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Exploring the Export-Growth in Nepal: A Time Series Analysis Using the ARDL Model

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Abstract

This study examines the relationship between economic growth and trade in Nepal using time series data. The research determines trade to be a crucial impetus to economic development and examines economic growth's contribution to Nepal's export performance. The study applies the autoregressive distributed lag (ARDL) technique to examine long-run and short-run relationships between key macroeconomic indicators, including gross domestic product (GDP), population, and import. The estimated log-linear ARDL results show that GDP and population carry negative coefficients, indicating that Nepal's economic and demographic growth have not translated into export expansion due to the dominance of non-tradable sectors, labor emigration, and structural inefficiencies, while the positive import coefficient confirms the import-dependent nature of export production. The tests establish the data points to be stable, normally distributed, and devoid of serial correlation and heteroskedasticity. The research concludes by calling to make policies that favour economic growth to enhance trade performance. The research recommends policy measures, including infrastructure investments, trade diversification, and better governance, to expand Nepal's export sector and attain sustainable economic development.

Keywords: trade-growth nexus, exports, economic growth, time series analysis, ARDL model, Nepal

Exploring the Export-Growth in Nepal: A Time Series Analysis Using the ARDL Model

Trade has long been found to be a leading engine of economic growth. In economic literature, it has been referred to as the "engine of growth" owing to its strong linkage with economic performance and progress (Paudel, 2019). Trade is one of the significant determinants of long-term economic development, and it significantly impacts economic as well as social outcomes. Theoretically, trade openness has been argued to benefit developing countries through two significant channels: trade liberalization benefits from comparative advantage and economic development from economies of scale, including technological spillovers (Todaro & Smith, 2003). Non-coastal or landlocked developing countries, including Nepal, are incentivized to leverage trade for economic development, particularly given geographical disadvantages and limited regional trade linkages.

Trade and economic growth have been a central focal point within macroeconomic literature. Empirical evidence continues to underscore that trade fosters economic growth by providing access to larger markets, facilitating technology transfers, and elevating productivity efficiencies (Bhat, 2014). Trade liberalization has historically been a major contributor to economic development in industrialized nations, and it continues to play a crucial role in emerging economies like Nepal. However, Nepal faces persistent challenges including limited export diversification, dependence on a small number of trading partners, and difficulty in competing in global markets. Addressing these barriers requires a comprehensive trade policy that enhances competitiveness, encourages diversification, and strengthens institutional capacity for international trade facilitation.

Given Nepal's economic structure, understanding the trade-growth nexus is essential for formulating policies that drive sustainable development. This study seeks to analyze Nepal's trade dynamics by examining the influence of economic growth on export performance. Specifically, it investigates export trends and patterns and assesses the degree to which economic growth impacts aggregate exports. Through this analysis, the research contributes to policy discourse on trade and growth, providing insights of particular value to Nepalese policymakers and economic planners.

Literature Review

The question of whether economic growth leads to an increase in exports is a central issue in trade and development economics. While classical economic theory traditionally posits that trade drives growth, the reverse causal relationship—where economic growth facilitates export expansion—has gained increasing attention. For a developing country like

Nepal, understanding this relationship is crucial to shaping effective trade policies aimed at enhancing export performance. This section reviews theoretical and empirical contributions that explore the impact of economic growth on exports, with a particular focus on the Nepalese context.

Theoretical Perspectives

Classical trade theories emphasize exports as a catalyst for growth. Adam Smith's (1776) theory of absolute advantage and David Ricardo’s (1817) model of comparative advantage suggest that countries benefit from specializing in goods they can produce most efficiently. However, economic growth in itself can expand a country's productive capacity, thus increasing the potential for exports (Riaz, 2010).

The Heckscher-Ohlin (H-O) model further develops this perspective by highlighting how a country’s factor endowments shape trade patterns (Deardorff, 2007). As economies grow, changes in resource allocation may shift comparative advantages, thereby influencing the structure and volume of exports.

Demand-Driven Export Growth Hypothesis

Challenging the traditional export-led growth model, some economists argue that economic growth can lead to higher exports through increased production capacity, improved infrastructure, and technological advancement (Krugman & Obstfeld, 2009). As GDP rises, domestic industries gain international competitiveness, encouraging firms to explore foreign markets to maintain growth momentum.

Empirical Studies

Numerous empirical investigations have explored the link between economic growth and exports. For example, Oloyede et al. (2021) identified a weak but positive relationship between GDP and exports in Africa, noting the influence of institutional factors. Ristanović et al. (2020), using a gravity model, found that higher GDP levels in Serbia correlated with increased export volumes.

Further studies by Shahriar et al. (2019) and Bakari and Mabrouki (2018) support the assertion that economic growth positively affects export performance. Some research highlights foreign direct investment and technological innovation as mediating variables (Balassa, 1978), while others underscore infrastructure development as a key driver (Rodrik, 2006).

For Nepal, the findings are mixed. Paudel and Cooray (2018) reported that GDP growth supports export expansion, though high trade costs limit this effect. Acharya (2013) confirmed a positive relationship between economic growth and trade, yet noted that Nepal's geographic isolation remains a barrier. Kafle (2017) emphasized the persistent trade deficit and argued that growth alone is insufficient without complementary policy measures.

Other studies such as Ghimire (2009) and Sharma and Bhandari (2005) found positive correlations between GDP and exports but pointed to structural limitations, such as weak industrialization, as constraints. These findings underscore that domestic production capacity—shaped by economic growth—plays a critical role in export performance.

Despite the existing body of literature, significant gaps remain in explaining the mechanisms through which economic growth influences exports in Nepal. Much of the prior research emphasizes export-led growth and trade liberalization rather than reverse causality. Moreover, limited studies employ robust econometric techniques to assess the causal relationship between growth and exports (Frankel & Romer, 1999).

This study seeks to address these gaps by employing both time-series analysis and the gravity model to examine how economic growth affects exports in Nepal. It further aims to propose policy measures to enhance this linkage. Although empirical evidence from other regions varies, findings from Nepal highlight structural barriers that mediate the growth-export relationship. By combining theoretical and empirical insights, this study contributes to a deeper understanding of Nepal's trade-growth nexus and informs export policy development.

Methodology

This section outlines the research approach, design, sample, variable descriptions, data sources, analytical techniques, and model specification. It focuses on the use of quantitative time series data, ensuring reliability and validity through appropriate econometric and statistical methods. Both descriptive and inferential statistics are utilized for analysis.

Research Design and Data Sources

The study employs a descriptive and analytical research design. Quantitative data are collected, organized, and analyzed statistically. A causal research design is used to explore the cause-and-effect relationship between macroeconomic variables. This approach enables the identification of patterns and interdependencies among variables over time.

The study covers the data of period from 1982 to 2024 for time series analysis. Since, most of the past empirical studies takes sample from 1960s and 1970s this study considered different data sample starting from 1980s to explored the relationship between export and

GDP based on recent data for time series analysis. Secondary data for the analysis were sourced from reputable international institutions World Bank database.

Previous studies provide the basis for this research framework. For example, Paudel and Cooray (2018) applied a gravity model using export as the dependent variable and GDP as an independent variable to analyze export performance in landlocked versus non-landlocked developing countries. This study, however, adopts a time series approach. In contrast to Prasai (2014), who analyzed trade using export and import as independent variables alongside GDP, population, and distance, this research includes population and import as additional independent variables in a time series context.

The rationale for including imports lies in their role as conduits for technological transfer and productivity gains. Intermediate and capital goods imported by domestic industries can improve efficiency, product quality, and international competitiveness, which may ultimately drive export growth.

Model Specification

The study employs the following log-linear functional form to estimate the relationship between exports and selected macroeconomic variables:

$$lnEXPORT_t = \beta_0 + \beta_1 lnGDP_t + \beta_2 lnPOP_t + \beta_3 lnIMPORT_t + \varepsilon_t \quad \ldots (1)$$

where, $lnEXPORT_t$ = log of the total export of Nepal at time 't'

$lnGDP_t$ = log of GDP of Nepal at time 't

$lnPOP'_t$ = log of the population of Nepal at time 't'

$lnIMPORT'_t$ = log of import of Nepal at time 't'

ε_t = Stochastic disturbanceterm at time 't'

Description of Variables

Export refers to the act of sending goods and services produced in one country to another country for sale or trade. For time series analysis, export refers the total export of Nepal to the foreign country. It is measured in terms of US dollars.

Gross domestic product (GDP) is an important statistic that indicates whether an economy is expanding or contracting. GDP can be tracked over long periods used in measuring a nation's economic growth. Gross Domestic Product (GDP) is the broadest quantitative measure of a nation's total economic activity. More specifically, GDP represents the monetary value of all goods and services produced within a nation's geographic borders over a specified period. It is the dependent variable in the study. Gross Domestic Product (GDP) is measured in the US dollar.

The size of the working age population is another independent variable of the study. Since, the higher the population higher will be the trade volume and vice versa (Acharya, 2013).

Import refers to the act of purchasing goods and services by the country that are produced outside the boundaries of the country. Import of intermediate and capital goods provide domestic industries access to advanced technologies, higher-quality inputs and innovative production methods that enhance the productivity and quality of domestic products. It makes domestic product more competitive in international markets that boost the exports. Import is measured in current US dollars.

Table 1

Expected Relation of Export with Explanatory Variables of Time Series Analysis

Variable	Units	Source	Expected Sign
Export	US dollar	World Bank	
GDP	US Dollar	World Bank	+
Population	in number	World Bank	+
Import	US Dollar	World Bank	+

Source: Based on different literatures

Result and Discussion

Descriptive Statistics of Time Series Variables

Descriptive statistics are a set of methods and techniques used to summarize and describe the basic features of a dataset. Descriptive statistics provide a way to organize and summarize data in a meaningful way, which can then be used to make informed decisions or draw conclusion about the data. The descriptive statistics for times series variable of the study is shown in the Table 2.

Table 2

Descriptive Statistics of Time Series Variables

	Log export	Log GDP	Log import	Log population
Mean	20.79	22.90	21.69	16.99
Median	20.92	22.57	21.417	17.067
Maximum	21.91	24.48	23.58	17.21
Minimum	19.34	21.59	19.93	16.61
Std. Dev.	0.76	0.96	1.14	0.18

Skewness	-0.54	0.29	0.13	-0.70
Kurtosis	2.07	1.59	1.71	2.15
Jarque-Bera	3.60	4.16	3.11	4.83
Probability	0.16	0.12	0.21	0.08
Observations	43	43	43	43

Source: Researchers' calculation using Eviews

As observed, the average log values for export, GDP, import, and population are 20.79, 22.90, 21.69, and 16.99, respectively. The maximum and minimum values for export are 21.91 and 19.34, while GDP ranges from 24.48 to 21.59. Similarly, import values range from 23.58 to 19.93, and population values range from 17.21 to 16.61.

Skewness indicates the degree of asymmetry in the distribution. The log values for GDP and import exhibit positive skewness, suggesting right-tailed distributions, whereas export and population display negative skewness, indicating left-tailed distributions.

Kurtosis measures the "tailedness" of the distribution. All variables have kurtosis values less than three, indicating a platykurtic distribution—flatter than a normal distribution.

The Jarque-Bera test is employed to assess normality. The null hypothesis states that the data are normally distributed. All variables exhibit p-values greater than 0.05, indicating that the log-transformed series for export, GDP, import, and population do not deviate significantly from normality.

Unit Root Test

The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) Tests are used for the test of stationary for the data used in the study. The null hypothesis of unit root test is that there is presence of unit root i.e., presence of nonstationary. The test results of unit root test is shown in the Table 3.

Table 3

Unit Root Test

at level	with constant	
Variables	ADF	PP
log export	-1.047	-1.046
log GDP	0.626	0.633
log import	-0.294	-0.506
log population	-3.045**	-5.375***

at difference	with constant	
Variables	ADF	PP
log export	-6.896***	-6.930***
log GDP	-5.841***	-5.824***
log import	-6.286***	-6.628***
log population	-0.803	-0.544

Note. ***, **, and * indicate that the statistics are significant at less than 0.01, 0.05, and 0.10 levels of significance

Source: Researchers' calculation using Eviews

As shown in Table 3, the variables log export, log GDP, and log import become stationary at first differences, indicating they are integrated of order one, I(1). Both ADF and PP tests confirm this result at the 1% significance level. However, the log population variable is stationary at level (I(0)) as confirmed by both tests, at the 5% level (ADF) and 1% level (PP).

Given this mixture of I(0) and I(1) variables, the Autoregressive Distributed Lag (ARDL) bounds testing approach is deemed appropriate for analyzing long-run relationships among the variables.

Autoregressive Distributed Lag (ARDL) Model

Autoregressive distributed lag (ARDL) approach is appropriate for the time series analysis when the variable under the study are mixed stationary at I(0) and I(1). ARDL approach of cointegration has been used for the analysis as the variables under the study are mixed stationary at I(0) and I(1). More specifically the log value of population is stationary at I(0) and the log value of export, GDP and import are stationary at I(1).

ARDL model and ECM Results

The estimated results for the ARDL model and ECM are shown in the Table 4. The value of F-statistic is statistically significant at less 1 per cent level of significant for the model which shows that the model is overall significant.

Table 4

ARDL Model, ECM Results

Dependent Variable: log export	ARDL (1,0,0,3), lag 4 (Automatic Selection), Akaike info criterion (AIC)

log export (-1)	0.37***
	(0.11)
log GDP	-0.65***
	(0.17)
log import	0.79***
	(0.16)
log population	8.41
	(7.82)
log population (-1)	-37.54**
	(18.57)
log population (-2)	53.60***
	(18.37)
log population (-3)	-23.50***
	(7.48)
ECM (-1)	-0.6281***
	(0.089)
Included observation	40
R-squared	0.9857
Adjusted R-squared	0.9826
F-statistics	316.579***

Note. ***, ** and * indicate that the statistics are significant at less than 0.01, 0.05 and 0.10 level of significance. The figures in the parenthesis are the standard error.

Source: Source: Researchers' calculation using Eviews

Table 4 shows the result ARDL (1,0.0,3) estimation based on the Akaike Information Criterion. The coefficient of log export with lag one, log GDP, log import, log population with lag two, and log population with lag three are statistically significant at the 1 percent level of significance. The coefficient of log population with lag one is statistically significant at the 5 percent level of significance.

The coefficient of log export with a lag of one is 0.37. It implies that the export increased by 0.37 percent on average when the export with a lag of one increased by 1 percent. Similarly, the coefficient of log GDP shows that the export decreased by 0.65 percent on average if GDP increased by 1 percent. On the other hand, the coefficient of log import shows that the export increased by 0.79 percent on average when log import increased by 1 percent, and log import with a lag of two shows that the export increased by 53.60 percent on average when log import with a lag of two increased by 1 percent. The coefficient of log population with lag one and log population with lag three show inverse relation with export. The coefficient of log population with lag one shows that the export decreased by 37.54 percent on average when log population with lag one increased by 1 percent. Similarly, the export decreased by 23.50 percent on average when the log population with lag three increased by 1 percent, as shown by the coefficient of log population with lag three.

In the model, ECM (-1) is statistically significant at 1 per cent level of significance with expected negative sign. It indicates that disequilibrium occurred in previous period is corrected in the present period.

Bound Test

To examine the existence of long-run relationship between the variables, outbounds test has been carried out. The bound testing approach uses the standard version of the F-test which is also known as the Wald test. According to bound test if the value of F-statistic is higher than upper bound then there exists long-run relationship. On the other hand, if the value of F-statistic is less than lower bound than does not exist long relationship. In the similar manner if the value of F-statistics is in between upper bound and lower bound than it is inconclusive for the relationship. The test results of bound test are shown in the Table 5.

Table 5

F-Bounds Test

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.798	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Researchers' calculation using Eviews

Table 5 shows the results of the bound test. The calculated value of the F-statistic for the model is 8.798. The value of the F-statistic is higher than that of the upper bound I(1) at a 1 percent level of significance. It indicates that the long-run relationships exist in the model.

ARDL Long-Run Form

The estimated long-run relationship results for the model are shown in Table 6. Table 6 shows the long-run relationship results for the model with GDP, import and population.

Table 6

ARDL Model Long Run Coefficients Results

Dependent Variable: log export	ARDL (1,0,0,3)
log GDP	-1.03***
	(0.26)
log import	1.26***
	(0.25)
log population	1.54***
	(0.53)

Note. ***, ** and * indicate that the statistics are significant at less than 0.01, 0.05 and 0.10 level of significance. The figures in the parenthesis are the standard error.

d indicates first difference.

Source: Researchers' calculation using Eviews

The coefficient of log GDP, log import and log population are statistically significant at 1 percent level of significance. It implies that there is long-run relationship between GDP with export, import with export and population with export. The coefficient of log GDP is -1.03 which imply that the export decreased by 1.03 percent on an average when GDP increased by 1 percent. The coefficient of log import is 1.26 indicates that export increased by 1.26 percent on an average when import increased by 1 percent. Similarly, the coefficient of log population shows that the export increased by 1.54 percent on an average when population increased by 1 percent.

Diagnostic Test

Serial Correlation Test

The Breusch-Godfrey Serial Correlation LM Test has been used for the test of serial correlation. The null hypothesis for the test is H0: No serial correlation at lag order p. The result of the test is given in the following table.

Table 7

Breusch-Godfrey Serial Correlation LM Test

Obs*R-squared	0.4769
Prob. Chi-Square(2)	0.7878

Source: Researchers' calculation using Eviews

Table 7 shows the test results of the serial correlation LM test for the model. The P-value of Chi-Square is greater than 5 percent. It shows that there is no serial correlation.

Heteroskedasticity Test

For the test of heteroskedasticity, Breusch-Pagen-Godfrey test has been employed in the study. The null hypothesis for the test is H0: There is no heteroskedasticity. The test result is shown in the following table.

Table 8

Breusch-Pagen-Godfrey Heteroskedasticity Test

Obs*R-squared	6.1693
Prob. Chi-Square	0.5201

Source: Researchers' calculation using Eviews

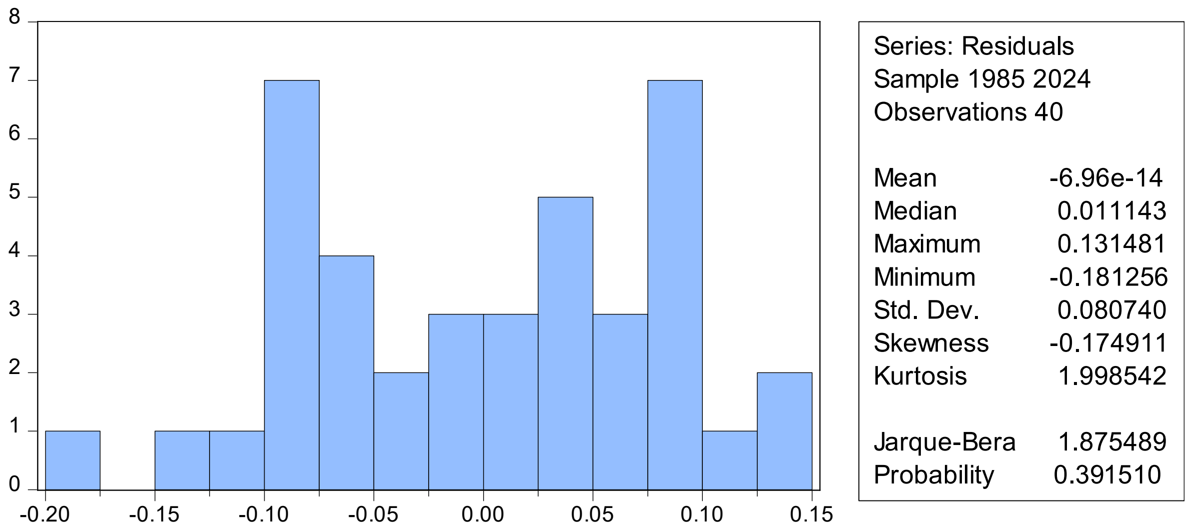
Table 8 the test result of the heteroskedsaticity test for the model. The P-value of Chi-Square is greater than 5 per cent. It shows that there is no heteroskedasticity.

Normality Test

For the test of normality, ARDL residual normality test has been employed in the study. The null hypothesis for the test is H0: data is normally distributed. The test result is shown as follow.

Table 9

Normality Test



Source: Researchers' calculation using Eviews

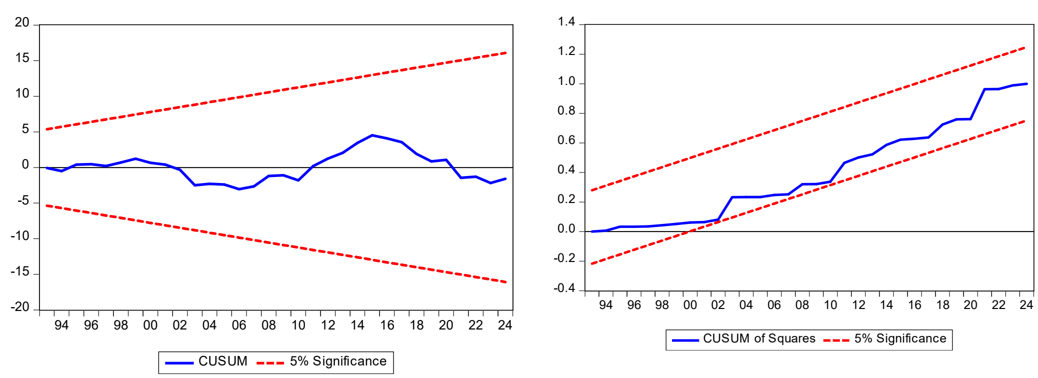
Table 9 shows the result of test of normality for the model. The p-value of Jarque-Bera is higher than 5 per cent level of significance. It shows that data are normally distributed.

Stability Test

The CUSUM and CUSUMSQ tests look at the stability of both the short-run dynamic and the long-run coefficient. If the plots of CUSUM and CUSUMSQ statistics stay within the critical bounds at 5 per cent level of significance the null hypothesis of H0: all coefficients in the error correction model are stable is not possible to reject. The plots of CUSUM and CUSUMSQ are shown as below

Figure 1

CUSUM and CUSUMSQ Plots for Specification in Column (1)



Source: Researchers' calculation using Eviews

Figure 1 shows the plots lie between the critical region at a 5 percent level of significance. It shows that the model is stable, implying no evidence of significant structural instability.

Conclusion

The Autoregressive Distributed Lag (ARDL) model of time series analysis has been followed as defined by the results of the unit root test. On the basis of the results of ARDL, the negative regression coefficient of GDP in the log model indicates that, holding other factors constant, an increase in economic growth is associated with a decline in export performance. This does not mean that growth directly reduces exports; rather, it suggests that Nepal's GDP growth has been driven mainly by non-tradable sectors, remittances, and consumption, rather than export-oriented production. Similarly, the negative coefficient of population growth in the log specification implies that population expansion has not translated into productive export labor, reflecting labor emigration, skills mismatch, and low industrial absorption. In contrast, the positive log coefficient of imports shows that exports are import-dependent, relying on imported inputs and capital goods for production. Furthermore, ARDL long run form and bound test shows that there is long run relationship between GDP and export, import and export as well as population and export. Breusch-Godfrey Serial Correlation LM test, Breusch-Pagen-Godfrey test for heteroskedasticity and normality test has been carried out to examine the stability of the results of ARDL. The test shows the model under ARDL is free from serial correlation, heteroskedasticity and data are normally distributed. Similarly, Bound test has been carried out to examine whether there exists a long-run relationship between variables or not. The result of the Bound test shows that there is a long-run relationship between the variable under the study. In the same way, Plots of CUSUM and CUSUMSQ imply that all coefficients in the error correction model are stable.

Policy Recommendations

Strengthening trade partnerships with economically strong nations can further maximize export potential, given the positive correlation between their GDP and Nepal's exports. Additionally, reducing trade barriers through regional agreements and improving transportation infrastructure will help mitigate the negative impact of geographic distance on exports. Lastly, import policies should prioritize capital goods and advanced technologies over consumer goods to ensure that economic growth aligns with enhanced productive capacity.

Scope of Future Research

Future research on exports can focus on several key areas. Sectoral analysis can identify which industries benefit most from economic growth. Studying the impact of trade agreements will help optimize trade policies for better export performance. Investigating the link between labor migration, remittances, and export competitiveness is crucial. Research on technological advancements, like digital transformation, can guide policies for integrating technology into production and trade. Additionally, comparative studies with other developing economies can highlight strategies for improving Nepal's export performance. Addressing these areas will provide valuable insights for crafting effective economic policies for sustainable growth.

Ethical Considerations

The authors of this study have adhered to ethical guidelines in conducting the research and writing the article. All data used in this study were sourced from reputable and publicly available resources, and proper citations have been provided for all references. No data manipulation or falsification was involved in the analysis. The authors have ensured the confidentiality of any sensitive information and have not disclosed any proprietary or confidential data without proper authorization. Furthermore, the study was conducted with objectivity and impartiality, ensuring that findings and interpretations are not influenced by any external interests. No conflicts of interest exist regarding the content of this article. The research was carried out with a commitment to academic integrity and transparency.

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