“Exploring the relationship between trade openness and economic growth in Nepal: Insights from ARDL bound test cointegration analysis”

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EXPLORING THE RELATIONSHIP BETWEEN TRADE OPENNESS AND ECONOMIC GROWTH IN NEPAL: INSIGHTS FROM ARDL BOUND TEST COINTEGRATION ANALYSIS

Abstract

The capacity of foreign trade to substantially raise GDP via increased exports, heightened competition, and enhanced efficiency holds the key to bolstering economic growth and prosperity. Recognizing this transformation underscores the importance of shaping Nepal's economic policies and development strategies for achieving lasting sustainable growth. The objective of this study is to investigate how trade openness has affected Nepal's economic growth, given its importance in the nation's overall development. By analyzing the correlation between trade openness and economic expansion, policymakers and researchers can uncover the role of international trade in driving Nepal's economic advancement. The research methodology involves constructing a regression model using the Autoregressive Distributed Lag bound test, with variables analyzed in growth form and subjected to the Augmented Dickey-Fuller and residual tests. The study's results indicate a strong positive relationship between trade openness and economic growth in Nepal from 1975 to 2020, with a long-term equilibrium observed. Short-term deviations from equilibrium are quickly corrected at 38.23% annually, highlighting the importance of balanced export and import growth for economic development. The study concludes that trade openness drives Nepal's economic growth for sustainable development and environmental protection. It offers valuable insights for policymakers and stakeholders to enhance economic growth and overall development of the country.

Keywords import, export, competition, efficiency, specialization, technology, investment, innovation

JEL Classification F14, F40, O47

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INTRODUCTION

Trade openness is widely recognized as a catalyst for economic growth, fostering domestic production, boosting investments, and creating job opportunities. Trade openness can help countries specialize in producing goods and services that they are good at producing, and it can also help them access new markets and technologies.

Nepal, now actively engaged in trade agreements and a World Trade Organization (WTO) member, is committed to trade openness by systematically removing trade barriers and bureaucratic impediments. Nonetheless, Nepal's status as a landlocked nation presents challenges, particularly regarding limited infrastructure. This makes it difficult for the country to trade with other countries, hindering economic growth. As a result, achieving a delicate equilibrium between trade openness and nurturing domestic industries becomes a critical factor in fostering enduring and sustainable economic growth. Nepal needs to find ways to improve

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its infrastructure, such as building roads and railways, to trade more easily with other countries. However, it also needs to protect its domestic industries from foreign competition so that they can grow and create jobs.

The study delves into the intricate relationship between trade openness and economic growth within the Nepalese context. Through the application of the ARDL bound test cointegration analysis, the study seeks to shed light on the potential long-term relationship between these two pivotal factors. By examining the empirical evidence specific to Nepal, this study contributes to a deeper understanding of how trade openness influences economic growth in a unique geographical and economic setting.

1. LITERATURE REVIEW AND HYPOTHESIS

Some evidence suggests that when an economy is more open to trade, it becomes more competitive, which boosts productivity and leads to economic growth. In this context, Ades and Glaeser (1999) found that trade can help increase the number of patents granted in a country. Rivera-Batiz and Romer (1991) found that trade can help increase a country's technological diffusion rate. Barro and Sala-i-Martin (1990) found that trade can help increase the level of income per capita in a country. Trade openness became one of the main components of growth since it allowed technological transference from industrialized to developing nations (Grossman & Helpman, 1990a, 1990b; Afonso, 2001).

Studies in various countries have explored the impact of trade openness on economic growth. Paudel and Perera (2009) found a positive cointegration relationship between economic growth and foreign debt, trade openness, and the labor force in Sri Lanka. Kim et al. (2011) observed a certain inhibitory effect of trade openness on economic growth in 61 nations, while Alimi (2014) found substantial positive effects of exports and trade openness on economic growth. Intisar et al. (2020) studied the influence of human resources and trade openness on the economic development of multiple Asian countries, finding positive effects on economic growth. Saleem et al. (2020) examined the effects of trade openness and foreign direct investment on GDP in five South Asian countries.

On the contrary, some theoretical studies claim that trade openness may harm economic growth. Economic integration increases competition and decreases expected profits, thereby discouraging innovation. Zahonogo (2017) studied trade openness and economic growth in sub-Saharan Africa (SSA). His findings revealed that the relationship is not a straight line; instead, it forms an inverted U-curve, where excessive trade openness can have a negative impact on economic growth. Ramzan et al. (2019) found that when considering the level of total factor productivity (TFP) development, the relationship between trade openness and GDP growth is not straightforward: trade can negatively affect GDP growth in countries specialized in low-TFP development, but it positively boosts GDP growth once countries reach a minimum TFP development level.

The study highlighted the intricate relationship between trade openness and decoupling carbon emissions from economic growth, depending on various factors (Wang & Zhang, 2021). Policymakers should carefully consider these factors when designing strategies to promote decoupling carbon emissions from economic growth. Li et al. (2021) identified various effective measures to reduce per-capita carbon emissions. Policymakers should thoroughly consider these factors when formulating policies to decrease carbon emissions. Wang et al. (2022) emphasized that the connection between urbanization and the Environmental Kuznets Curve (EKC) is intricate and influenced by multiple factors.

Policymakers should consider these factors when developing policies to enhance environmental protection in urban areas. Wang et al. (2023a, 2023b) partially supported the Environmental Kuznets Curve (EKC) theory, suggesting an inverted U-shaped link between economic growth and environmental degradation. However, the relationship was more complex than initially be-

lieved across 208 countries. Wang et al. (2023a, 2023b) revealed that trade protectionism could hinder countries from achieving carbon neutrality, as it may lead to higher pollution levels, production relocation to countries with weaker environmental regulations, and increased consumer prices.

Empirical research findings on the relationship between trade openness and economic growth have been contradictory and inconsistent across countries. Studies suggest that international trade benefits low-income countries more than high-income ones (Rassekh, 2007). Some research, like that of Chang et al. (2009) and Harrison (1996), found a significant positive relationship between trade openness and economic growth. Harrison (1996) conducted time-series cross-country research for developing nations, examining the relationship between trade openness and economic growth. Other studies have explored the impact of trade openness and investment on economic development, such as Musila and Yiheyis (2015) in Kenya and Altaee and Al-Jafari (2015) in Bahrain.

Lawal et al. (2016) used the Autoregressive Distributed Lag (ARDL) model to study the impact of trade openness on economic growth in Nigeria, while Obeid and Awad (2018) conducted a comprehensive analysis of the relationship between economic development, trade openness, and economic growth in Jordan. Kong et al. (2021) examined the relationship between Chinese trade openness and the quality of economic growth, finding that when short-term fluctuations deviate from long-term equilibrium, the quality of economic growth can stabilize through automatic adjustment, with trade openness having a significant regional heterogeneity and non-linear threshold impact on economic growth quality in China.

Cheung and Ljungqvist (2021) studied 31 OECD nations using the Panel Fixed Effect Model and found that trade openness significantly affected economic growth rates. Juliansyah et al. (2022) analyzed pooled OLS data from 1967 to 2020, concluding that exports boosted economic growth in selected economies while imports had a hampering effect. Sunde et al. (2023) investigated the impact of trade openness, imports, and exports on Namibia's economic development using the ARDL cointegration technique, observing that imports had a constraining effect. Kumari et al. (2023) found no bi-directional causality between India's trade openness and economic growth.

Research on the relationship between Nepal's economic development and trade has been modest (Dhungel, 2016; Rana, 2020). The cointegration method found a long-run relationship between imports, exports, and Nepal's economic development. Pokhrel (2022) concluded that all variables positively affect economic growth in Nepal using an ordinary least squares regression approach. The sole and proper aim of this study is to comprehensively investigate the intricate relationship between trade openness and economic growth in Nepal. Through the application of the ARDL bound test cointegration analysis, this paper endeavors to reveal enduring associations between these pivotal factors over the long term. By concentrating on empirical evidence specifically tailored to the unique conditions prevailing in Nepal, this study suggests the following hypothesis:

H1: In the context of Nepal, increased trade openness is positively associated with economic growth over the long term.

2. METHODOLOGY

The theoretical framework examines how the Real Gross Domestic Product (RGDP) is influenced by trade openness, population, capital stock, and government expenditure. In this framework, RGDP is a function of these variables, where trade openness, population, capital stock, and government expenditure changes may affect RGDP positively or negatively.

The theoretical framework for Real Gross Domestic Product (RGDP) incorporates several key factors. First, RGDP represents the total economic output of a country, encompassing all goods and services produced within its borders, adjusted for inflation. Secondly, trade openness, which reflects a country's participation in international trade, plays a crucial role. Higher trade openness can increase exports and imports, positively impacting RGDP by stimulating economic activity and providing

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access to a larger global market.

Another determinant is the population, which represents the total number of people living in the country. A larger population can contribute to higher RGDP by expanding the labor force and increasing consumer demand. However, sufficient economic opportunities must accompany population growth for this relationship to be beneficial.

Furthermore, capital stock, comprising physical and financial assets used in production (e.g., machinery, infrastructure), influences RGDP. A higher capital stock enhances productivity, increasing production and the possibility of higher RGDP. Investments in capital stock contribute to overall economic growth.

Lastly, government expenditure is a significant factor affecting RGDP. The government's spending on goods, services, and public investments can directly contribute to economic growth, particularly through infrastructure and development projects. Additionally, government expenditure impacts aggregate demand and generates multiplier economic effects, influencing RGDP through various channels. Understanding and analyzing the relationships among trade openness, population, capital stock, and government expenditure in the context of RGDP helps comprehend and formulate policies for economic growth and development.

Trade openness can boost productivity and economic growth, leading to a larger population and capital stock. A larger population increases the demand for goods and services, fostering economic growth. Similarly, a larger capital stock enhances productivity and economic growth. At the same time, increased government expenditure can also contribute to growth, but the relative importance of each variable varies by country or region. However, the relationship is not always linear, and excessive government expenditure may hinder economic growth by crowding out private investment. The framework does not consider other factors like technological innovation and political stability that can also influence economic growth.

In this study, an ARDL (Autoregressive Distributed Lag) bound test is performed to assess the relationship between Real Gross Domestic Product (RGDP) and its determinants: trade openness, population, capital stock, and government expenditure. The time series data used for analysis are obtained from the Economic Survey, covering the period from 1975 to 2020.

The specific methodology involves preprocessing the data to ensure stationarity, specifying the ARDL model, determining the appropriate lag order, estimating the model using the Ordinary Least Squares (OLS) method, conducting the bound test to identify long-run relationships, developing the Error Correction Mechanism (ECM) for short-run dynamics, and performing diagnostic checks for model validity. This approach helps to understand how trade openness, population, capital stock, and government expenditure influence Nepal's economic growth over time.

The empirical assessment models for the analysis are presented in equation (1) as follows:

$$RGDP\_G = f\begin{pmatrix} TO\_G, POP\_G, \\ Cstock\_G, GovExp\_G \end{pmatrix} \quad (1)$$

where *RGDP_G* = economic growth; *POP_G* = population growth; *Cstock_G* = growth of capital stock and *GovExp_G* = growth of government expenditures.

In this study, all the variables have been transformed to their growth rates, which helps achieve stationarity and simplify the interpretation of the model. The problem of non-stationary variables is addressed using growth rates, as differences between consecutive observations tend to remove the trend and make the data stationary. This approach allows for a more straightforward interpretation of the relationships between the growth rates of Real Gross Domestic Product (RGDP) and its determinants, including trade openness, population, capital stock, and government expenditure (Leamer, 1998; Dollar & Kraay, 2004). Analyzing the growth rates helps capture the relative changes in these variables over time and facilitates a clearer understanding of their impact on Nepal's economic growth.

In cointegration testing, the augmented Dickey-Fuller (ADF) test is used to determine the order of integration for each variable (*RGDP_G*, *POP_G*, *Cstock_G*, and *GovExp_G*). This test checks to see if the underlying variables are stationary. The ADF

test establishes whether each variable is I (0) (stationary), I (1) (integrated of order 1), or both, which is a prerequisite for conducting the ARDL bound test. The null hypothesis assumes the presence of unit roots (non-stationarity) in the fundamental variables, while the alternative hypothesis states their absence. The prediction is that none of the variables will be I (2) (integrated into order 2), suggesting that second-order differencing is less likely.

Pesaran et al. (1999, 2001) used the ARDL-bound test to assess cointegration, which has several advantages over other cointegration methodologies by Johansen and Juselius (1990) and Engle and Granger (1987). Unlike Johansen's approach, ARDL can be applied regardless of whether variables have different orders of integration (I(0), I(1)). ARDL also shows better statistical validity with small sample sizes. Moreover, ARDL allows variables to have varying optimum lags, uses a single equation instead of multiple equations, and provides balanced estimates of the long-term model and proper t-statistics even with some endogenous regressors (Bhatta, 2013).

The ARDL model study is represented by equations (2), (3), and (4).

$$\begin{aligned} RGDP\_G_t &= \beta_0 + \beta_1 TO\_G_t + \\ &+ \beta_2 POP\_G_t + \beta_3 Cstock\_G_t + \\ &+ \beta 4 GovExp\_G_t + \varepsilon_t, \end{aligned} \tag{2}$$

$$\begin{aligned} \Delta RGDP\_G_t &= \propto_0 + \sum_{i=1}^{m} \propto_{1i} \Delta RGDP\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{2i} \Delta TO\_G_{t-i} + \sum_{i=1}^{n} \propto_{3i} \Delta POP\_G_{t-i} + \\ &\sum_{i=1}^{n} \propto_{4i} \Delta Cstock\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{5i} \Delta GovEx\_G_{t-i} + \propto_{11} \Delta RGDP\_G_{t-1} + \\ &+ \propto_{12} \Delta TO\_G_{t-1} + \propto_{13} \Delta POP\_G_{t-1} + \\ &+ \propto_{14} \Delta Cstock\_G_{t-1} + \propto_{15} \Delta GovEx\_G_{t-1} + \varepsilon_{1t}, \end{aligned} \tag{3}$$

where Δ is the difference, the constant term is, $\propto_0$ and, $\propto_{1i}$, $\propto_{2i}$, $\propto_{3i}$,$\propto_{4i}$ and $\propto_{5i}$, (i = 0, 1, 2, ... n) are the short-term coefficients. And $\propto_{11}$, $\propto_{12}$, $\propto_{13}$,$\propto_{14}$ and $\propto_{15}$ are the long-term coefficients. (m = 1) is the optimal lag of the dependent variable, and (n = 2) is the optimal lag of the independent variables. The optimum lag is designated based on the Akaike information criteria.

H0: $\propto_{11} = \propto_{12} = \propto_{13} = \propto_{14} = \propto_{15} = 0.$

H1: $\propto_{11} \neq \propto_{12} \neq \propto_{13} \neq \propto_{14} \neq \propto_{15} \neq 0.$

If the test result impacts the upper critical boundary value, the study denies H0, and cointegration fails to take place. H0 is supposed to be exact when the F-statistic is less than the lower critical value. The ARDL ECM (Error Correction Model) must be used to estimate when the model's parameters are cointegrated.

Godfrey (1978) says that the cointegration bound test is based on ARDL in two equally special cases (cointegration or no cointegration) when using the model (m, n) to figure out the relationship between the variables.

The ARDL (m, n) model is defined as follows if there is no cointegration:

$$\begin{aligned} \Delta RGDP\_G_t &= \propto_0 + \sum_{i=1}^{m} \propto_{1i} \Delta RGDP\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{2i} \Delta TO\_G_{t-i} + \sum_{i=1}^{n} \propto_{3i} \Delta POP\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{4i} \Delta Cstock\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{5i} \Delta GovEx\_G_{t-i} + \varepsilon_t, \end{aligned} \tag{4}$$

If cointegration exists, the ECM is specified as:

$$\begin{aligned} \Delta RGDP\_G_t &= \propto_0 + \sum_{i=1}^{m} \propto_{1i} \Delta RGDP\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{2i} \Delta TO\_G_{t-i} + \sum_{i=1}^{n} \propto_{3i} \Delta POP\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{4i} \Delta Cstock\_G_{t-i} + \\ &+ \sum_{i=1}^{n} \propto_{5i} \Delta GovEx\_G_{t-i} + \lambda ECT_{t-1} + \varepsilon_{1t}, \end{aligned} \tag{5}$$

where *ECT* is the error correction term and λ is the speed of correction parameter with a negative sign. The short-term dynamic components of the

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model's adjustment to long term equilibrium are $\propto_{1i}$, $\propto_{2i}$, $\propto_{3i}$, $\propto_{4i}$, and $\propto_{5i}$.

In the residual diagnostic test, two tests are performed in a specific order: the heteroscedasticity test (Breusch-Pagan-Godfrey) and the serial correlation test (Breusch-Godfrey). For the diagnostic tests to be satisfactory, the probabilities of heteroscedasticity and autocorrelation must be greater than five percent. This indicates no significant issues with heteroscedasticity or autocorrelation in the model's residuals (Jarque & Bera, 1980).

3. RESULTS

Trade is crucial for economic development, and this study focuses on the relationship between economic growth and trade in Nepal, which has experienced irregular economic growth over the years. Figure 1 depicts Nepal's RGDP_G development, which peaked at 10% in 1981 after hitting a low of –1.5% in 1980.

Figure 2 depicts the relationship between Nepal's imports and exports. For the past few years, the gap between Nepal's imports and exports has increased significantly. This gap was the highest in 2019 and seems to decrease in 2020. It has also shown that the gap between Nepal's imports and exports constantly increases, which has not been good for economic development.

The descriptive statistics of the model series, based

Source: MOF (2022).

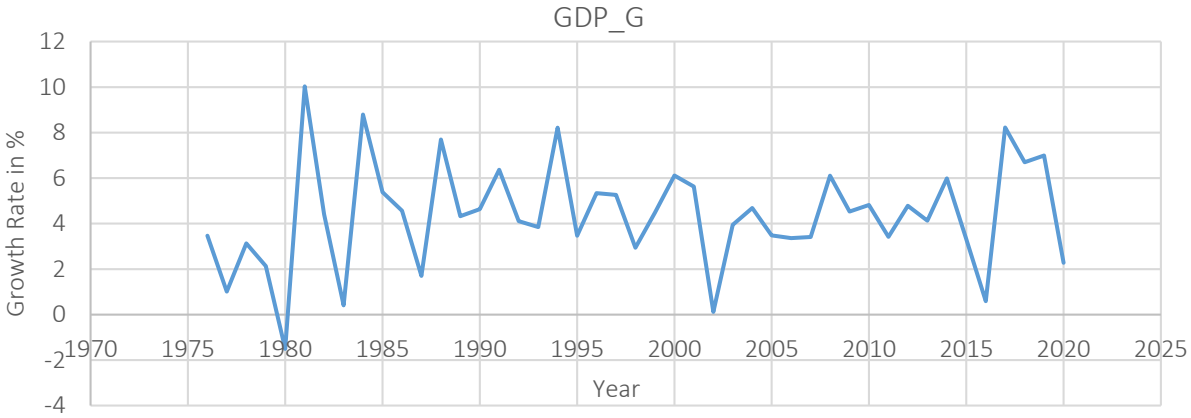

Figure 1. Development of Nepal's economic growth, 1975–2020

Source: MOF (2022) (calculated using Eviews-13).

Figure 2. Nepal's imports and exports, 1975–2020

Table 1. Descriptive statistics

Source: Calculated using EViews 13.

Variable	*RGDP_G*	*TO_G*	*POP_G*	*CAPST_G*	*GEX_G*
Mean	4.3743	12.8948	1.9029	15.4733	16.0945
Median	4.4114	11.3769	2.0989	15.7522	14.9048
Maximum	10.0312	85.5344	2.6584	21.7528	39.3016
Minimum	–1.5040	–24.0988	1.2660	10.5968	–1.4512
Std. dev.	2.35101	21.7354	0.4929	2.8884	9.0625
Skewness	–0.01741	1.0315	0.0319	0.0045	0.4243
Kurtosis	3.2714	4.4596	1.4969	2.0294	3.0123
Jarque-Bera	0.1404**	11.9764	4.2437	1.7662	1.3507
Probability	0.9321	0.0025	0.1198	0.4134	0.5089
Sum	196.8451	580.2693	85.6306	696.3014	724.2543
Sum Sq. dev.	243.2004	20786.9689	10.6934	367.0943	3613.6866
Observations	45	45	45	45	45

Note: RGDP_G = economic growth; *TO_G* = growth of trade openness; *POP_G* = population growth; *Cstock_G* = growth of capital stock and *GovExp_G* = growth of government expenditures.

on time series data from 1975 to 2020, explore the effects of trade openness, population growth, capital stock growth, and government spending on Nepal's economic growth. Table 1 provides a summary of these statistics. According to Jarque-Bera's statistics, the data exhibit a normal distribution, constant variance, and zero covariance. This suggests that the model series meets the assumptions of normality and homoscedasticity, which are essential for reliable statistical analysis.

Although ADF tests are not required when using the ARDL technique, the study conducted them to ensure that no variable in the model was integrated of order I (2) (Pesaran et al., 2001). The augmented Dickey-Fuller (ADF) test, proposed by Dickey and Fuller (1979), was used to test for unit roots in the variables. The results of the unit root tests are presented in Table 2, which provides insights into the integration orders of the variables in the study.

Table 2. Unit root test

Source: Calculated using EViews 13.

Variable	ADF		Decision
	Level	First difference	I (d)
RGDP_G	0.0000**	–	I (0)
TO_G	0.0000**	–	I (0)
POP_G	0.509	0.0000**	I (1)
Cstock_G	0.147	0.0000**	I (1)
GovExp_G	0.0000**	–	I (0)

Note: ** significant at a 5 percent level. *RGDP_G* = economic growth; *TO_G* = growth of trade openness; *POP_G* = population growth; *Cstock_G* = growth of capital stock and *GovExp_G* = growth of government expenditures.

The selection of the most suitable model for ARDL is crucial for obtaining accurate short- and long-term estimations. To achieve this, the model that minimizes the residual sum of squares (RSS) is chosen, considering both lagged values of dependent and independent variables. The optimal lag values (m and n) are determined by calculating the Akaike information criterion (AIC) for different combinations of lags. The ARDL (2, 0, 0, 0, 0) model, with $m = 2$ and $n = 0, 0, 0, 0$, emerged as the best model among the 2,500 tested models, as it demonstrated the lowest AIC value and satisfied all fitness standards. Figure 3 displays the top 20 models with various lag values, confirming the superiority of the selected model with the lowest RSS.

The first step in the ARDL analysis technique is cointegration testing to investigate whether a long-run relationship exists between the variables. The F-test is used to calculate upper and lower boundaries, and under the null hypothesis of no cointegration, the F-statistics should follow an unusual final distribution. The practical estimation of the OLS model is the initial phase of the ARDL-bound method, helping to determine the presence of a long-run or short-run relationship. The study conducted a cointegration test using the ARDL (2, 0, 0, 0, 0) bound testing technique with *RGDP_G* as the dependent variable. The F-statistics result was 14.3873**, higher than the upper bound critical value at 5% (3.905**), leading to the rejection of the null hypothesis (*H0*). This implies that the parameters in the model are cointegrated, indicating a long relationship among them (Table 3).

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Source: Calculated using EViews 13.

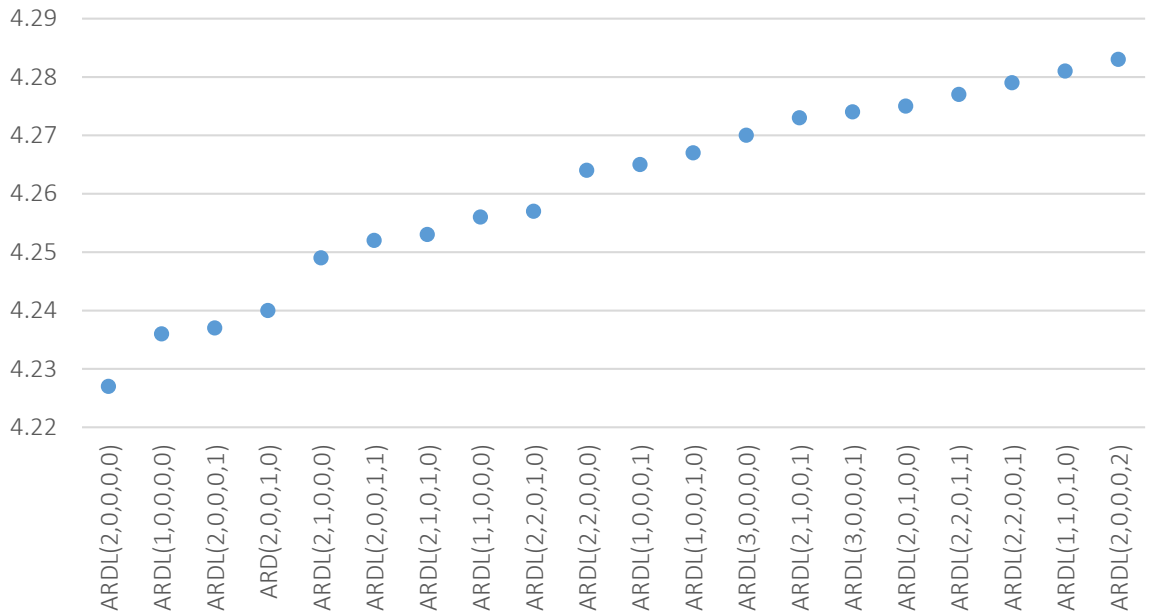

Figure 3. AIC of top 20 models

Table 3. Results of bound testing, critical values, and diagnostic testing

Source: Calculated using EViews 13.

F-statistic: 14.3873**						
Sample Size of the variables	10%		5%		1%	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
40	2.427	3.395	2.893	4	3.967	5.455
45	2.402	3.345	2.85	3.905**	3.892	5.173
Asymptotic	2.2	3.09	2.56	3.49	3.29	4.37

Note: * I (0) and I (1) are respectively stationary and non-stationary. ** Rejection of the null hypothesis.

Table 4 reveals that the long-run trade openness growth coefficient (*TO_G*) is positively and significantly related to economic growth at the 5% level. This means that Nepal's trade openness positively impacts its economic growth over time, with a 1% increase in foreign trade leading to a 0.259% growth in real gross domestic product. Numerous studies support the idea that trade openness contributes to a nation's long-term economic growth. However, the negative and statistically insignificant coefficient for population growth (*POP_G*) may indicate that Nepal's low-income status and

Table 4. Results of long-run estimates

Source: Calculated using EViews 13.

ARDL (2, 0, 0, 0, 0, 0) model based on AIC			
Dependent Variable *RGDP_G*			
Variables	Coeff.	t-stat	Prob.
TO_G	0.259532**	3.850139	0.0005**
POP_G	–1.190770*	–1.822785	0.0766*
CStock_G	0.128621*	1.075294	0.2894*
GExp_G	0.147*	1.251388	0.2189*
C	4.906201**	2.403095	0.0215**

Note: In probability notation, '*' signifies a value greater than 5%, whereas '**' denotes a value less than 5% but in Coeff it indicates only comparison with Prob. value. *RGDP_G* = economic growth; *TO_G* = growth of trade openness; *POP_G* = population growth; *Cstock_G* = growth of capital stock and *GovExp_G* = growth of government expenditures.

Table 5. Results of short-run estimates

Source: Calculated using EViews 13.

D(RGDP_G) (dependent variable)				
Variable	**Coeff.**	**Std. error**	**t-statistic**	**Prob.**
*COINTEQ**	–0.382373**	0.1394180	–9.915307	0.000000**
D (RGDP_G (–1))	0.142226	0.09908031	1.435467	0.158739
R^2	0.778396	Mean dependent var.		0.029422
Adjusted- R^2	0.772991	S.D. dependent var.		3.663374
S.E.	1.745430	Akaike info criterion		3.997274
RSS	124.9075	Schwarz criterion		4.079190
Log-likelihood	-83.94140	Hannan-Quinn criterion		4.027482
F-stat	144.01498	Durbin-Watson stat		1.963651
Prob. (F-stat): 0.00000000				

Note: * p-values are incompatible with t-stat. ** indicates significance at a 5% level. *RGDP_G* = economic growth; *TO_G* = growth of trade openness; *POP_G* = population growth; *Cstock_G* = growth of capital stock and *GovExp_G* = growth of government expenditures.

consistent rapid population growth could hinder its economic progress. The data suggest that trade openness policies play a crucial role in enhancing Nepal's economic growth in the long run. Thus, the findings suggest Nepal should focus on increasing exports and imports to achieve sustained economic growth.

Table 5 reveals that the short-r** signs indicate significance at a 5% level, and dynamics of the ARDL (2, 0, 0, 0, 0) model's error-correcting representation are presented. Notably, the lagged error correction term (*ECT*) at (–1) is negative and significant at the 5% level. The coefficient of *ECT* (–0.382373) indicates the speed of adjustment toward long-run equilibrium. The study demonstrates that any short-term deviations from equilibrium are corrected at 38.23% annually, indicating a swift return to long-term balance. The relatively low capacity of exports compared to imports may impact this rapid adjustment in production growth. For long-term outcomes, it can be concluded that Nepal's total trade openness contributes to economic growth over time. The strategic implication of these findings for Nepal is the need to focus on generating export growth in line with import growth to support economic development in the country.

Figure 4 shows that the cointegration series is an essential part of this analysis as it helps identify a stable long-term relationship among the variables under consideration.

Source: Calculated using Eviews-13.

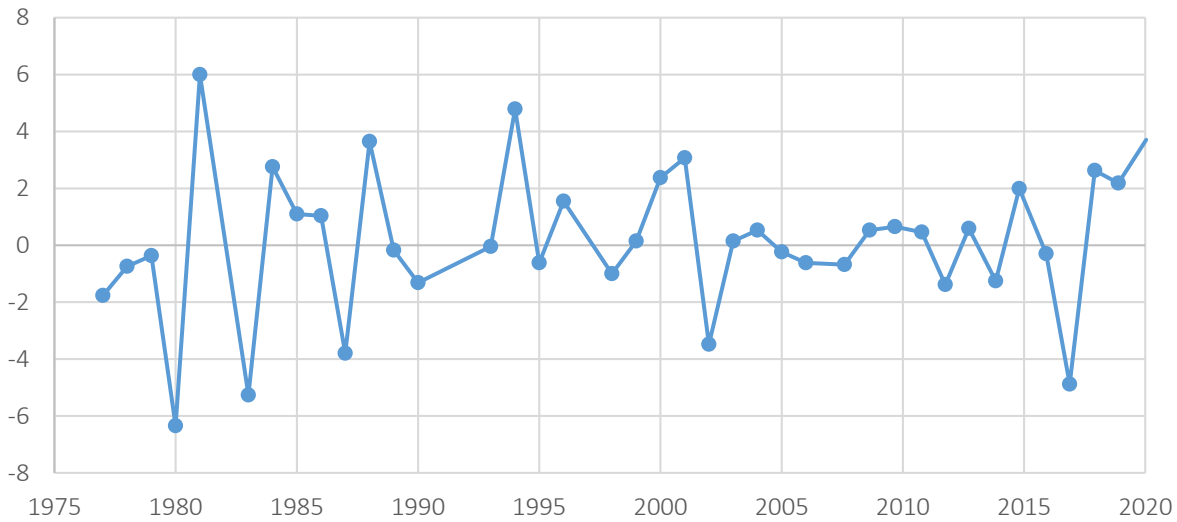

Figure 4. The ARDL cointegration series

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Table 6. Diagnostic stability test

Source: Calculated using EViews 13.

Heteroscedasticity Test Breusch-Pagan-Godfrey			
F-statistic	1.257750	Prob. F (6.36)	0.301061
Obs · R-squared	7.45179***	Prob. Chi-Square (6)	0.28107**
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.518222	Prob. F (2.34)	0.233584
Obs · R-squared	3.5253***	Prob. Chi-Square (2)	0.1715**

Note: ** corresponding likelihood lower value; *** higher value.

Table 6 reveals that diagnostic tests are essential to validate the projected outcomes of the long-run model. The Breusch-Pagan-Godfrey test with an observed R-squared value of 7.45179, is higher than the corresponding likelihood (0.28107), indicating that the model is not heteroscedastic. The residuals are also free of serial correlation, as shown by the LM test with an observed R-squared value of 3.5253, higher than the associated probability of 0.1715. This suggests that serial correlation does not negatively affect the long-term model. In summary, the data do not support both heteroscedasticity and serial correlation hypotheses.

The increased trade openness is anticipated to have a positive correlation with long-term economic growth; the study's findings are complemented by the coefficient of Error Correction Term (ECT) (–0.382373). This coefficient serves as a crucial measure, indicating the swiftness of adjustments toward the long-run equilibrium. The study underscores that any momentary deviations from equilibrium are rectified at a rapid annual rate of 38.23%, thereby signaling a prompt restoration to long-term balance. By employing the ARDL bound test cointegration analysis, the study not only substantiates significant and enduring correlations between trade openness and economic growth but also aligns the observed adjustment dynamics with the hypothesis. This insight contributes to a comprehensive understanding of how trade openness interacts with economic growth within Nepal's unique geographical and economic context.

The findings, encompassing the Error Correction Term (ECT) coefficient and observed adjustment patterns, corroborate the hypothesis that heightened trade openness has a favorable connection with sustained economic growth in Nepal over the long term. The paper reveals that adjustments following transient equilibrium deviations align with the expected trade openness-economic growth relationship. This concordance fortifies comprehension of how trade openness impacts Nepal's economic growth, particularly within its unique geographical and economic framework.

The higher levels of trade openness are connected to favorable long-term economic growth. As a nation engages more in international trade and opens its markets to the global economy, it tends to experience increased economic expansion over extended periods. This positive association suggests that trade openness can act as a catalyst, stimulating economic activities and contributing to sustained economic development in the long run.

The explanation for the positive association between increased trade openness and long-term economic growth lies in the mechanisms through which trade openness can spur economic development. When a country engages in greater international trade, it opens up new avenues for its businesses to access larger markets and diverse sources of inputs. This competition and exposure to global markets encourage domestic industries to become more efficient and innovative, increasing productivity. Additionally, trade openness attracts foreign investment, technological transfer, and knowledge sharing, further contributing to economic growth. Over the long term, sustained trade openness can lead to cumulative gains in enhanced productivity, increased exports, and improved economic performance, thereby fostering economic growth and development.

In the context of Nepal, the justification for the positive association between increased trade openness and long-term economic growth is rooted in the country's unique circumstances. As Nepal embraces significant international trade, it gains access to broader markets and diverse sources of inputs that can invigorate its industries. This exposure stim-

ulates healthy competition and compels domestic businesses to adopt more efficient and innovative practices, leading to heightened productivity. Moreover, trade openness in Nepal can attract much-needed foreign investment, enabling the infusion of capital and technology that can drive economic advancement.

Additionally, the sharing of knowledge and expertise through international trade channels contributes to the country's capacity to adapt and innovate, further propelling economic growth. Over an extended period, sustained trade openness can contribute to cumulative improvements in productivity, expanded exports, and overall economic performance, ultimately fostering the long-term growth and development of Nepal's economy.

The study's outcomes validate the alternative hypothesis. The study indicates a positive association between trade openness and economic growth in Nepal. The study found that a 1% increase in foreign trade leads to a 0.259% increase in real GDP. This is a statistically significant positive relationship, meaning the null hypothesis (H0) can be rejected. The results also show that the relationship between trade openness and economic growth is strong and persistent. The study found that the relationship between the two variables converges to long-term equilibrium at an annual rate of 38.23%. This means that the positive impact of trade openness on economic growth will likely continue.

4. DISCUSSION

The conclusions drawn from the review of existing literature and the empirical research shed light on the complex relationship between trade openness and economic growth. The theoretical foundation underlying the positive effects of trade openness on economic growth is well-established in the literature. However, the empirical evidence presents a nuanced picture, suggesting that this relationship is not uniform across countries.

The review of existing theoretical studies aligns with the consensus that trade openness can contribute positively to economic growth. Nonetheless, the empirical landscape reveals considerable heterogeneity in the outcomes of various studies. While some investigations indicate a positive impact of trade openness on economic growth, others present contradictory or inconsistent findings. This variability underscores the need for comprehensive studies considering various factors influencing economic and environmental dynamics.

The study contributes to this discourse by providing insights specific to Nepal's context. The findings demonstrate that trade openness indeed has a positive influence on Nepal's economic growth over time. The observed 0.259% growth in real GDP (Gross Domestic Product) per 1% increase in foreign trade underscores the significance of international trade in bolstering the nation's economy.

The short-run dynamics observed in the present study reveal a rapid rate of return to long-term equilibrium, quantified at 38.23% annually. This highlights the economy's resilience and ability to adjust to changes in trade openness relatively quickly. However, the statistical insignificance of the coefficient for population growth raises critical concerns. Rapid population growth in a low-income country like Nepal poses challenges that could counteract the benefits of trade openness. Further exploration is needed to understand the interplay between population growth, economic growth, and trade dynamics in this unique context.

Research findings underscore the importance of acknowledging the multifaceted relationship between trade, economic growth, and environmental challenges. While trade openness can drive economic growth, its implications for environmental concerns and carbon emissions necessitate a more nuanced exploration. This concurs with the review's suggestion that comprehensive studies should consider not only trade openness but also per-capita carbon reduction measures, urbanization effects, and the potential impacts of trade protectionism.

The findings of this study are similar to the findings of Wang et al. (2023a, 2023b), Altaee and Al-Jafari (2015), Lawal et al. (2016), Sunde et al. (2023), Zahonogo (2017) and Wang and Zhang (2021). However, they contrast the findings of Ades and Glaeser (1999), Peraran et al. (2001), Zahonogo (2017), and Musila and Yiheyis (2015). These findings can be explained by the fact that trade openness positively affects the economic growth of Nepal.

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CONCLUSION

Trade openness is vital to Nepal's development; thus, this study examines its objectives for economic growth. The data strongly suggest that trade openness boosts Nepal's economy. A strong, statistically significant positive relationship between trade openness and real GDP suggests a long-term relationship. This shows that trade openness drives long-term economic prosperity in Nepal. However, the study shows that rapid population growth in a low-income nation like Nepal complicates its economic future. This paper emphasizes the importance of trade openness in Nepal's economic growth and the need to account for demographic dynamics when analyzing its economic prospects.

This study contributes empirical insights that align with the theoretical proposition that trade openness positively impacts economic growth. However, the intricate interplay between trade, growth, and environmental challenges necessitates ongoing research to fully comprehend these relationships and their implications for countries like Nepal. The findings emphasize the need for balanced policy approaches that harness the benefits of trade openness while addressing potential challenges arising from rapid population growth and environmental concerns.

AUTHOR CONTRIBUTIONS

Conceptualization: Khom Raj Kharel.
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Resources: Suman Kharel.
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