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Trade Dependence and Demographic Dynamics as Determinants of Long Run Economic Growth in Somalia from 1993 to 2024

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Abstract

This article examines the long-run relationship between real gross domestic product (GDP), exports, imports, and total population in Somalia over 1993–2024. Annual data from the World Bank's World Development Indicators and the Statistical, Economic and Social Research and Training Centre for Islamic Countries are analysed using a log-linear specification. Augmented Dickey–Fuller and Phillips–Perron tests, an Engle–Granger residual-based cointegration test, ordinary least squares, pairwise Granger tests, and residual diagnostics are applied. All variables are integrated of order one. The residual test provides evidence of a lo ng-run association, although inference at the 5% level is sensitive to the critical-value convention and is therefore interpreted cautiously. In the estimated levels equation, the export elasticity is − 0.692, the import elasticity is 1.043, and the population elasticity is 0.401. Exports and imports are extremely highly correlated (r = 0.997), so the separate trade coefficients should not be treated as precisely identified causal effects; the more defensible result is that Somalia's trade structure is strongly associated with output. Pairwise tests indicate predictive precedence from exports and imports to GDP, while population shows no such relationship. The findings point to export diversification and value addition, productive use of imports, stronger trade institutions, and investment in human capital and employment as priorities for more resilient growth.

1 Introduction

Economic growth is central to development policy because sustained expansion in real output supports employment, poverty reduction, and improvements in living standards (Solow 1956; Lucas 1988). In low-income and fragile economies, however, growth is often constrained by weak productive capacity, limited fiscal space, and exposure to external shocks. Understanding which macroeconomic forces are most closely associated with output is therefore especially important where policy resources are scarce and the cost of ineffective intervention is high.

International trade affects growth through several channels. Exports can enlarge effective demand, generate foreign exchange, improve resource allocation, and support productivity through economies of scale and learning effects (Balassa 1978; Feder 1983; Grossman and Helpman 1991). These gains are not automatic. Economies that export a narrow range of low-value primary commodities may remain vulnerable to price shocks, climatic disruptions, and weak domestic linkages, so export expansion may fail to generate broad structural transformation (Bunje et al. 2022; Adelakun et al. 2025). Imports are similarly ambiguous. Imported machinery, intermediate inputs, fuel, and embodied technology can raise productive capacity (Coe and Helpman 1995), while excessive reliance on consumption imports can widen external imbalances and tighten the balance-of-payments constraint (Thirlwall 1979).

Demographic change adds a third channel. A larger population can expand the labour force and the domestic market, but the growth payoff depends on education, health, capital accumulation, and employment creation. When those complementary conditions are absent, rapid demographic expansion can dilute capital per worker and increase dependency pressures rather than generate a demographic

dividend (Bloom et al. 2003; Woldegiorgis 2023). The interaction among trade, production, and population is therefore likely to be particularly consequential in a post-conflict economy.

Somalia provides an important case. Following the collapse of the central state in 1991, public institutions, infrastructure, formal production systems, and statistical capacity deteriorated severely. Recovery since the early 2000s has been driven largely by private activity, remittances, telecommunications, livestock, and trade, but real growth has remained modest and vulnerable to drought, insecurity, and changes in external support (Ali et al. 2018; Abdi and Qutieshat 2024; World Bank 2024). The external sector is structurally imbalanced: Somalia relies heavily on imported food, fuel, construction materials, machinery, and manufactured products, whereas exports remain concentrated in livestock and other primary commodities. This dependence exposes the economy to foreign-exchange pressure and supply disruptions (UNCTAD 2024; WTO 2024).

Existing evidence for Somalia is limited and mixed. Ali et al. (2018) report export-led effects using historical data that end before the post-1991 economic structure became established. More recent studies show that trade openness, domestic investment, exchange-rate conditions, and institutional quality interact in complex and sometimes asymmetric ways (Abdi et al. 2024; Abdi and Mohamed 2025; Abdulle et al. 2025). Many studies examine trade or demographic variables separately, use different sample windows, or focus on short-run dynamics. Consequently, policymakers lack an integrated comparison of exports, imports, and population within one long-run framework covering the post-collapse period.

This article addresses that gap using annual observations from 1993 to 2024. It asks three related questions: whether exports, imports, and total population are associated with real GDP in the long run; which relationships are statistically strongest within the specified model; and whether the trade and population variables contain predictive information for GDP. The contribution is not a new growth theory, but an integrated, Somalia-specific assessment with explicit attention to time-series properties, data limitations, and the very high correlation between exports and imports. That caution is essential: the model can reveal the joint importance of trade for Somali output, but it is less able to cleanly separate the independent contribution of each trade flow.

2 Literature Review and Theoretical Framework

2.1 Exports and economic growth

The export-led growth hypothesis proposes that export expansion raises output through demand growth, foreign-exchange earnings, specialization, competition, and productivity spillovers (Balassa 1978; Feder 1983). Access to larger markets may permit firms to exploit economies of scale and to adopt more efficient technologies and management practices (Grossman and Helpman 1991). Cross-country studies often find a positive export–growth association, but the size and stability of that association vary with

diversification, technological content, institutions, and exposure to external shocks (Kalaitzi and Chamberlain 2021; Odhiambo 2022).

African evidence illustrates this conditionality. Bunje et al. (2022) find that the growth effect of trade openness differs across countries and depends on complementary policies. Adelakun et al. (2025) report positive export effects across EAC and SADC economies while also showing that broader openness can increase vulnerability. For Somalia, the narrow primary-commodity base and exposure to drought, livestock bans, insecurity, and exchange-rate instability can weaken the domestic value added generated by exports (Abdi and Mohamed 2025). The conventional expectation is therefore positive, but a weak or negative coefficient is economically plausible where export expansion is volatile, low value, and poorly linked to the rest of the economy.

2.2 Imports and economic growth

Imports can support growth by supplying capital equipment, intermediate goods, energy, and technologies that are not produced domestically. Knowledge embodied in imported inputs may raise productivity and facilitate capital deepening (Coe and Helpman 1995). This channel is especially relevant in economies with limited industrial capacity, because domestic production and investment may depend directly on imported materials and equipment.

The opposite effect arises when imports are dominated by final consumption goods, displace domestic activity, or create a persistent foreign-exchange constraint (Thirlwall 1979). Empirical results consequently differ across settings. Millia et al. (2021) identify a negative long-run import effect in Indonesia, while Bashir and Ibrahim (2022) show that imported inputs are essential to export performance in Sudan. Panta et al. (2022) and Saqfalhait (2023) provide evidence consistent with import-led growth in small developing economies. In Somalia, where imported food, fuel, construction materials, and equipment sustain both consumption and productive activity, a positive coefficient may represent necessary input supply, but it may simultaneously signal structural dependence.

2.3 Population and economic growth

Neoclassical growth theory treats population as a source of labour-force expansion but also as a potential cause of capital dilution when capital accumulation does not keep pace (Solow 1956). Endogenous growth approaches emphasize that education, skills, health, and knowledge determine whether additional workers raise productivity (Lucas 1988). The demographic-dividend literature similarly argues that a growing working-age population generates growth only when institutions and labour markets can productively absorb it (Bloom et al. 2003).

Sub-Saharan African evidence stresses these preconditions. Woldegiorgis (2023) identifies human capital, employment creation, and institutional capacity as key drivers of the demographic dividend, while ACET (2025) and UNECA (2024) document the difficulty of translating a large youth cohort into productive employment. In Somalia, total population may be positively associated with aggregate GDP

simply because a larger population increases labour and demand, but the elasticity may remain weak where unemployment, informality, and limited human-capital investment constrain productivity.

2.4 Synthesis and expectations

The literature does not justify imposing the same directional expectation on all three variables. Export-led growth predicts a positive association but allows weak outcomes in undiversified primary exporters. Imports can either enhance capacity or intensify external dependence. Population can expand output or dilute capital per worker. The study therefore tests non-directional hypotheses that exports, imports, and total population each have a statistically significant long-run association with real GDP. The relative signs and magnitudes are determined empirically.

A central identification concern is that exports and imports commonly move together as economies expand. In the Somali data their correlation is almost perfect. This does not invalidate the question of whether trade is associated with GDP, but it makes the separate export and import elasticities sensitive to small changes in specification and data. The discussion therefore distinguishes between the model's strong joint explanatory relationship and the less certain decomposition of that relationship into opposing export and import coefficients.

3 Methods

3.1 Research design, data, and variables

The study uses a quantitative longitudinal time-series design and annual data for Somalia from 1993 through 2024, producing 32 observations. The starting year reflects data availability after the collapse of national statistical systems in the early 1990s. Real GDP and total population are drawn from the World Bank's World Development Indicators, while exports and imports of goods and services are obtained from SESRIC. Monetary series are expressed at constant 2015 prices. All variables are transformed into natural logarithms, allowing coefficients in the levels equation to be read as elasticities, conditional on a valid cointegrating relationship.

The dependent variable is the natural logarithm of real GDP (LNGDP). The explanatory variables are the natural logarithms of exports (LNEXP), imports (LNIMP), and total population (LNPOP). The population variable measures population size, not the annual population growth rate; throughout the empirical analysis, references to demographic expansion should therefore be understood in terms of changes in total population.

Table 1 Variables, measurement, and data sources

Variable	Symbol	Measurement	Source
Real GDP	LNGDP	Natural log of real GDP (constant 2015 US$)	World Bank (WDI)
Exports	LNEXP	Natural log of exports of goods and services	SESRIC
Imports	LNIMP	Natural log of imports of goods and services	SESRIC
Population	LNPOP	Natural log of total population	World Bank (WDI)

Note: WDI = World Development Indicators; SESRIC = Statistical, Economic and Social Research and Training Centre for Islamic Countries.

3.2 Model specification

The long-run relationship is represented by the following log-linear equation:

$$lnGDP_t = \beta_0 + \beta_1 lnEXP_t + \beta_2 lnIMP_t + \beta_3 lnPOP_t + \varepsilon_t$$

Here, β_0 is the intercept, β_1–β_3 are the long-run elasticities, and ε_t is the error term. Because regression among non-stationary level series may be spurious, the equation is interpreted only after testing the order of integration and the stationarity of the estimated residuals.

3.3 Estimation strategy

Descriptive analysis. Means, medians, dispersion, distributional statistics, and Pearson correlations summarize the data and identify unusually strong associations among regressors.

Unit-root testing. Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests are applied in levels and first differences under the null hypothesis of a unit root (Dickey & Fuller 1979; Phillips and Perron 1988).

Cointegration testing. The Engle–Granger two-step procedure estimates the levels equation and applies an ADF test to its residuals (Engle and Granger 1987). Stationary residuals indicate a stable long-run linear combination. Because residual-based critical values differ from ordinary ADF critical values, the reported statistic, approximate p-value, and MacKinnon critical values are considered jointly (MacKinnon 2010).

Long-run estimation. Ordinary least squares (OLS) estimates the cointegrating vector. OLS slope estimates are super-consistent under cointegration (Stock 1987), but a 32-observation sample and near-collinearity among trade variables can still produce imprecise or unstable individual coefficients. The results are therefore presented as conditional long-run associations rather than structural causal effects.

Predictive-direction testing. Pairwise Granger tests with two lags assess whether past values of one variable improve prediction of another (Granger 1969). Since simple pairwise tests do not incorporate an explicit error-correction term, they are treated as supplementary evidence of predictive precedence rather than definitive causality.

Diagnostic testing. The Jarque–Bera test assesses residual normality; the Breusch–Godfrey test assesses serial correlation; and the Breusch–Pagan–Godfrey test assesses heteroscedasticity (Jarque and Bera 1980; Breusch 1978; Godfrey 1978; Breusch and Pagan 1979).

4 Results

4.1 Descriptive patterns and correlations

The logged series all trend upward over the sample, with exports more volatile than imports and imports persistently above exports. Real GDP and population rise more smoothly. These common trends explain the strong level correlations and make stationarity and cointegration testing essential before interpreting a levels regression.

Table 2 Descriptive statistics and correlation matrix

Statistic / variable	LNGDP	LNEXP	LNIMP	LNPOP
Panel A: Descriptive statistics				
Mean	32.4573	19.3111	20.7416	16.2575
Median	32.4410	19.7413	21.0200	16.2846
Maximum	33.3245	21.8742	23.0526	16.7604
Minimum	31.5316	15.9872	17.9478	15.7148
Std. deviation	0.6030	1.7538	1.6141	0.3028
Observations	32	32	32	32
Panel B: Pearson correlations				
LNGDP	1.000			
LNEXP	0.970	1.000		
LNIMP	0.983	0.997	1.000	
LNPOP	0.984	0.977	0.984	1.000

Note: All variables are natural logarithms. The export–import correlation of 0.997 indicates severe overlap in the information carried by the two trade variables.

Exports and imports have the greatest dispersion, consistent with Somalia's exposure to trade and external shocks. GDP is strongly correlated with exports (0.970), imports (0.983), and population (0.984). The independent variables are also strongly correlated, particularly exports and imports (0.997). The regression can therefore estimate the joint relationship between trade and GDP more reliably than it can isolate two independent trade effects.

4.2 Unit roots and cointegration

Table 3 Unit-root and residual-based cointegration tests

Variable	ADF level	PP level	ADF first difference	PP first difference	Order
LNGDP	−1.239 (0.656)	0.249 (0.975)	−3.445 (0.010)**	−7.782 (0.000)***	I(1)
LNEXP	−2.375 (0.149)	−2.255 (0.187)	−3.052 (0.030)**	−3.191 (0.021)**	I(1)
LNIMP	−1.847 (0.357)	−1.681 (0.441)	−3.768 (0.003)***	−4.065 (0.001)***	I(1)
LNPOP	−0.008 (0.958)	−1.173 (0.685)	−2.826 (0.055)*	−2.748 (0.066)*	I(1)
Residual ADF	−4.296 (0.029)		5% critical: −4.470	10% critical: −4.085	Evidence of cointegration

*Note: p-values in parentheses. ***, **, and * denote 1%, 5%, and 10% significance. The population series rejects a unit root only at 10% after differencing. For the residual test, the statistic lies between the reported 5% and 10% critical values, while the approximate MacKinnon p-value is 0.029; the long-run evidence is therefore treated as supportive but not unequivocal under every critical-value convention.*

None of the variables is stationary in levels. After first differencing, GDP, exports, and imports reject the unit-root null at 5% or better, while population rejects at 10%. The series are accordingly treated as I(1). The residual ADF statistic is −4.296. It is more negative than the reported 10% critical value but less negative than the stricter 5% value; the approximate p-value is 0.029. Taken together, these statistics support a long-run linear relationship, but the evidence should be described as borderline rather than mechanically definitive. This qualification is carried into the interpretation of the level's equation.

4.3 Long-run regression estimates

Table 4 OLS estimates for the logged GDP equation

Variable	Coefficient	Std. error	t-statistic	p-value
Constant	17.6584	2.3665	7.462	<0.001
LNEXP	−0.6919	0.0849	−8.146	<0.001
LNIMP	1.0432	0.1117	9.342	<0.001
LNPOP	0.4012	0.1976	2.031	0.0519

Model summary: n = 32; R^2 = 0.9927; adjusted R^2 = 0.9919; F = 1270.84, p < 0.001. Dependent variable: LNGDP. Coefficients are conditional long-run elasticities if the cointegrating relationship is accepted.

The model is jointly significant and explains 99.3% of the variation in logged GDP. Such a high R^2 is expected when strongly trending, potentially cointegrated variables share a common long-run path; it should not be interpreted by itself as evidence of causal fit.

The export coefficient is negative and statistically significant (−0.6919, p < 0.001), while the import coefficient is positive and statistically significant (1.0432, p < 0.001). Taken literally, a 1% increase in exports is associated with a 0.69% reduction in GDP and a 1% increase in imports with a 1.04% increase in GDP, holding the other variables constant. However, the condition “holding the other trade variable constant” is empirically demanding when exports and imports correlate at 0.997. The signs and exact magnitudes are therefore highly conditional. The safer interpretation is that the trade block is strongly associated with GDP, with the sample allocating opposite coefficients to two nearly collinear series.

Population has a positive coefficient of 0.4012 and a p-value of 0.0519. It is not significant at 5% but is marginally significant at 10%. The result is consistent with a positive aggregate-size effect that has not become a strong productivity-based demographic dividend.

4.4 Predictive direction and diagnostics

Table 5 Pairwise Granger tests and residual diagnostics

Test / null hypothesis	Statistic	p-value	Decision at 5%
Panel A: Pairwise Granger tests (2 lags)			
LNEXP does not predict LNGDP	F = 6.023	0.0073	Reject
LNGDP does not predict LNEXP	F = 0.156	0.8561	Do not reject
LNIMP does not predict LNGDP	F = 5.578	0.0099	Reject
LNGDP does not predict LNIMP	F = 0.057	0.9445	Do not reject
LNPOP does not predict LNGDP	F = 0.680	0.5158	Do not reject
LNGDP does not predict LNPOP	F = 1.074	0.3570	Do not reject
Panel B: Residual diagnostics			
Jarque–Bera normality	JB = 0.854	0.6524	No rejection
Breusch–Godfrey serial correlation	F = 1.431	0.2572	No rejection
Breusch–Pagan–Godfrey heteroscedasticity	F = 2.472	0.0824	No rejection

Note: "Predict" is used instead of structural "cause" because pairwise Granger tests establish temporal predictive content, not causal identification. The heteroscedasticity p-value is above 0.05 but close enough to justify robust-standard-error checks in future work.

Past exports and imports improve prediction of GDP at the 5% level, whereas GDP does not improve prediction of either trade variable. No predictive relationship is detected between population and GDP. These results reinforce the importance of trade fluctuations for short-horizon output prediction, but they do not resolve endogeneity or replace a vector error-correction framework. Residual tests do not reject normality, no serial correlation, or homoscedasticity at 5%. The heteroscedasticity statistic is nevertheless relatively close to the threshold, so the absence of rejection should not be interpreted as proof of perfectly constant variance.

5 Discussion

The empirical results demonstrate that Somalia's economic output is strongly associated with developments in the external sector. The estimated coefficients reveal a negative relationship between exports and economic growth and a positive relationship between imports and economic growth. Overall, the findings indicate that the structure and composition of Somalia's external trade play an important role in shaping the country's economic performance.

Turning first to exports, the negative export coefficient differs from the conventional export-led growth prediction proposed by Balassa (1978) and Feder (1983). However, this result does not necessarily imply that exporting harms Somalia's economy. Instead, it may reflect the structural characteristics of the country's export sector. Somalia's exports are concentrated in low-value, climate-sensitive primary

products with limited processing and weak domestic linkages. Under these conditions, higher gross exports may coexist with low value addition, dependence on imported inputs, vulnerability to trade bans and price shocks, and limited productivity spillovers. Recent African and Somali evidence similarly emphasizes that the growth benefits of exports depend on diversification, institutional quality, technology, and stability (Bunje et al. 2022; Abdi et al. 2024; Abdi and Mohamed 2025; Adelakun et al. 2025). Therefore, the negative coefficient may indicate that Somalia's current export structure has not yet developed into a reliable engine of broad-based growth.

In contrast to the export result, the positive import coefficient is consistent with import-led growth evidence from small developing economies (Panta et al. 2022; Saqfalhait 2023). Somalia's limited domestic productive base makes imported food, fuel, machinery, construction materials, and intermediate inputs essential to consumption, investment, and service-sector activity. Imports may therefore provide access to productive inputs, technology, and external financing. Nevertheless, this positive association also reveals an important vulnerability, because growth that depends heavily on imported essentials may be disrupted by exchange-rate pressures, rising shipping costs, geopolitical shocks, or reductions in remittances and aid. Accordingly, the policy objective should not be the indiscriminate restriction of imports, but rather a gradual shift in import composition toward capital goods, intermediate inputs, and technologies that expand domestic productive capacity.

Beyond the effects of external trade, population is positively associated with aggregate GDP, although the relationship is only marginally significant. This finding is consistent with neoclassical growth theory and demographic-dividend theory, which suggest that a larger labour force can raise total output when it is supported by adequate capital, skills, healthcare, institutions, and employment opportunities (Solow 1956; Lucas 1988; Bloom et al. 2003). However, the absence of predictive precedence from population to GDP suggests that demographic expansion alone has not been a major short-run driver of economic growth. This result is consistent with wider African evidence showing that a young and growing population becomes an economic advantage only when economies can productively absorb new labour-market entrants (Woldegiorgis 2023; ACET 2025; UNECA 2024).

Taken together, these findings clarify the contribution of the present study to the existing literature on Somalia. Earlier export-led growth studies based on pre-collapse data may not fully describe the post-1991 economy, while more recent ARDL and nonlinear studies focus on different issues, including dynamics, asymmetry, investment, and trade openness (Ali et al. 2018; Abdi et al. 2024; Abdulle et al. 2025). By examining exports, imports, and population jointly over the period 1993–2024, this study shows that trade remains central to Somalia's economic performance, while population has not yet emerged as an independently strong driver of growth. This integrated conclusion provides a more useful basis for policy than simply ranking the estimated coefficients.

6 Conclusion and Policy Implications

This article examined the association of exports, imports, and total population with real GDP in Somalia from 1993 to 2024. The variables are treated as I(1), and the residual-based test provides supportive, though critical-value-sensitive, evidence of a long-run relationship. The levels model assigns a negative coefficient to exports, a larger positive coefficient to imports, and a positive but only marginally significant coefficient to population. Pairwise predictive tests run from both trade variables to GDP but not from population. The central conclusion is that Somalia's growth path is strongly connected to its trade structure, while its demographic potential remains only partially realized.

Four policy implications follow. First, export policy should emphasize diversification, processing, standards, storage, logistics, and value addition in livestock, agriculture, and fisheries rather than simply increasing gross export volumes. Second, import policy should protect access to essential inputs while using tariffs, finance, and investment incentives to favour machinery, intermediate goods, and technologies that expand domestic production. Third, trade facilitation, exchange-rate stability, port and customs efficiency, and reliable national statistics should be strengthened to reduce transaction costs and policy uncertainty. Fourth, education, technical and vocational training, health, and employment-intensive investment are required to convert population growth into a genuine demographic dividend.

Because the trade coefficients are highly collinear, these recommendations should not be based on the numerical claim that imports are precisely 1.043 times growth-enhancing while exports are precisely −0.692 growth-reducing. The evidence supports a broader conclusion: Somalia needs a less vulnerable and more productive external sector, with stronger domestic linkages on both the export and import sides.

7 Limitations and Future Research

The analysis has five main limitations. The sample contains only 32 annual observations, limiting the power of unit-root, cointegration, and diagnostic tests. Early Somali macroeconomic observations are partly estimated because of weak statistical capacity. Exports and imports are nearly perfectly correlated, making individual trade coefficients unstable even though no separate variance-inflation calculation is reported. The static OLS equation omits short-run adjustment, potential structural breaks, and other determinants such as investment, remittances, inflation, foreign direct investment, institutions, insecurity, and climatic shocks. Finally, pairwise Granger tests do not provide structural causality and are not a substitute for an error-correction or Toda–Yamamoto framework.

Future research should replicate the model with updated or higher-frequency data and test structural breaks associated with droughts, political transitions, debt relief, and major trade disruptions. FMOLS, DOLS, ARDL, VECM, or Bayesian time-series methods could assess the robustness of the long-run coefficients and explicitly model short-run adjustment. Disaggregating exports and imports into capital, intermediate, food, fuel, livestock, agricultural, and service components would be especially valuable because composition, rather than gross trade alone, is likely to determine the growth effect.

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Author contributions: Sadaq Elmi Gedi conceived the study, assembled the data, conducted the analysis, interpreted the findings, and drafted the manuscript. Nor Hisham Bin Haron supervised the research, provided methodological guidance, and critically reviewed and revised the manuscript. Both authors read and approved the final manuscript.

Data availability: The underlying series are publicly available from the World Bank World Development Indicators and SESRIC. The compiled dataset and analysis files should be deposited as supplementary material or made available by the corresponding author.

Ethics approval: Not applicable. The study uses publicly available aggregate secondary data and involves no human participants, animals, or identifiable personal information.

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Figures

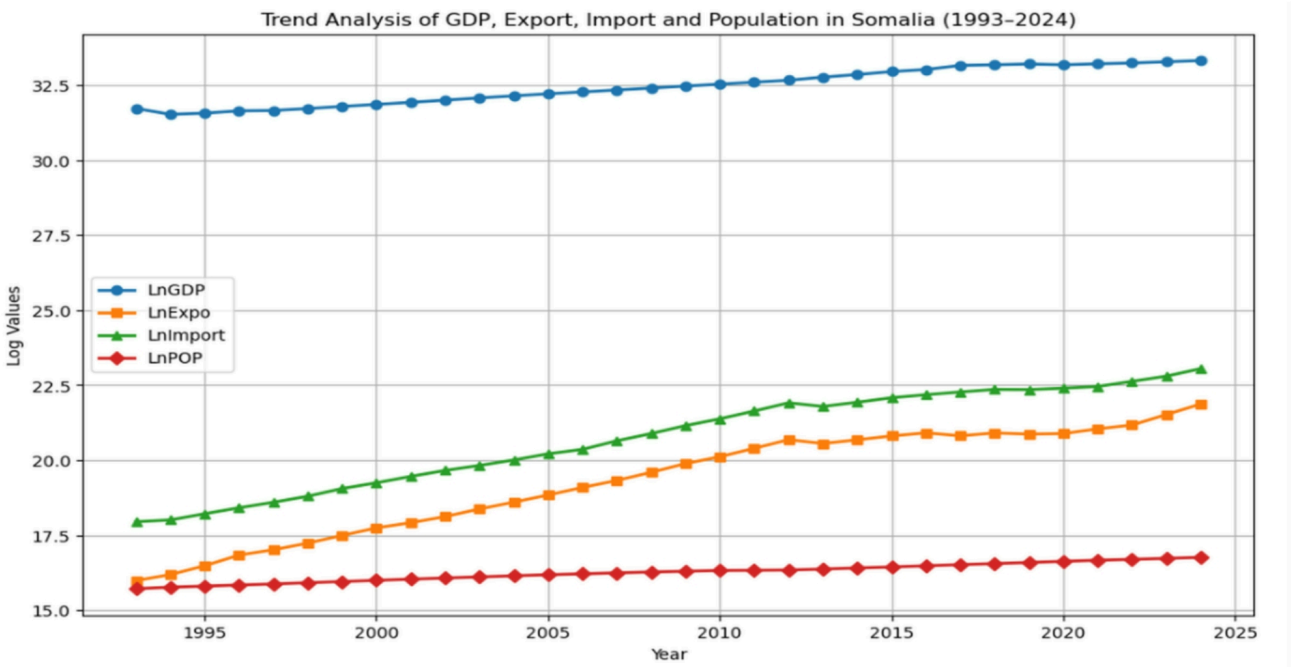


Figure 1

Trends in logged GDP, exports, imports, and population in Somalia, 1993–2024

Source: Author's plot based on World Bank WDI and SESRIC data