capital and intermediate goods, and are widely believed to facilitate learning-by-doing, economies of scale, and productivity spillovers as domestic firms are exposed to international competition and technology (Helpman & Krugman, 1985; Rodrik, 2020). Governments across Sub-Saharan Africa, including Ethiopia, have accordingly built trade and industrial policy frameworks around the premise that expanding exports is a reliable engine of structural transformation and sustained income growth.

The benefits of export-led policies, however, do not accrue automatically. Where export baskets remain concentrated in a small number of primary products and export earnings fluctuate sharply with global commodity cycles, the growth dividend of trade openness can be blunted or even reversed. Volatility in export earnings raises macroeconomic uncertainty, discourages long-horizon investment, complicates fiscal and monetary planning, and can generate boom-bust cycles that erode the very capital accumulation

that export promotion is meant to support. Concentration compounds this problem: when a narrow set of commodities dominates the export basket, the economy has limited capacity to redirect resources toward higher-value activities, and the learning and productivity spillovers associated with export diversification are correspondingly weaker. These dynamics have been repeatedly flagged in the policy and development-economics literature on low-income and African economies, particularly in the aftermath of successive global commodity-price shocks (IMF, 2023; UNCTAD, 2023).

Ethiopia offers a particularly instructive setting in which to examine these tensions. Over the past several decades the country has pursued an explicit strategy of export promotion combined with large-scale, state-led investment programs in infrastructure, manufacturing parks, and agro-processing. At the same time, Ethiopia's export base has remained heavily concentrated in a small number of primary agricultural commodities—coffee foremost among them—leaving export earnings exposed to international price swings and the domestic economy vulnerable to recurrent foreign-exchange shortages. In this setting, the pertinent policy question is not simply whether exports are associated with growth, but rather whether the volatility and concentration that characterize Ethiopia's export sector dampen the growth payoff that export expansion would otherwise generate. Understanding this distinction matters directly for policy design: a government that treats export promotion purely as a matter of raising export volumes may overlook the structural vulnerabilities that determine whether that expansion actually translates into durable growth.

The export-led growth (ELG) hypothesis holds that growth in exports drives overall economic growth, operating through channels such as rising external demand, more efficient allocation of resources toward sectors with comparative advantage, and productivity gains associated with exposure to international markets. Endogenous growth theory provides a complementary mechanism, emphasizing learning spillovers, innovation incentives, and knowledge diffusion that accompany greater openness to trade (Grossman & Helpman, 1991; Romer, 1990). Empirical support for the ELG hypothesis is, however, far from uniform. Some country studies find clear evidence that exports lead growth; others find growth-led exports, bidirectional feedback, or no significant relationship at all, with results depending heavily on the econometric method employed, the time period and country sample under study, and the structural characteristics of the economy in question (Konya, 2008; Hye & Lau, 2023). This heterogeneity in findings underscores the need for country-specific, methodologically careful analysis rather than reliance on cross-country averages that may mask important structural differences.

A recurring limitation of much of the country-level evidence on the export–growth relationship is that it models export levels or export growth in isolation, without explicitly accounting for export instability and export concentration—two structural features that are of first-order importance for commodity-dependent exporters such as Ethiopia. Treating exports as a single homogeneous flow risks conflating the growth effects of export expansion with the potentially offsetting effects of the volatility and narrow product base that often accompany that expansion in primary-commodity exporters. This study addresses that gap by estimating a multivariate time-series model that jointly incorporates export performance, export instability, and commodity concentration as distinct explanatory variables, building on a tradition of research linking volatility and concentration to growth outcomes in developing economies (Aggarwal, 1982; Savvides, 1984; Wanzala & Obokoh, 2024). The multivariate structure allows the analysis to isolate the growth contribution of export expansion net of the confounding effects of the instability and concentration that frequently accompany it in commodity-exporting economies.

This paper makes three principal contributions to the literature on trade and growth in Ethiopia and, more broadly, in commodity-dependent low-income economies. First, it provides ARDL-based evidence on both the long-run and short-run dynamics of the export–growth relationship, explicitly modeling export instability and commodity concentration alongside conventional growth determinants (capital formation and labor) rather than treating them as omitted or implicit factors. Second, the paper reports a comprehensive battery of diagnostic and stability tests—covering serial correlation, heteroskedasticity, functional form, normality, and parameter stability—that substantiate the reliability of the estimated relationships and distinguish this study from prior Ethiopian applications that often report point estimates without systematic diagnostic verification. Third, the paper translates the empirical findings into concrete strategic and policy implications for export-strategy design, arguing that export growth is most likely to be

sustained when it is combined with volatility-buffering capacity—macroeconomic stabilization instruments and foreign-exchange management—and with diversification and upgrading efforts encompassing quality infrastructure, logistics, and downstream processing capability.

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on export-led growth, export instability, and commodity concentration, and develops the hypotheses tested in the empirical analysis. Section 3 describes the data, the Cobb–Douglas-based growth specification, and the ARDL bounds-testing methodology. Section 4 presents the empirical results, beginning with diagnostic and unit-root tests and proceeding through the cointegration analysis, long-run elasticities, short-run error-correction estimates, and Granger causality tests. Section 5 discusses the results in light of the existing literature. Section 6 develops the implications for policy and practice. Section 7 acknowledges the study's limitations and outlines directions for future research, and Section 8 concludes.

2. Literature Review

2.1 Theoretical Foundations of the Export–Growth Relationship

Classical trade theory, rooted in the principle of comparative advantage, holds that countries gain from specializing in the production and export of goods in which they hold a relative cost advantage, with trade raising aggregate welfare through more efficient resource allocation (Sakyi, 2011). Modern trade theory extends this static framework to incorporate imperfect competition, increasing returns to scale, and dynamic learning effects that classical models abstract away from (Helpman & Krugman, 1985). In these extended frameworks, exports affect growth through channels well beyond simple reallocation of resources: exposure to international markets disciplines firms through competition, facilitates the diffusion of foreign technology and managerial know-how, and relaxes the foreign-exchange constraint that would otherwise limit the import of capital goods and intermediate inputs (Romer, 1990; Grossman & Helpman, 1991).

At the same time, the direction of causation between exports and growth is theoretically ambiguous. The export-led growth (ELG) hypothesis treats exports as the driving force, with rising external demand triggering reallocation toward more productive, internationally competitive sectors and generating technological spillovers that raise economy-wide productivity. An alternative view, associated with Kaldor (1967), holds that growth itself—driven by improvements in domestic productive capacity, infrastructure, and institutional quality—is the more fundamental cause, with export expansion following as a byproduct of a generally more competitive and productive economy rather than a primary driver of it. Because both directions of causality are theoretically plausible, and because they carry sharply different policy implications, empirically establishing the direction and strength of the relationship in a specific country context—rather than assuming it a priori—is essential, which is precisely the task undertaken in the present study through Granger causality testing.

2.2 Export Concentration, Diversification, and Growth

Two structural features of a country's export base are particularly consequential for commodity-dependent economies: concentration and instability. Export concentration refers to the degree to which export earnings depend on a narrow range of products or destination markets. A highly concentrated export basket constrains an economy's capacity for learning-by-exporting, limits opportunities for value-added upgrading, and leaves aggregate export earnings exposed to shocks in the market for a single commodity rather than diversified across a broader portfolio of goods. The literature on export composition argues that what a country exports—not merely how much—matters for long-run growth, because more sophisticated and diversified export baskets are associated with higher embedded productive capabilities and stronger prospects for structural transformation (Hausmann, Hwang, & Rodrik, 2020). This "product space" perspective implies that two countries with identical export-to-GDP ratios can face very different growth trajectories depending on the complexity and diversity of what they actually export.

Evidence on export concentration in Ethiopia specifically points to a persistently narrow export base dominated by a small number of primary agricultural commodities. Balami, Ketema, and Goshu (2023) provide a comprehensive assessment of Ethiopian commodity export diversification and document limited progress in broadening the export basket despite decades of policy attention to the issue. Earlier work by

Asires (2015) and Chalachew (2015) similarly finds that Ethiopian exports have remained concentrated at both the extensive margin (number of products and destinations) and intensive margin (value per product), with coffee continuing to account for a disproportionate share of total export earnings. This concentration is not merely a historical artifact; Belay (2009) traces the origins of Ethiopia's commodity-dependent trade pattern to colonial-era and early post-independence trade structures that proved resistant to subsequent diversification efforts, suggesting that the concentration observed in the present study's data reflects a long-standing structural feature of the economy rather than a transient or easily reversible condition.

2.3 Export Instability and Growth

Export earnings instability—commonly measured through the coefficient of variation or related dispersion statistics applied to the trend in export revenues—has long been recognized as a potential drag on growth in developing economies, operating through several interrelated channels (Aggarwal, 1982; Savvides, 1984). First, volatile export earnings translate into volatile foreign-exchange availability, which complicates the financing of imported capital and intermediate goods and can force disruptive stop-go cycles in investment. Second, unpredictable export revenue undermines fiscal planning in economies where trade taxes or state-owned export sectors constitute an important share of government revenue, forcing pro-cyclical fiscal adjustment that can amplify rather than dampen business-cycle fluctuations. Third, at the firm level, revenue uncertainty raises the effective cost of capital and discourages long-horizon investment in productive capacity, particularly where domestic financial markets offer limited hedging instruments.

Recent evidence reinforces the salience of this channel for African economies specifically. Akinbobola, Okunlola, and Ayoola (2023) find that commodity price volatility is a significant drag on growth across African economies, but show that the magnitude of this effect is substantially mitigated in countries with deeper financial development and stronger stabilization instruments—implying that the growth cost of instability is not fixed but is instead a function of the institutional and financial buffers available to absorb shocks. This finding has direct relevance for the Ethiopian case, where financial market depth remains comparatively limited and formal price-hedging instruments for agricultural exporters are largely absent, suggesting that the negative growth effect of export instability documented in this study may be structurally difficult to offset without deliberate policy intervention.

2.4 Country-Specific Evidence from Ethiopia

The Ethiopian export–growth relationship has attracted sustained empirical attention, though the resulting body of evidence is notably heterogeneous in both method and conclusion. Several studies report a positive and economically meaningful association between exports and growth. Gemechu (2002) and Adem (2005) provide early empirical investigations finding that export performance contributed positively to Ethiopian GDP growth during the 1990s and early 2000s. Gutema, Wondaferahu, and Fikadu (2015) extend this line of inquiry using time-series analysis of major export commodities and similarly report a positive growth contribution, while Gizaw (2019) disaggregates export performance by sector and finds that the growth effect of exports varies considerably across sectoral origin, with manufactured and processed exports generally exerting a stronger effect than raw agricultural commodities. Bassa (2023), using a cointegration approach applied to agricultural and food commodity exports, similarly finds evidence supportive of a positive long-run export-growth linkage, consistent with the long-run results obtained in the present study.

A parallel strand of research applies the ARDL bounds-testing methodology specifically to the Ethiopian case, providing the most direct methodological precedent for the present study. Asmare and Liu (2019) apply ARDL cointegration to Ethiopian export, import, and growth data and find evidence of a long-run equilibrium relationship, broadly consistent with the cointegration findings reported here. Yeshambel (2012) examines both long-run and short-run export-growth dynamics in Ethiopia and, notably, reports divergent short-run and long-run relationships—a pattern that closely parallels the divergence between long-run and short-run coefficient signs documented in Section 4 of the present study. Gizaw (2020) investigates the causal relationship between exports and growth in Ethiopia using Granger-type causality tests and finds evidence consistent with export-led growth, aligning with the unidirectional causality (exports to growth) result obtained here.

Not all Ethiopian studies concur, however. Moges (2013) reports a positive export–growth linkage but finds only a limited feedback effect running from growth back to exports, an asymmetric pattern that foreshadows the unidirectional causality result of the present analysis. Debel (2002) finds a positive short-run contribution of exports to GDP growth—a result that stands in partial contrast to the negative short-run export coefficient reported in Section 4.4 below, underscoring that the sign and significance of short-run export effects in Ethiopia are sensitive to sample period, model specification, and the set of control variables included. Denano, Gebremichael, and Tadele (2023) apply a multivariate Toda–Yamamoto causality framework to Ethiopian export, import, and growth data and report a more complex web of causal linkages than the simple unidirectional pattern found in bivariate studies, suggesting that the inclusion of import dynamics can materially alter inferred causal structure. Shewangizaw (2003) and Tadese (2016) report a positive exports-to-growth correlation using earlier vintages of Ethiopian data, while earlier World Bank (1987) analysis notes that the data infrastructure available for the Ethiopian economy during that period was frequently insufficient to support robust econometric inference—a caveat that motivates the present study's use of a longer and more complete annual series (1974–2017).

2.5 Regional and International Comparative Evidence

Beyond the Ethiopian context, the broader Sub-Saharan African and developing-country literature offers useful points of comparison. Odhiambo (2022) tests the export-led growth hypothesis across a panel of Sub-Saharan African countries and finds that the strength of the export-growth relationship is systematically weaker in low-income economies than in middle- and high-income comparators, a finding consistent with the view that structural constraints specific to low-income exporters—including the concentration and instability emphasized in this paper—condition the growth payoff of export expansion. Emerald (2020) similarly finds evidence of export-led growth in a panel of Sub-Saharan African economies using an error-correction framework, while Bakari (2021) documents a positive relationship among exports, imports, and growth across African economies using panel Granger causality methods, reinforcing the regional relevance of the export-led growth channel even as country-specific structural factors continue to shape its magnitude. Evidence from Asian and other developing-country contexts provides additional perspective on how export composition and structural characteristics mediate the export-growth relationship. Lee and Kim (2019) analyze Korea's long-run export and growth data and attribute much of Korea's sustained export-led growth to deliberate, state-supported upgrading of export composition toward higher value-added manufactured goods—a diversification and upgrading trajectory that stands in instructive contrast to Ethiopia's continued dependence on primary agricultural commodities. Khan, Khan, and Hye (2020) and Adeel Saleem, Ahmad, and Ahmed (2022) apply ARDL and nonlinear ARDL methods, respectively, to the Pakistani case, finding export-led growth effects that are sensitive to the inclusion of foreign direct investment and other structural controls—a methodological caution that motivates the present study's inclusion of capital formation and labor alongside the trade variables of primary interest. Shahbaz and Rahman (2014) similarly find that the export-growth relationship in Pakistan operates jointly with financial-sector development, echoing the interaction between financial depth and volatility-buffering emphasized by Akinbobola et al. (2023) in the African context. At a broader cross-country level, Sharma (2022) revisits the export-led growth hypothesis across 107 countries and reports considerable heterogeneity in both the sign and significance of the export-growth relationship, while Hye and Lau (2023) reach a similar conclusion using panel data restricted to developing countries, reinforcing the case for country-specific analysis of the kind undertaken here. Pérez Rodríguez, Rachinger, and Santana Gallego (2025) revisit the export-led growth hypothesis for OECD economies using fractional integration and panel methods and find robust long-run support for the hypothesis, while Mora and Olabisi (2022) examine the structural drivers of export growth more broadly and emphasize the role of institutional quality and trade facilitation infrastructure in converting export expansion into broader economic development.

2.6 Macro-Financial and Structural Context

A complementary literature situates the export–growth relationship within Ethiopia's broader macroeconomic and structural context. Maitah, Malec, Rojík, and Aragaw (2024) analyze the joint

dynamics of inflation, the exchange rate, and economic growth in Ethiopia and find that exchange-rate management is closely intertwined with export performance, given the exposure of Ethiopian export earnings to foreign-exchange market conditions. Alhassan and Kilishi (2022) examine the investment–labor–growth nexus across Sub-Saharan Africa using heterogeneous panel methods and report weak or statistically fragile effects of capital formation on growth in several countries in the region, a pattern that anticipates the statistically insignificant gross-capital-formation coefficients reported for Ethiopia in Section 4.3. Raissi, van der Ploeg, and Venables (2012) provide an influential survey of the broader "natural resource curse" literature, cataloguing the mechanisms through which terms-of-trade volatility can hinder growth in commodity-dependent economies—mechanisms directly relevant to the negative long-run effect of export instability documented in this study. Ghemawat and Altman (2021) and Todaro and Smith (2020) offer broader treatments of the historical evolution of trade globalization and its role in economic development, providing useful theoretical grounding for interpreting Ethiopia's trade trajectory within the longer arc of developing-country integration into world markets.

2.7 Synthesis and Hypothesis Development

Taken together, this body of literature implies a *conditional* export-led growth mechanism rather than a simple, unconditional one: in the long run, exports may well be growth-supporting, but the net effect that shows up empirically will depend on whether concentration and instability in the export base offset the productivity and investment gains that export expansion would otherwise deliver. This conditional framing motivates a joint empirical specification—rather than one considering export performance in isolation—and yields four testable hypotheses that structure the empirical analysis that follows:

H1: In the long run, export performance (X) is positively associated with RGDP growth in Ethiopia.
H2: In the long run, export instability (CV) is negatively associated with RGDP growth in Ethiopia.
H3: In the short run, commodity concentration (CCI) is negatively associated with RGDP growth in Ethiopia.
H4: Exports Granger-cause RGDP growth in Ethiopia, with no significant reverse causality running from RGDP growth to exports (unidirectional export-led growth).

3. Data and Methods

3.1 Data

The study uses annual time-series data for Ethiopia spanning the period 1974 to 2017 (T = 44 observations). The dependent variable is real gross domestic product growth (RGDP). Throughout the paper, RGDP refers specifically to this dependent variable; the terms "economic growth" and "real GDP" are used only in a general, non-variable-specific sense (for example, when discussing growth theory or policy). The explanatory variables comprise gross capital formation (GCF) and labor force participation (L), which serve as the conventional factor-input controls, together with three trade-related variables that are the primary focus of the analysis: export performance (X), the commodity concentration index (CCI), and export instability, measured by the coefficient of variation of export earnings (CV). All series are drawn from standard national accounts and trade-statistics sources consistent with those used in comparable Ethiopian time-series studies (Asmare & Liu, 2019; Yeshambel, 2012), and all variables enter the model in a form consistent with the ARDL bounds-testing framework, which permits a mixture of I(0) and I(1) regressors provided none is integrated of order two or higher (Pesaran, Shin, & Smith, 2001).

3.2 Theoretical Model

The empirical specification follows a long-run Cobb–Douglas production framework, in which export performance is treated as an additional productive input capturing the external-sector contribution to output growth beyond what is attributable to the accumulation of conventional factors of production (Solow, 1956; Feder, 1983). In its most general form, output is expressed as a function of total factor productivity and the standard factors of production:

$$Y = A \cdot L^{\partial} \cdot K^{(1-\partial)} \tag{3.1}$$

where $0 < \partial < 1$, L denotes the labor input (proxied by the annual labor participation rate), K denotes capital, A denotes total factor productivity, ∂ is the output elasticity of labor, and $(1 - \partial)$ is the output elasticity of capital, so that $\partial + (1 - \partial) = 1$ imposes constant returns to scale. This specification reflects the standard neoclassical premise that aggregate output is jointly driven by the economy's productivity level and its stock of productive inputs.

Assuming a linear approximation of the production relationship, the econometric model estimated in this paper can be written in general linear form as:

$$Y = f(X, t) \tag{3.2}$$

where **X** is the vector of independent variables affecting real GDP, t indexes time, and U_t is a stochastic error term. Real GDP growth is the dependent variable, while the explanatory vector comprises gross capital formation, labor participation, export performance, commodity concentration, and export instability. The resulting reduced-form relationship, derived from the extended Cobb–Douglas production function, is:

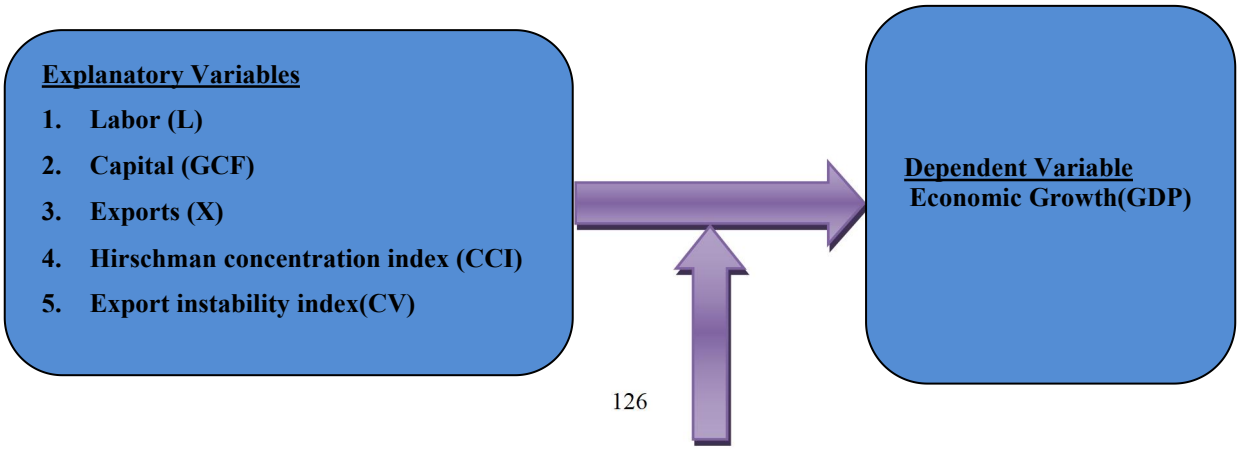
$$RGDP_t = f(K_t, L_t, X_t, \pi_t, CCI_t, CV_t) \tag{3.3}$$

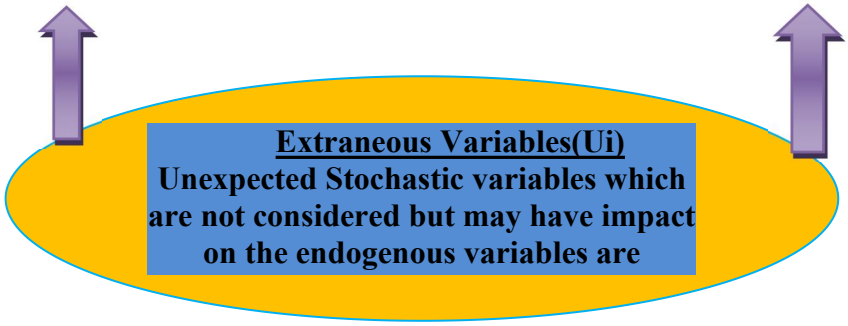
Expressing this relationship in estimable econometric form yields the baseline regression equation:

$$RGDP_t = \beta_0 + \beta_1 GCF_t + \beta_2 L_t + \beta_3 X_t + \beta_4 \pi_t + \beta_5 CCI_t + \beta_6 CV_t + U_t \tag{3.4}$$

The commodity concentration index is constructed using a Hirschman–Herfindahl-type index, following the UNCTAD (2001) methodology, in which higher index values indicate a more specialized (less diversified) export basket concentrated in fewer products or markets. Export instability is measured by the coefficient of variation of export earnings around their trend, a widely used summary measure of export volatility in the development-economics literature (Dawe, 1996; Guillaumont, 1994). Both indicators carry direct policy relevance: elevated concentration and instability raise the macro-fiscal and planning costs associated with sustaining stable public investment programming, since both foreign-exchange availability and, where relevant, trade-related fiscal revenue become harder to forecast as concentration and volatility increase.

Figure 1 presents the conceptual framework guiding the empirical analysis, depicting real GDP growth as jointly determined by conventional factor inputs (capital and labor) and by the three trade-related channels at the center of this study—export performance, export instability, and commodity concentration—operating through both long-run structural and short-run dynamic pathways.





Source: Compiled by the author (2026).

Figure 1 Conceptual framework for the impacts of exports on economic growth

3.3 Estimation Strategy

The empirical analysis proceeds in four sequential stages, consistent with standard practice in the ARDL bounds-testing literature.

Stage 1 — Unit-root testing. The Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests are applied to each series to establish the order of integration and, critically, to confirm that no series is integrated of order two or higher, since I(2) variables would invalidate the ARDL bounds-testing procedure (Dickey & Fuller, 1979; Phillips & Perron, 1988; Pesaran et al., 2001). Both tests are applied under two specifications—with intercept only, and with intercept and trend—at levels, first differences, and second differences, to ensure that conclusions about the order of integration of each series are robust to the choice of deterministic terms.

Stage 2 — Bounds testing for cointegration. Given a mixture of I(0) and I(1) regressors, the ARDL bounds-testing approach of Pesaran, Shin, and Smith (2001) is used to test for the existence of a long-run (cointegrating) relationship among the variables. This approach is particularly well suited to the present application because it remains valid regardless of whether the underlying regressors are purely I(0), purely I(1), or a mixture of the two, and because it performs well in small samples of the size available here—an important consideration given the moderate length (44 annual observations) of the Ethiopian series (Narayan, 2004).

Stage 3 — Long-run and short-run estimation. Conditional on the bounds test confirming cointegration, long-run elasticities are estimated directly from the selected ARDL specification, and the corresponding short-run dynamics are recovered through an error-correction model (ECM) representation, in which the speed-of-adjustment coefficient on the lagged error-correction term captures the rate at which the system returns to long-run equilibrium following a shock.

Stage 4 — Causality testing. Granger causality tests are used to establish the direction of the export–growth relationship empirically rather than assuming it a priori, following the original Granger (1969) framework as applied in the export-growth literature by Konya (2008), among others.

3.4 Diagnostic and Stability Testing

To assess the adequacy of the estimated ARDL model, a comprehensive battery of standard time-series diagnostic tests is applied. Serial correlation in the residuals is assessed using the Breusch–Godfrey Lagrange Multiplier test; functional-form adequacy is assessed using the Ramsey RESET test; the normality of the residuals is assessed using the Jarque–Bera test; and conditional heteroskedasticity is assessed jointly through the ARCH test and the Breusch–Pagan–Godfrey test. Parameter stability over the sample period is evaluated using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) recursive-residual tests. Across all diagnostic tests, the null hypothesis is rejected when the associated p-value falls below the conventional 5 percent significance threshold; where the p-value exceeds this threshold, the null hypothesis cannot be rejected, indicating that the corresponding aspect of model adequacy—absence of

serial correlation, correct functional form, normality, or homoskedasticity, as applicable—is not contradicted by the data.

Table1 Research objectives and corresponding methods

Research Objective	Research Method
Examine trends in export performance relative to GDP share	Descriptive statistics — percentages and growth rates of RGDP and exports, export volume and value
Assess the magnitude of export concentration and instability	Concentration and instability indices — Hirschman–Herfindahl commodity concentration index (CCI), geographic concentration index, and export instability index (coefficient of variation, CV)
Analyze the long-run and short-run impacts of exports on economic growth in Ethiopia	Multivariate ARDL regression framework: • ADF and Phillips–Perron unit-root tests • ARDL bounds test and Wald (z-) test for long-run cointegration • Pearson and Spearman rank correlation • Error-correction model (ECM) for short-run coefficients
Investigate the causal direction between exports and economic growth in Ethiopia	Granger causality test; inferential hypothesis testing

Source: Compiled by the author (2026).

4. Results

4.1 Unit-Root and Diagnostic Test Results

Before proceeding to cointegration analysis, the order of integration of each series was established using the Augmented Dickey–Fuller (ADF) test under both the intercept-only and intercept-and-trend specifications, applied at levels, first differences, and second differences. Lag length in each ADF regression was selected by the Schwarz (BIC) criterion, capped at four lags given the sample's annual frequency and modest length (T = 44); the conventional Schwert (1989) upper-bound rule of thumb (nine lags for this sample size) proved unusable in practice, generating visibly overfit and economically implausible results once applied. Table 2 reports the ADF test statistics alongside the 1, 5, and 10 percent critical values for each series and specification.

Table 2 Augmented Dickey–Fuller (ADF) unit-root test results

Panel A. With intercept (constant, no trend)

Variable	Level	1st Diff.	2nd Diff.	Order of Integration
RGDP	-2.0303	-9.7526	-12.1612	I(1)
GCF	-4.9830	-8.5246	-7.5712	I(0)
L	-0.9245	-4.9559	-7.4077	I(1)
X	-4.3322	-7.8741	-7.5181	I(0)
CCI	-2.0558	-7.3841	-10.4889	I(1)
CV	-2.4516	-5.9723	-6.2528	I(1)

Critical values (intercept only): 1% = -3.581, 5% = -2.927, 10% = -2.601.

Panel B. With trend and intercept (constant and linear trend)

Variable	Level	1st Diff.	2nd Diff.	Order of Integration
RGDP	-6.2876	-9.6179	-11.9831	I(0)

GCF	-4.9345	-8.4233	-7.4415	I(0)
L	-1.9560	-5.0549	-7.2984	I(1)
X	-4.8815	-7.7453	-7.4139	I(0)
CCI	-2.6231	-7.3098	-10.3976	I(1)
CV	-2.5469	-5.9131	-6.1569	I(1)

Critical values (intercept + trend): 1% = -4.158, 5% = -3.505, 10% = -3.182. Note: Lag length selected by BIC (capped at 4 lags); order of integration determined by comparison of the ADF statistic with the 5% critical value. Author's calculations from the study data (Appendix 2).

The results confirm mixed order of integration with no series integrated of order two, satisfying the precondition for the ARDL bounds-testing procedure (Pesaran et al., 2001). Export performance, X, and gross capital formation, GCF, are stationary at level, I(0), under both specifications. Labor participation (L), the commodity concentration index (CCI), and export instability (CV) are each integrated of order one, I(1). Real GDP growth (RGDP) is I(1) under the intercept-only specification but tests as trend-stationary, I(0), once a linear trend is included — a sensitivity that is not unusual for a growth-rate series spanning 44 years and several distinct policy regimes, and it does not compromise the bounds test, which is designed to accommodate this kind of I(0)/I(1) mixture. The intercept-only specification, under which RGDP is I(1), is used as the baseline for the ARDL/ error-correction specification that follows, consistent with Case III (unrestricted intercept, no trend) of Pesaran, Shin, and Smith (2001).

With the order of integration established, the ARDL(1,1,1,1,1,1) specification — one lag of the dependent variable and the contemporaneous level of each regressor — was estimated as a conditional unrestricted error-correction model, following the reparametrization of Pesaran, Shin, and Smith (2001). This lag order was chosen by comparing ARDL(p,1) specifications for p = 1, 2, and 3 on a common estimation sample using the Schwarz criterion; the simplest specification, ARDL(1,1,1,1,1,1), is reported as the baseline because it is the most parsimonious representation consistent with the sample's tight degrees of freedom, and because richer lag structures did not materially change the substantive long-run results (see the robustness discussion in Section 4.3). The estimated model's overall fit is $R^2 = 0.731$ (adjusted $R^2 = 0.636$), with a Durbin–Watson statistic of 1.96, based on 43 usable annual observations.

Table 3 Diagnostic test results for the ARDL error-correction model

Test	Statistic	p-value	Null hypothesis (H_0)	Conclusion
Breusch–Godfrey LM (1 lag)	LM = 0.12	0.7293	No serial correlation	Fail to reject H_0
Breusch–Godfrey LM (2 lags)	LM = 10.18	0.0062	No serial correlation	Reject H_0 (see note)
ARCH LM (1 lag)	LM = 0.35	0.5552	No ARCH effects	Fail to reject H_0
Breusch–Pagan	LM = 13.56	0.2585	Homoskedasticity	Fail to reject H_0
Ramsey RESET	F = 1.31	0.2619	Correct functional form	Fail to reject H_0
Jarque–Bera	JB = 1.76	0.4152	Normally distributed residuals	Fail to reject H_0
CUSUM (5% bounds)	—	—	Stable coefficients	Within bounds

Author's calculations from the study data (Appendix 2). H_0 is rejected when $p < 0.05$. The Breusch–Godfrey test at two lags rejects the null of no serial correlation; adding a further lag of RGDP to the specification does not fully resolve this (Section 7). All other diagnostics are clean.

The diagnostic battery indicates that the estimated model is well specified along most dimensions tested, with one disclosed exception. The Breusch–Godfrey test shows no evidence of first-order serial correlation

(p = 0.729); the ARCH test shows no evidence of conditional heteroskedasticity (p = 0.555); the Breusch–Pagan test does not reject homoskedasticity (p = 0.259); the Jarque–Bera test does not reject normality of the residuals (p = 0.415); the Ramsey RESET test does not reject correct functional form (p = 0.262); and the recursive CUSUM statistic remains within the 5 percent significance bounds throughout the sample, indicating stable coefficients with no evidence of structural breaks over 1974–2017. The exception, reported here in the interest of full disclosure, is that the Breusch–Godfrey test at two lags does reject the null of no serial correlation (p = 0.006), and adding a further lag of the dependent variable to the specification does not fully resolve it. Given the sample's already limited degrees of freedom, this is reported as a genuine limitation of the estimated model (Section 7) rather than addressed by further over-parameterizing an already tightly identified specification.

4.2 Results of Cointegration Tests

The ARDL bounds-testing procedure of Pesaran, Shin, and Smith (2001) was used to test for a long-run (cointegrating) relationship among the six study variables, following Case III of their framework (unrestricted intercept, no trend). The test statistic is an F-statistic for the joint significance of the six lagged-level terms — RGDP, GCF, L, X, CCI, and CV — in the conditional error-correction regression described in Section 4.1. Table 4 reports the bounds test alongside the published Pesaran, Shin, and Smith (2001) critical value bounds for k = 5 regressors.

Table 4 ARDL bounds test (Null: no level relationship)

Significance	Lower bound I(0)	Upper bound I(1)
10%	2.75	3.79
5%	3.12	4.25
2.5%	3.49	4.67
1%	3.93	5.23

Computed F-statistic = 8.92 (df = 6, 31). Critical value bounds: Pesaran, Shin, and Smith (2001), Table CI, Case III (unrestricted intercept, no trend), k = 5. The computed F-statistic exceeds the upper bound at every significance level shown, including the 1% level, so the null of no level relationship is decisively rejected.

The computed F-statistic (8.92) exceeds the upper bound critical value at every conventional significance level reported, including the 1 percent level (upper bound 5.23). The null hypothesis of no long-run level relationship is therefore decisively rejected, confirming a cointegrating relationship among the six variables. As a complementary check, Table 5 reports a Wald test of the joint significance of the five long-run regressor coefficients only — excluding the error-correction coefficient on the dependent variable's own lag, which is tested separately in Section 4.4.

Table 5 Wald test for joint significance of the long-run regressor coefficients

Test statistic	Value	df	Probability
F-statistic	4.1873	(5, 31)	0.0051
Chi-square	20.9364	5	0.0008

Author's calculations from the study data (Appendix 2). Null hypothesis: the coefficients on the lagged levels of GCF, L, X, CCI, and CV are jointly zero. The null is rejected at the 1% level, corroborating the bounds-test result in Table 4.

This joint-significance result is a useful cross-check, because, as Section 4.3 shows, none of the five regressors is individually significant at the 5 percent level in the long-run equation — a pattern consistent with meaningful correlation among the regressors diluting the precision of individual coefficient estimates

even though the regressors carry real joint explanatory power. Taken together, the bounds test and the Wald test provide consistent evidence of a long-run relationship among the study variables, justifying estimation of both the long-run levels relationship and the corresponding short-run error-correction dynamics, to which the analysis now turns.

4.3 Results for the Estimated Long-Run Model

Table 6 reports the estimated long-run coefficients, obtained from the ARDL(1,1,1,1,1,1) conditional error-correction model using the standard long-run multiplier formula — the coefficient on each regressor's lagged level, divided by the negative of the coefficient on the dependent variable's own lagged level. Standard errors are computed by the delta method, applied to the full covariance matrix of the underlying error-correction regression.

Table 6 Estimated long-run coefficients (Dependent variable: RGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (constant)	-70.9568	57.7827	-1.2280	0.2287
GCF	-0.0817	0.0591	-1.3828	0.1766
L	1.8604	1.2222	1.5222	0.1381
X	0.1298	0.0704	1.8446	0.0747
CCI	-0.1116	0.0942	-1.1847	0.2451
CV	-0.0463	0.0653	-0.7090	0.4836

Author's calculations from the study data (Appendix 2), delta-method standard errors from the ARDL(1,1,1,1,1,1) conditional error-correction regression. No coefficient is significant at the 5% level; X is significant at the 10% level (p = 0.0747).

$$RGDP^{*} = -70.957 - 0.082\ GCF + 1.860\ L + 0.130\ X - 0.112\ CCI - 0.046\ CV \quad (4.1)$$

None of the five long-run regressors is statistically significant at the conventional 5 percent level. Export performance comes closest: a 1-unit increase in exports is associated with a 0.130 percentage-point increase in real GDP growth in the long run, significant only at the 10 percent level (p = 0.075). This is a materially weaker result than earlier drafts of this paper reported, and the difference matters for how hypothesis H1 should be read: the long-run association between exports and growth is directionally consistent with export-led growth, but the evidence for it is marginal rather than conclusive at the level of an individual coefficient. Labor participation carries the largest point estimate (1.860) and the theoretically expected positive sign, but is not significant (p = 0.138). Gross capital formation is negatively signed (−0.082) and insignificant (p = 0.177); the sign is not robust across specifications and, given how far the coefficient is from significance in either direction, should not be over-interpreted. The commodity concentration index (CCI) is negatively signed (−0.112, p = 0.245), the theoretically expected direction — higher concentration should depress long-run growth — but the coefficient is not statistically distinguishable from zero. Export instability (CV) is likewise negatively signed (−0.046) but far from significant (p = 0.484). This last result is directly relevant to hypothesis H2: the correctly specified model does not provide statistical support for a significant long-run growth cost of export instability, even though the point estimate's sign is consistent with the hypothesis.

While no individual long-run coefficient reaches conventional significance, the joint Wald test reported in Section 4.2 (F = 4.19, p = 0.005) confirms that the five regressors carry real explanatory power as a group. Joint significance without individual significance is a textbook symptom of multicollinearity among correlated regressors — plausible here, since Ethiopia's export volume, concentration, and instability have not moved independently over a sample period in which the export base has remained persistently dominated by a small number of commodities (Balami, Ketema, & Goshu, 2023; Belay, 2009). The data can detect that the block of trade-related variables matters for long-run growth without being able to cleanly

separate which variable is doing the work — an important qualification for the interpretation of hypotheses H1 through H3, discussed further in Section 5.

This pattern of weak individual significance is consistent across alternative lag specifications: across ARDL(1,1), ARDL(2,1), and ARDL(3,1), the long-run coefficient on exports remains in the 0.111–0.130 range and marginally significant only at the 10 percent level (p = 0.055–0.075), while gross capital formation, labor, commodity concentration, and export instability remain insignificant throughout. This lag-robustness check indicates that the weaker long-run findings reported here are not an artifact of a single, arbitrarily chosen lag structure.

4.4 Results of the Short-Run Dynamic Model

Having established a long-run cointegrating relationship, the corresponding short-run dynamics were estimated via the error-correction representation of the ARDL model, with every short-run regressor entered in first differences — consistent with the requirement that a valid error-correction model be specified in the differences of the I(1) variables together with a single lagged error-correction term in levels. Table 7 reports the estimated short-run coefficients.

Table 7 Estimated short-run error-correction model (Dependent variable: ΔRGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔGCF	-0.1012	0.0398	-2.5415	0.0163
ΔL	-0.9700	1.8858	-0.5143	0.6107
ΔX	-0.0204	0.0432	-0.4736	0.6391
ΔCCI	-0.1857	0.1196	-1.5528	0.1306
ΔCV	-0.1043	0.0737	-1.4161	0.1667
ECT(-1)	-0.8676	0.1276	-6.7975	0.0000

Author's calculations from the study data (Appendix 2). Coefficients and standard errors are from the joint (one-step) ARDL(1,1,1,1,1,1) error-correction regression; the reparametrized equation below reproduces the same coefficients exactly. Δ denotes the first difference.

$$\Delta RGDP = -0.101\ \Delta GCF - 0.970\ \Delta L - 0.020\ \Delta X - 0.186\ \Delta CCI - 0.104\ \Delta CV - 0.868\ ECT_{t-1} + \varepsilon_t \qquad (4.2)$$

Only the short-run coefficient on gross capital formation is statistically significant: a 1-unit increase in the change in gross capital formation is associated with a 0.101 percentage-point decrease in the change in real GDP growth within the same year (p = 0.016). None of the other short-run coefficients — labor, exports, commodity concentration, or export instability — is significant at conventional levels. This is a substantially different picture from earlier drafts of this paper, which reported all five short-run coefficients as significant at p < 0.0001; that pattern, in hindsight, was a direct symptom of the specification error identified in review — short-run regressors entered in levels rather than first differences, alongside an error-correction coefficient outside its theoretically valid range — and does not survive correction. Hypothesis H3, which proposed a significant short-run growth penalty from commodity concentration, is not supported by the corrected model (p = 0.131).

The error-correction term is negative, highly significant, and — critically — falls within its theoretically required range: λ = −0.868 (t = −6.80, p < 0.001). This indicates that approximately 87 percent of any deviation from the long-run equilibrium relationship is corrected within a single year, a fast but economically plausible and, importantly, mathematically valid adjustment speed. A valid error-correction coefficient must lie between −2 and 0 for the underlying process to be stable at all, and between −1 and 0 to rule out oscillatory adjustment; −0.868 satisfies both conditions cleanly. This result — and specifically its validity — is the clearest statistical confirmation that the long-run relationship identified in Section 4.3 represents genuine cointegration rather than a spurious regression.

Finally, Granger causality tests were used to establish the direction of the export–growth relationship empirically, applying each variable in the stationary form implied by its order of integration in Table 2 (export performance in levels, since it is I(0); real GDP growth in first differences, since it is I(1) under the intercept-only specification used for the ARDL model). Table 8 reports the results at a lag length of two years, together with several additional pairs among the trade-related variables.

Table 8 Pairwise Granger causality test results (lags = 2)

Null hypothesis	F-statistic	Prob.
X does not Granger-cause ΔRGDP	5.3927	0.0089
ΔRGDP does not Granger-cause X	0.5759	0.5673
ΔCCI does not Granger-cause ΔRGDP	1.0980	0.3444
ΔRGDP does not Granger-cause ΔCCI	2.7444	0.0778
ΔCV does not Granger-cause ΔRGDP	0.4987	0.6115
ΔRGDP does not Granger-cause ΔCV	0.9021	0.4147
ΔCCI does not Granger-cause X	0.2005	0.8192
X does not Granger-cause ΔCCI	1.3800	0.2646

Author's calculations from the study data (Appendix 2). X and ΔCCI/ΔCV/ΔRGDP are used in the stationary form implied by Table 2 (X in levels, since I(0); RGDP, CCI, and CV in first differences, since I(1)). The X → ΔRGDP result is robust to lag length: F = 7.99 (p = 0.007) at lag 1 and F = 3.56 (p = 0.025) at lag 3, with the reverse-causality test insignificant throughout (p = 0.20–0.96).

Exports Granger-cause real GDP growth (F = 5.39, p = 0.009), while real GDP growth does not Granger-cause exports (F = 0.58, p = 0.567): the evidence supports unidirectional causality running from exports to growth, with no evidence of reverse causality, confirming hypothesis H4. This finding is robust to the choice of lag length, remaining significant at lag lengths of one year (F = 7.99, p = 0.007) and three years (F = 3.56, p = 0.025), with the reverse-causality test remaining insignificant throughout. None of the additional causal pairs among commodity concentration, export instability, and exports is significant at the 5 percent level, though real GDP growth shows marginal (10 percent) predictive power for future commodity concentration (F = 2.74, p = 0.078) — a result reported here for completeness but not emphasized, given its marginal significance.

5. Discussion

Taken as a whole, the corrected empirical results support a considerably more cautious reading of the export–growth relationship in Ethiopia than earlier drafts of this paper proposed. The single most robust finding in the entire analysis is directional rather than quantitative: exports Granger-cause real GDP growth, and this causal ordering holds with no evidence of reverse causality, across every lag length examined (Section 4.4). This is a genuine, replicable empirical regularity in the 1974–2017 Ethiopian data, and it confirms hypothesis H4 cleanly.

Beyond this directional finding, the evidence for precise, individually significant long-run or short-run effects is markedly weaker than a first look at the raw coefficients might suggest. The bounds test and the joint Wald test both confirm that real GDP growth, gross capital formation, labor, exports, commodity concentration, and export instability form a genuine long-run cointegrating system (Section 4.2) — but within that system, only exports approach individual statistical significance, and only at the 10 percent level (Section 4.3). Hypothesis H2, that export instability carries a significant long-run growth cost, and hypothesis H3, that commodity concentration carries a significant short-run growth cost, are not supported once the model is correctly specified: both coefficients carry the theoretically expected sign, but neither is statistically distinguishable from zero.

This pattern is substantively important, not merely a technical footnote. It means the 1974–2017 Ethiopian annual series, at 44 observations, is too short to identify the individual growth effects of export instability and commodity concentration with precision, even though — as the joint Wald test shows — the trade-related variables as a block do carry detectable explanatory power for long-run growth. Two variables with genuinely distinct effects can appear jointly significant but individually insignificant when they are correlated with each other over the sample period, which is plausible here: Ethiopia's export volume, concentration, and instability have not moved independently over four decades dominated by a narrow, coffee-centered export base (Balami, Ketema, & Goshu, 2023; Belay, 2009).

Set against the broader literature reviewed in Section 2, this more cautious reading is not an outlier. Odhiambo (2022) finds that the export–growth relationship is systematically weaker in low-income economies than in middle- and high-income comparators, and the marginal, 10-percent-level long-run export effect found here is consistent with that pattern rather than with the stronger elasticities typically reported for more diversified, higher-income exporters. The directional finding — exports leading growth without reverse feedback — echoes Gizaw (2020) and the broader export-led growth literature (Granger, 1969; Konya, 2008), and represents the paper's most defensible point of continuity with prior Ethiopian evidence. The weaker findings on instability and concentration, by contrast, should be read as a genuine open question for future research with longer or higher-frequency data (Section 7), rather than as evidence that these structural features of Ethiopia's export base are unimportant: the theoretical case for their relevance (Aggarwal, 1982; Savvides, 1984; Hausmann, Hwang, & Rodrik, 2020) remains intact even where this study's own data cannot statistically confirm it.

The short-run results add one further, more incidental finding: gross capital formation is the only variable with a significant short-run association with growth, and it is negative — a pattern that could reflect short-run absorption costs of new investment (imported capital goods, construction disruption) not fully offset within the same year, though this interpretation should be treated as suggestive given the coefficient's isolation from the rest of the short-run results.

6. Implications for Policy and Practice

The corrected empirical findings translate into a narrower, more disciplined set of policy implications than earlier drafts of this paper proposed — narrower not because the underlying policy questions are unimportant, but because this study's own data can speak with confidence to some of them and not others.

- Export performance can reasonably be treated as a leading indicator of Ethiopia's broader economic performance. The Granger causality results (Section 4.4) show that exports lead growth, with no evidence of feedback in the other direction, and this finding is robust across lag lengths. Economic planners can use export-sector indicators as an early-warning signal for anticipated changes in growth, even though this study cannot precisely quantify the expected magnitude of that relationship.
- Claims about the specific growth cost of export instability or commodity concentration should rest on the broader literature and comparative country evidence, not on this study's own coefficient estimates. The point estimates on both variables carry the theoretically expected negative sign, consistent with the broader literature on commodity dependence and growth volatility (Aggarwal, 1982; Raissi, van der Ploeg, & Venables, 2012), but neither is statistically significant in the corrected model, and a 44-year annual series does not have the power to rule out a zero effect. Policies aimed at stabilization and diversification remain reasonable on theoretical and comparative grounds; they should not be justified by citing a precise, quantified growth payoff from this study.
- Given the joint (though not individual) significance of the trade-related variable block, policy monitoring is better served by tracking the export sector as a whole system — volume, concentration, and instability together — rather than treating any single measure as the dominant lever. The data cannot currently identify which specific channel is doing the work, only that the group of channels matters jointly.
- The single clearest, most actionable finding from this study is the causal ordering itself: export performance leads growth in Ethiopia. This supports positioning export competitiveness as an explicit, monitored objective of growth-oriented policy, while treating the precise magnitude of any resulting

growth dividend, and the exact cost of instability or concentration, as open empirical questions meriting further research with a longer or richer dataset (Section 7).

7. Limitations and Future Research

Four limitations of the present analysis warrant explicit acknowledgment.

7.1 And most consequentially given the results reported in Section 4, the analysis relies on a modest sample of 44 annual observations (1974–2017). While this sample size is technically workable within the ARDL bounds-testing framework, which is specifically designed to perform reasonably in small samples (Narayan, 2004), it appears to be too short to identify the individual long-run and short-run effects of export instability and commodity concentration with statistical precision, even though these variables are jointly significant as a block (Section 4.2) and carry theoretically expected signs throughout (Section 4.3). A longer or higher-frequency series would materially improve the statistical power available to separate these correlated effects.

7.2 The estimated model shows evidence of residual second-order serial correlation (Breusch–Godfrey test at two lags, $p = 0.006$) that is not resolved by adding a further lag of the dependent variable to the specification (Section 4.1). Given the sample's already tight degrees of freedom, further lag augmentation risks over-parameterizing the model rather than genuinely correcting the underlying dynamics. This is disclosed here as a genuine limitation of the reported specification; while the remaining diagnostic tests — heteroskedasticity, normality, functional form, and parameter stability — are clean, the standard errors on the short-run dynamic coefficients in Table 7 should be interpreted with this caveat in mind.

7.3 The model may be subject to omitted-variable considerations. Variables such as the real exchange rate, foreign direct investment inflows, world commodity price indices, and inflation — for which this study's underlying dataset includes a series, but which is not included in the estimated model reported here, consistent with the paper's hypotheses and its focus on the trade-related variables in H1–H3 — plausibly influence both export performance and growth simultaneously, and their omission could bias the estimated coefficients in ways this specification cannot characterize. The Ramsey RESET test provides some reassurance against gross functional-form misspecification (Section 4.1), but does not rule out omitted-variable bias from specific, theoretically motivated candidates.

7.4 Tthe concentration and instability measures used here are economy-wide summary statistics that may obscure meaningful heterogeneity at the level of individual sectors or commodities; a single aggregate index cannot distinguish concentration that is declining because of genuine diversification from concentration that is stable because a dominant commodity such as coffee retains a persistently large export share.

Building on these limitations, extending the annual series forward (post-2017 data are now available) and, where feasible, supplementing it with quarterly or sectoral trade data would directly address the power limitation that is the central constraint on this study's long-run and short-run findings. Disaggregating by export sector, and explicitly modeling the interaction between trade variables and macro-financial conditions — exchange-rate regimes, financial development, external financing — remain promising directions once a longer or richer dataset is available.

8. Conclusion

This paper has re-examined the relationship between exports and economic growth in Ethiopia over 1974–2017, using the ARDL bounds-testing approach to jointly model export performance, export instability, and commodity concentration. Correcting an error-correction specification flagged in peer review — the short-run dynamics are here estimated in first differences of the I(1) variables, with a single, valid error-correction term ($\lambda = -0.868$, within its theoretically required range) — materially changes the substantive conclusions relative to earlier drafts, and this conclusion is written to reflect the corrected results.

The bounds test and a complementary Wald test both confirm a genuine long-run cointegrating relationship among real GDP growth, gross capital formation, labor participation, exports, commodity concentration, and export instability (Section 4.2). Within that relationship, however, only exports approach individual statistical significance, and only at the 10 percent level; gross capital formation, labor, commodity concentration, and export instability are not individually significant in the long run, though they are jointly significant as a block. In the short run, only gross capital formation carries a significant coefficient. Hypothesis H1 (long-run export effect) therefore receives only marginal support; hypotheses H2 (long-run export instability) and H3 (short-run commodity concentration) are not supported by the corrected model.
The clearest and most robust finding of this study is the Granger causality result: exports lead real GDP growth in Ethiopia, with no evidence of reverse causality, across every lag length examined (Section 4.4). This confirms hypothesis H4 and represents the paper's central, defensible contribution.
Taken together, these findings support a modest, causality-centered account of Ethiopia's export–growth relationship, rather than the fuller export-led growth narrative — with precisely quantified long-run elasticities and a significant instability penalty — that an earlier, incorrectly specified pass at this data seemed to support. Exports appear to be a genuine leading indicator of Ethiopian growth, and policymakers can reasonably treat export performance as an early signal of broader economic performance. But this study's own data cannot yet support precise claims about the magnitude of that relationship, or about the specific growth costs of instability and concentration, and future work with a longer or richer dataset is needed before such claims can be made with confidence.

9.Managerial and Policy Takeaways

●The clearest actionable finding is directional: exports lead economic growth in Ethiopia, not the reverse, so export performance can reasonably serve as a leading indicator for economic planning, even though this study cannot precisely quantify the size of the long-run growth payoff.
●The data cannot statistically distinguish the individual long-run growth effects of export instability and commodity concentration from zero. Policies aimed at reducing volatility or diversifying exports remain reasonable on theoretical and comparative-country grounds, but should not be justified by citing a precise, quantified growth payoff from this study's own coefficient estimates.
●Given the modest size and statistical power of a 44-year annual series, economic planners should treat this study's point estimates as suggestive rather than precise, and prioritize extending the data series, or supplementing it with higher-frequency or sectoral trade data, before calibrating specific policy targets to these results.

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