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| RESEARCH ARTICLE

Determinants of Export Performance of a Landlocked Country with Developing Economy: Time-series Econometric Analysis of Nepal's Trade from 1975 to 2021

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| ABSTRACT
The study aimed to identify the key determinants of the export performance of Nepal, a landlocked country with a developing economy. We used econometric time-series analysis to investigate the association of export performance with foreign direct investment, foreign exchange rate, and import value data from 1975 to 2021. The log-transformation of export performance, foreign direct investment (FDI), foreign exchange rate (FER), and import value were not stationary at level/order null I (0), but at the initial difference, I (1). Despite significant long-run relationships between export performance, FDI, FER, and import value, a short-term significant association existed with normalized co-integration and high log-likelihood (Adjusted R2 = 98.98, the value of Durbin-Watson test ≈2, P<0.01). Further, the foreign exchange rate had a significant effect on exports (p<0.01), while foreign exchange and imports had a significant impact on FDI (p<0.1 & p<0.05, respectively). Our study concluded that there is no co-integration of exports with FDI, FER, and import value in the long run, but FER interacts with them in the short run. The absence of a significant long-run relationship between export performance with FER, FDI, and import value could be due to rapid political changes and natural disasters, such as earthquakes from 1975 to 2021, leading to further changes in the business environment. These findings have important implications for Nepal's economic development.

| KEYWORDS

Export, Import, Trade, Econometric analysis, Time-series analysis, Developing economy, Landlocked country, Nepal.

| ARTICLE INFORMATION

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1. Introduction

The trade balance is a crucial macroeconomic performance indicator for any country. A high trade deficit often indicates reduced competitiveness of commodities, poor export performance, and hindered economic progress (Irwin, 2024). A decline in trade performance, particularly poor export performance, can significantly impede economic growth (Blavasciunaite et al., 2020). In theory, the depreciation of a country's currency can boost exports by making them more competitive in the global market. However, the government may also need to restrict imports as they become more expensive due to the currency depreciation (Laksono & Saudi, 2020).

Nepal is landlocked between two significant economies, China and India, while Nepal's significant trade relations prevail with these countries. Nepal has been one of the most trade-liberalized countries in South Asia since its membership with the World Trade Organization (WTO) in 2004. It has continued to broaden the openness to trade and push down tariff barriers and restrictions. However, the ratio of aggregated export to import is around 1:10, showing no significant increment in the rate of export over time as compared with imports, resulting in a stagnant high trade deficit. The vast difference between imports and exports has resulted in a huge trade deficit, with almost stagnant export growth and geometric import increment in Nepal. (NPC, 2016; Kharel & Kharel, 2020; Nepal, 2020; Barotov, 2020).

In addition, earlier research in the trade literature concentrated on industrialized economies in the West, with less priority on developing countries' export performance (Boso *et al*., 2016). As there could be significant differences in the factors affecting the trade balance of Western developed countries, the trade dimensions and determinants may differ with underdeveloped countries like Nepal because of different socio-cultural and socio-economic contexts. More crucially, exporting businesses from developing economies face several difficulties in the exporting market. Given these variations, additional research and information from developing nations are required to advance the evidence base. This study, therefore, aims to determine the factors affecting export performance in a developing economic context, especially in a landlocked country.

Previous research shows that the trade balance depends on the exchange rate, Gross Domestic Product (GDP), market openness, and trade agreements. India continued to lead Nepal's highest share in foreign trade, followed by China. The key factors related to Nepal's almost stagnant growth rate of exports and the fast growth rate of imports need to be investigated to better strategize the macroeconomic growth of developing economies.

The study examines the short—and long-term associations of export performance with foreign direct investment (FDI), the foreign exchange rate (FER), and the value of an import.

2. Literature review

Incorporating countries into the global economy is a crucial determinant of a nation's macroeconomic health, as the macroeconomic health incorporates trade performance, including export and import. International trade enhances efficient resource allocation, promotes economies of scale, enables the diffusion of knowledge, stimulates the progress of technology, and fosters economic competition (Andersen & Babula, 2009; Busse & Koniger, 2012; Bakariet *et al*., 2019).

A study conducted in Jordan (Alawin & Al-Maghareez, 2013) found a substantial long-term relationship between trade performance with remittance and FDI while none with Real Exchange Rate (RER) for the period of 30 years (1980 to 2010). In Indonesia, Sugema (2005) concluded that the improvement in trade was associated with a reduction of RER, an increment in exports, and a shrinkage in imports. Laksono & Saudi (2020) showed the long-term effect of the value of import, GDP, export, and exchange rate on trade performance for 35 years (1980 to 2015) with no short-run equilibrium.

The study by Hassan, Wajid, and Kalim (2017) in Pakistan, India, and Bangladesh for 40 years (1972-2013) showed the adverse linkage of the trade deficit with RER, GDP, and investment. Export performance in Bangladesh (Rahman, 2010) was positively associated with FER and import value. The FDI harmed Somalian trade performance (Sharif & Ali, 2016), while the exchange rate had no significant impact. Bi, Alexander & Pei (2019) analyzed panel data in 46 countries over the decade (2004 to 2015) and found an ambiguous effect of import, FER & FDI on trade.

2.1 Factor Affecting Export Performance: A Theoretical Framework

According to the theoretical framework synthesized a framework based on literature and recent works in the area, trade liberalization encourages economic growth in countries through the supply side variables, in particular, increasing export performance (Paul & Dhiman, 2021; Ghazouani & Maktouf, 2024). With a total allocation of resources, higher trade flow encourages domestic firms to focus on activities in which they have a comparative advantage. Switching to more helpful activities will later result in the reallocation of resources and increased productivity, decreasing the use of resources in unproductive sectors (Cai, 2023; Owusu, 2024). The variables included in the framework are the export performance indicator, a measure of domestic trade openness, national trade liberalization, the total output of the local and global economies, and the foreign exchange rate.

Export performance: As delineated by resource reallocation theory, exports are one of the significant aspects of overall trade performance affected by trade liberalization policies.

Foreign Exchange Rate (FER): FER depicts the units of domestic currency necessary to return for a unit of foreign money. It indicates the competitiveness of local goods compared to international ones. Therefore, depreciating FER would favorably affect exports.

Foreign Direct Investment (FDI): FDI is a type of investment across the border in which a stake in one country is invested in another one. According to estimates, FDI has a favorable impact on export performance.

Value of Import: Import is when a country buys goods from another country. Imports can negatively affect a country's exchange rate. A weak internal currency enhances exports and raises import prices, while a strong currency reduces exports and lowers import prices.

3. Methodology

This study adopted a quantitative approach and tested the study variables by applying time-series analysis.

3.1 Research Design

This study applied an econometric approach, i.e., time-series analysis, to test the hypotheses concerning export performance over time (1975-2021).

3.2 Variables

Dependent variable: Export performance is the dependent variable.

Independent variables: FER (in USD), FDI, and the value of imports were the independent variables that predicted export performance.

Time: The time-series analysis covered the data for 47 years (1975 to 2021), as it was the only available data in the data portal of the Ministry of Finance, Nepal.

3.3 Data and Sampling Strategy

In this study, the data on export performance, foreign exchange rate, FDI, and import value of Nepal in the past 47 years (1975 to 2021) was analyzed using the time-series analysis. This study relies on secondary sources for data collection. All the data on export performance, FDI, and imports were obtained from the database of the Ministry of Finance (MoF). The FER data from 2000 to 2021 was obtained from the MoF database. In contrast, the data from 1975 to 2021 was obtained from the World Development Indicator (WDI) data bank of the World Bank because of the unavailability of the MoF database.

3.4 Data Processing and Analysis

The data was first pulled into MS Excel for primary screening, identifying missing data, and checking consistency. Then, it was transferred into EViews 12 statistical software for further econometric analysis. After importing the MS Excel dataset into EViews 12, the time-series analysis of data was carried out using EViews 12 statistical software. The details of the time-series analysis and the key results are available in the results section.

3.5 Econometric results

This study analyzed the time-series data of export, FDI, FER, and import value from Nepal's trade data set. Export was the dependent variable, whereas import, FDI, and FER were the independent variables.

3.6 Log transformation

First, the time-series data of export, import, FDI, and FER variables were normalized using a log transformation. Then, a unit root test was applied to test the data's stationarity.

3.7 Unit root test

The Augmented Dickey and Fuller (ADF) unit root tests of analysis were used to test the stability of log-transferred export, import, FDI, and FER series.

Table 1: Unit root test of log-transformed export

Null Hypothesis: D(LEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic – based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.596858	0.0002
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

**MacKinnon (1996) one-sided p-values*

As the log-transformed export performance data was found non-stationary at level/order, it was further tested at the first difference. The unit root test showed that the log-transformed export performance data was stationary at the first difference. Both intercept and trend were not stationary at level/order, while both were significant at the first difference level.

Table 2: Unit root test of log-transformed foreign direct investment (FDI)

Null Hypothesis: D(LFDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic – based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.66433	0.0000
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

**MacKinnon (1996) one-sided p-values*

As the log-transformed FDI data was found to be non-stationary in order, the unit root test was further conducted at the first difference. It indicated that the data of log-transformed FDI was stationary at the first difference. Both intercept and trend are not stationary at level/order, while both are significant at the first difference.

Table 3: Unit root test of the log-transformed foreign exchange rate (FER)

Null Hypothesis: D(LFOREX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic – based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.192832	0.0006
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

**MacKinnon (1996) one-sided p-values*

Unit root test was carried out at the initial difference because the FER data after log transformation was non-stationary in order. According to the unit root test, the log-transformed foreign exchange rate (FER) was stationary at the initial difference. Both intercept and trend were not stationary at level/order, while both were significant at the first difference.

Table 4: Unit root test of log-transformed import

Null Hypothesis: D(LIM) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic – based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.316499	0.0000
Test critical values:	1% level	-4.175640	
	5% level	-3.513075	
	10% level	-3.186854	

**MacKinnon (1996) one-sided p-values*

As the data for log-transformed imports was non-stationary at the level/order, the unit root test was further conducted at the first difference. The unit root test indicated that the log-transformed data of import was stationary at the first difference. Both intercept and trend are not stationary at level/order, while both were significant at the first difference.

3.8 VAR Lag Order Selection Criteria Test

The choice of the lag order is another crucial factor in determining the ideal latency through time-series data analysis. The sequential modified LR (LR) test statistic, final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion were used to determine the lag lengths.

Table 5: VAR Lag Order Selection Criteria Test

Endogenous variables: LEX LFDI LFOREX LIM
Exogenous variable: C

Sample: 47
Included Observations: 43

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-118.6113	NA	0.003522	5.702853	5.866685	5.763269
1	80.36758	351.6837*	7.12e-07	-2.807794*	-1.988631*	-2.505712*
2	86.75052	10.09396	1.14e-06	-2.360489	-0.885996	-1.816742
3	100.7060	19.47271	1.32e-06	-2.265394	-0.135571	-1.479981
4	111.6073	13.18295	1.86e-06	-2.028244	0.756909	-1.001166

** Indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

According to the VAR Lag Order Selection Criteria Test, all the LR, FPE, AIC, SC, and HQ recommend choosing one lag for this study's calculations. As a result, one lag was utilized in the study's additional testing. Based on this (1), the series is integrated in the first order.

3.9 Co-integration tests

As all observed variables were significant at the first difference, this suggests using the co-integration test to identify the variables' long-term relationships. This study also tested the co-integration by applying a trace test and maximum Eigine value analysis to test the long-run movement of variables.

*Table 6: Unrestricted Co-integration Rank Test (**Trace stat**)*

Sample (adjusted): 47
Included observations: 45 after adjustments
Trend assumption: Linear deterministic trend
Series: LEX LFDI LFOREX LIM
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.314934	34.85252	47.85613	0.4558
At most 1	0.247456	17.83172	29.79707	0.5785
At most 2	0.086669	5.038423	15.49471	0.8047
At most 3	0.021083	0.958862	3.841465	0.3275

Trace test indicates no cointegration at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Since the variables were integrated first order I (1), an unrestricted co-integration rank test (trace stat) was performed after the series data stationarity test to examine the long-term link between them (export performance, FDI, FER, and import value). The critical value was established at the specified significance threshold of 5%. The trace co-integration test results show no evidence of significant long-term correlations between the variables.

*Table 7: Unrestricted Co-integration Rank Test (**Maximum Eigenvalue**)*

Sample (adjusted): 47
Included observations: 45 after adjustments
Trend assumption: Linear deterministic trend
Series: LEX LFDI LFOREX LIM
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.314934	17.02081	27.58434	0.5782
At most 1	0.247456	12.79329	21.13162	0.4714
At most 2	0.086669	4.079562	14.26460	0.8509
At most 3	0.021083	0.958862	3.841465	0.3275

The max-eigenvalue test indicates no cointegration at the 0.05 level
* Denotes rejection of the hypothesis at the 0.05 level
** MacKinnon-Haug-Michelis (1999) p-values

Since the variables (export performance, FDI, FER, and import value) were integrated first order I (1), a second unrestricted co-integration rank test (maximum eigenvalue) was conducted. As indicated by the trace co-integration test (1), no long-term relationships were observed among the variables. At the specified significance threshold of 5%, the critical value and p-value were calculated. The results of the Maximum Eigenvalue test also indicate that long-term relationships between variables do not exist significantly.

As indicated by the trace test and maximum Eigenvalue test, there is no substantial long-term co-integration among the variables employed in this study, which means there is no long-run combined movement of variables studied under this study.

3.10 Co-integration

According to the unrestricted co-integration rank tests (Trace and maximum Eigenvalue), there was no long-term link between the variables (export performance, FDI, FER, and import value). Therefore, the short-run movement of the relationship of the variables was examined through co-integrating equations.

Table 8: Co-integrating equations

1 Cointegrating Equation(s):		Log likelihood	80.32144
Normalized cointegrating coefficients (standard error in parentheses)			
LEX	LFDI	LFOREX	LIM
1.000000	0.208103	-0.990794	-0.521046
		(0.34237)	(0.15565)

The co-integration equation shows a short-run relation in the time-series movement of the variables, as each of the ratios of the normalized co-integrating coefficients and corresponding standard error of the log-transformed variables (FDI, FER & import) against export performance variables yields the value of over 1.96 ($P<0.05$). The co-integrating equation has a log-likelihood of over 80%.

3.11 Granger causality test

Further, the paired Granger Causality test was applied to investigate the variables' considerable short-term correlation.

Table 9: Pair-wise Granger Causality Test

Sample: 47
Lags: 1

Null Hypothesis:	Obs	*F-Statistic*	*Prob.*
LFDI does not Granger Cause LEX	46	0.54097	0.4660
LEX does not Granger Cause LFDI		2.69380	0.1080
LFOREX does not Granger Cause LEX	46	14.6533	0.0004
LEX does not Granger Cause LFOREX		1.60593	0.2119
LIM does not Granger Cause LEX	46	1.44877	0.2353
LEX does not Granger Cause LIM		0.52853	0.8141
LFOREX does not Granger Cause LFDI	46	2.89134	0.0963
LFDI does not Granger Cause LFOREX		0.52853	0.4712
LIM does not Granger Cause LFDI	46	5.95246	0.0189
LFDI does not Granger Cause LIM		0.01494	0.9033
LIM does not Granger Cause LFOREX	46	0.81439	0.3719
LFOREX does not Granger Cause LIM		0.01998	0.8882

Granger Causality Test results at Lag 1 show a substantial impact of foreign currency rates on export performance (p 0.01). Similarly, foreign exchange and import have significant effects on FDI with $p<0.1$ and $p<0.05$, respectively. The analysis of the causality effect of FDI and import on export and that of import on foreign exchange and vice versa was insignificant. In addition, the effect of export and FDI on foreign exchange and that of FDI on import was also insignificant.

3.12 Least squares regression

Considering the short-term relationship of movement of the variables, the dependent variable, i.e., log-transformed export, was regressed with log-transformed independent variables, i.e., FER, FDI, import, by applying the least squares method..;

Table 10: Least squares method (Gauss-Newton/ Marquardt steps)

Sample (adjusted) 2: 47
Included observations: 46 after adjustments
LEX = C(1)*LEX(-1) + C(2)*LFD(-1) + C(3)*LFOREX(-1) + C(4)*LIM(-1) + C(5)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.586284	0.118845	4.933166	0.0000
C(2)	-2.76E-05	0.034681	-0.000795	0.9994
C(3)	0.847259	0.244008	3.472264	0.0012
C(4)	-0.003156	0.083017	-0.038015	0.9699
C(5)	-0.023841	0.148151	-0.160921	0.8729

R-squared	0.990792	Mean dependent var	7.419875
Adjusted R-squared	0.989894	S.D. dependent var	1.640110
S.E. of regression	0.164879	Akaike info criterion	-0.664886
Sum squared resid	1.114591	Schwarz criterion	-0.466120
Log likelihood	20.29237	Hannan-Quinn criterion	-0.590427
F-statistic	1102.934	Durbin-Watson stat	1.746035
Prob (F-statistic)	0.000000		

In the short run, the least squares analysis showed the model of fit with adjusted R^2 = 98.98, with the value of the Durbin-Watson test nearly 2. In the models generated, C (1) and C (3) are significant, and the B-coefficients in each case are positive, i.e., 0.586284 & 0.847259, respectively, with $P<0.01$ in each case.

4. Discussion

The time-series analysis of Nepal's export performance data with foreign direct investment, foreign exchange rate, and export and import value from the trade data set has many important implications. The ADF unit root tests of the series data of log-transformed variables indicated that the log-transformation of Nepal's export performance, FDI, FER, and import value was non-stationary at level/order null I (0) but were stationary at the first difference, I (1). The VAR lag selection criteria applying sequential modified LR test statistics, FPE, AIC, SC & HQ suggested selecting lag length one as the optimal lag, indicating that the series is integrated first order I (1). The unrestricted co-integration tests applying the trace test and maximum Eigenvalue analysis indicated no significant

existence of long-run relationships or no long-term together movement between Nepal's export performance, FDI, FER, and import value, comparable to other research (Din, 2004; Hsiao & Hsiao, 2006; Verma & Kaur, 2019).

The co-integration equations reveal a short-run association in the relationship of Nepal's export performance with FDI, FER, and import, showing the significant ratio of the normalized co-integration coefficients and corresponding standard error of the log-transformed variables and the high log-likelihood of the model. Further, the foreign exchange rate substantially impacts export ($p<0.01$), according to the paired Granger Causality test at Lag 1, to investigate the significant association of the variables in the short term. Also, foreign exchange and import have significant effects on FDI ($p<0.1$ & $p<0.05$, respectively), while the other variables have insignificant associations. In the short-run, the least squares analysis of log-transformed variables to explain the short-run interaction of the export performance with FER, FDI, and import value showed the model of fit with adjusted $R^2 = 98.98$, with the value of Durbin-Watson test nearly two and significantly positive B-coefficients for log-transformed export & foreign exchange rate in the model generated with $P<0.01$ in each case.

The time-series analysis results indicated no co-integration in the long run but a significant short-term relationship in Nepal's export performance with the FDI, FER, and import value. Other literature has also supported the short-run relationships of these variables discussed in the literature review section (Akter, 2014; Utouh, 2024). An exciting result of no significant existence of long-run relationship (co-integration) of the export performance of Nepal with the FDI, FER, and import value could be due to a couple of reasons that affected the inter-relationship of export performance, FER, FDI, value of import in the long-run: i) the political situation of Nepal underwent changing after 1975 to 2021, such as transformation from Panchayati system to Democratic multi-parties system, monarchy to republic system, ii) the legal environment of Nepal was changed significantly over this time, for instance, the constitution of Nepal was changed over three times during the time, leading to further changes in the legislative instruments, iii) some significant natural disasters such as two major earthquakes and anthropogenic movements such as Maoist insurgency and counterinsurgency emerged during the time, iv) Nepal's openness to trade was realized at around mid of the time series considered in this study.

The efforts were entirely made to increase the generalizability of the results by conducting the time-series analysis of export performance against foreign direct investment, foreign exchange rate, and value of an import. There might be other factors affecting export performance, which the study did not examine. Further, as the study used the time-series data of export performance and other variables for a country, it is essential to consider the stratification of multiple observations over time for multiple countries, which would be helpful to conduct causal analysis through panel data analysis and identify any discrepancies with this time-series analysis (Alexander & Pei, 2019; Ghazouani & Maktouf, 2024).

The results will be useful for improving and regulating trade management by strategizing further policies and programs to address a country's high trade deficit, both in the short run and in the long run. The findings of this study contribute not only to devising policies and adopting practices to increase exports and improve a country's trade performance but also to designing further research on trade.

5. Conclusion

This time-series analysis highlights a significant short-run relationship between Nepal's export performance and foreign direct investment (FDI), foreign exchange rates (FER), and import value. However, no long-run co-integration was observed, suggesting the influence of dynamic political, legal, and environmental factors on Nepal's trade landscape. These findings underscore the complex interplay between export performance and macroeconomic variables, emphasizing the need for adaptable trade policies that account for short-term fluctuations and long-term structural shifts.

This research contributes valuable insights for policymakers and researchers. It underscores the importance of addressing the high trade deficit through strategic interventions, mainly focusing on short-term measures aligned with the significant relationships identified. Additionally, this study lays the foundation for future research, particularly panel data analysis across multiple countries, to further enhance our understanding of the causal dynamics between export performance and macroeconomic factors.

Declarations

Availability of data and materials: The datasets generated and analyzed during the current study are publicly available in the Ministry of Finance and the World Bank repository and are available from the corresponding author on reasonable request.

Competing interests: The author declares no competing interests.

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