



Genuine Co-Movement, Spurious Trend, and a Ratio That Does Not Help: Variable Construction for Nigerian Macroeconomic Models

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Abstract: Macroeconomic models routinely include exchange-rate and trade variables side by side as separate regressors. This paper examines whether they are separate, using 67 quarterly Nigerian observations from 2008Q2 to 2024Q4, and reports two results that point in different directions. First, the co-movement among the exchange rate, exports, imports and total trade is genuine rather than a shared trend. Levels correlations run from 0.95 to 0.99, and they survive first differencing at 0.68 to 0.93, so this is not a spurious-regression artefact. Second, the co-movement between these series and GDP is spurious: the level correlation between the exchange rate and GDP is 0.607 and falls to -0.132 in differences, and trade against GDP falls from 0.599 to -0.106. This matters for a common variable-construction choice. Normalising trade by GDP is often justified as removing shared scale, but here the numerator and denominator have no genuine co-movement, and the available series compounds the problem by dividing nominal trade by real GDP. The resulting ratio reaches 189% of GDP and tests as $I(2)$, which invalidates the ARDL bounds procedure. We recommend testing correlations in differences before treating a ratio as a solution to collinearity, and checking that numerator and denominator share a price basis.

Keywords: Multicollinearity; Spurious Correlation; Trade Openness; Variable Construction; Nigeria.

JEL Classification: C52; F31; F41; O55.

1. INTRODUCTION

In an economy where export earnings concentrate in a few commodities, exchange-rate movements and trade volumes are unlikely to be independent. A currency that depreciates when export earnings fall will be observed moving with the trade series that caused the depreciation. Nigeria is a clear case, since crude oil has historically supplied most export earnings and foreign-exchange inflows.

When models include these as separate regressors without checking their association, coefficients can be unstable and hard to interpret even where a variance-inflation-factor check on the final specification looks clean, because that check depends on how each variable was built. This paper looks at the association directly and at what a common construction choice actually does.

1.1 What this paper contributes

- It reports correlations in levels and in first differences side by side, which separates genuine co-movement from shared trend.
- It finds the exchange-rate and trade cluster is genuine, and the association of both with GDP is not.
- It shows that a ratio normalisation commonly justified as removing shared scale does not do so here, and documents a units error that makes the ratio $I(2)$.
- It gives two concrete checks to run before constructing a ratio regressor.

2. LITERATURE REVIEW

2.1 Resource concentration

Corden and Neary (1982) formalise how a booming resource sector reshapes a small open economy through the real exchange rate. Sachs and Warner (2001) and Frankel (2010) document the empirical regularities of resource dependence, including exchange-rate sensitivity to commodity terms of trade. For an oil exporter this implies the exchange rate and trade aggregates are joint outcomes of a common commodity-price process, which is a substantive economic claim and not merely a statistical inconvenience.



2.2 Spurious correlation

Granger and Newbold (1974) showed that regressions among independent non-stationary series routinely produce high R-squared and apparently significant coefficients, and Phillips (1986) supplied the asymptotic theory. A correlation of 0.99 between two trending level series may say only that both trend. Differencing is the standard diagnostic: co-movement that survives it is not driven by a shared trend.

2.3 Ratios as a remedy

Normalising a variable by GDP is often presented as removing common scale and resolving collinearity, and a clean VIF in the final specification is offered as confirmation. Belsley, Kuh and Welsch (1980) develop collinearity diagnostics, and O'Brien (2007) cautions against mechanical VIF thresholds. What is less often noted is that a clean VIF is a property of the estimated specification and says nothing about whether the ratio is a coherent quantity.

3. METHOD

The dataset was originally assembled as 144 quarterly observations from 1990Q1. Everything before 2008 proved to be linearly interpolated from annual figures, with each series changing by a constant amount within the year and jumping at the boundary, so that period has been dropped. Trade openness was excluded because the available series divides nominal trade by real GDP and tests as $I(2)$. GDP is rebased in 2025 with an unadjusted splice, so 2025 is dropped. The working sample is 2008Q2 to 2024Q4, 67 quarters.

Pearson correlations were computed pairwise across the ten series on levels and, separately, on first differences. Cumulative growth of the components of the trade-openness ratio was compared over the sample to check whether numerator and denominator share a price basis, and the ratio was tested for integration order at level, first and second difference.

4. RESULTS

Table 1. Correlations in levels and in first differences

Pair	Levels	First differences	Change
ECH – Export	0.964	0.808	-0.157
ECH – Import	0.969	0.712	-0.258
ECH – Trade	0.978	0.832	-0.146
Export – Import	0.953	0.678	-0.275
Export – Trade	0.990	0.928	-0.062
Import – Trade	0.986	0.903	-0.083
ECH – GDP	0.607	-0.132	-0.739
Trade – GDP	0.599	-0.106	-0.705
FDI – ECH	-0.444	-0.131	+0.314
FDI – Trade	-0.425	-0.184	+0.241

The exchange-rate and trade cluster survives differencing. The association of both with GDP does not: two correlations near 0.6 in levels become slightly negative in differences.

Table 2. Components of the trade-openness ratio, 2008–2024

Series	Cumulative growth	Implied basis
GDP	+68%	Constant prices — implied annual growth rates match Nigeria's real GDP series
Trade	+782%	Current prices
Exchange rate	+1,146%	—

Trade tracks the exchange rate; GDP does not. Dividing one by the other produces a ratio reaching 189% of GDP, which tests as $I(2)$ (level $p = 0.9972$, first difference $p = 0.7441$, second difference $p < 0.0001$).



5. DISCUSSION

The first result is that the exchange rate, exports, imports and trade genuinely move together. Levels correlations of 0.95 to 0.99 could be trend artefacts, but they fall only to 0.68 to 0.93 in differences. Quarter-to-quarter changes in the naira and in trade volumes are strongly associated, which fits the oil-dependence mechanism: a commodity shock changes foreign-exchange inflows, moves the rate, and passes through to import costs in the same period. These four series carry substantially overlapping information, and including them as independent regressors is not defensible.

The second result cuts the other way and undermines a common remedy. The apparent association between GDP and this cluster is a trend artefact. Level correlations of 0.607 and 0.599 become -0.132 and -0.106 in differences. GDP does not co-move with the exchange rate or with trade at quarterly frequency in this sample.

That has a direct consequence for normalisation. Dividing trade by GDP is often justified by saying the denominator absorbs the shared trend. Here there is no shared quarter-to-quarter movement for it to absorb, so the ratio inherits the numerator's dynamics almost intact and adds noise from an unrelated denominator.

The available series makes this worse. The GDP figures are at constant prices, with implied annual growth rates matching Nigeria's published real series, while the trade figures are at current prices. Over 2008 to 2024 GDP grows 68% and trade 782%, tracking the naira's 1,146% depreciation. A ratio of nominal to real therefore measures currency depreciation more than openness, reaches 189%, and tests as I(2). Since the ARDL bounds procedure requires I(0) or I(1) regressors, any bounds test including this variable is invalid, whatever its VIF happens to be.

Two checks follow, and both are quick. Before treating a ratio as a collinearity remedy, test whether the numerator and denominator co-move in differences; if they do not, normalisation achieves nothing. And compare their cumulative growth over the sample; an order-of-magnitude divergence indicates a price-basis mismatch.

6. CONCLUSION

Nigeria's exchange rate, exports, imports and trade genuinely co-move, with correlations surviving first differencing. Their association with GDP does not survive it. Normalising trade by GDP therefore does not remove a shared trend, because there is no shared quarter-to-quarter movement to remove, and the particular series available compounds this by mixing price bases, producing an I(2) ratio that cannot be used in a bounds-testing framework. Researchers should test correlations in differences before assuming a ratio solves collinearity, and should confirm that numerator and denominator share a price basis.

7. LIMITATIONS

Pearson correlation captures linear association only. Given the documented non-normality of several of these series, rank correlations would be a useful robustness check.

Differencing addresses spurious trend but discards information about long-run relationships. If the series are cointegrated, a Johansen analysis would characterise the common trends properly and is the natural next step.

The oil-dependence mechanism is invoked and not tested. Including oil price explicitly and asking whether it accounts for the shared variation would test the proposed channel.

The ratio problem could be resolved with nominal GDP from the CBN Statistical Bulletin, which is not in the assembled dataset. Trade openness belongs in these models on theoretical grounds and was dropped only for the data reason given here.

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