Causal Relationship among Exports, Imports and Economic Growth in Nepal: Evidence from VAR Model

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ABSTRACT

This study's goal is to evaluate the causal relation among Nepal's exports, imports, and real gross domestic product. One of the most significant sources of foreign currency income that reduces the strain on the balance of payments is considered to be exports. The relationship between real GDP, exports and imports is investigated on Nepalese economy over the period 1975-2020, using yearly data. For that purpose, Vector Autoregressive model is used as there is no cointegration among variables as per Johansen's approach. Similarly variance decomposition test is also conducted. Findings confirm the presence of relationship among Real GDP, exports and imports. The results of VAR granger causality test shows that surprisingly export doesn't cause real GDP and import whereas import causes real GDP. Similarly, real GDP causes export, and import also causes export. But there is no bi-directional causality between the variables. Nepal will gain from raising its international trade competitiveness to reduce current account deficits. Prioritizing research and development and producing export goods with high value added by focusing on science and technology are the simplest ways to do this. Similarly, in order to raise worker productivity, which will immediately spur economic growth and raise living standards in Nepal, there is a need to increase technology imports.

Keywords: Exports, imports, RGDP, VAR, Variance Decomposition.

Introduction

Imports of essential resources are crucial to the economy. Nepal mostly imports iron, steel, gold, fuel, clothing, and machinery and equipment. 60% of Nepal's imports from India are $9.58 billion USD. China is the second-largest partner, contributing 15% (2.38 billion US dollars). Third place goes to Argentina with a share of 2.85% (451 million US dollars). Then, United Arab Emirates came in third with a stake of 2.62% (415 million US dollars), while Indonesia came in fourth with a share of 2.31% (366 million US dollars). Nepal exports carpets, beverages, textiles, tea, and plastic in large quantities. India, the United States, Bangladesh, and Germany are among of its top export customers.

Nepal is member of the World Trade Organization (WTO), the South Asian Association for Regional Cooperation, and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC).

Nepal's foreign currency reserves and balance of payments deficit must be impacted by the widening of its trade imbalance. Historically, import growth has outpaced export growth. According to the data provided by NFM, ratio of export and GDP is the highest in 2000 but afterward it started to decline until 2018. Ratio of export import reached the low level in the 2018 which war 0.065, but afterwards it again increased slowly. So Nepal's foreign trade deficit is very alarming. Since the beginning of time, imports have outpaced exports, creating a deficit in the balance of trade. Nepal has seen considerable and quick trade liberalization during the past three decades. According to data released by the Nepal Finance Ministry (NFM), the Nepal's trade deficit has steadily increased considerably ever since the liberalization policy taken in 1987. Landlocked, lacking substantial resources and an inadequate transportation facility must be reason of high cost of production as a result it is difficult to compete with foreign product for Nepal.

The import and export of a nation can have an impact on its GDP, exchange rate, inflation, and interest rates. The amount of imports and the size of the trade deficit both can hurt a nation's currency. It is proved that increasing exports would increase employment. If more goods and services are exported, ultimately that creates more employment. With this view I try to conduct the relationship among export, import and real GDP. Considering this fact Ahmed et al. (2011) and Uddin et al., (2010) are of view that export is considered to be paramount factor of employment generation in an economy. According to the growth hypothesis, economic growth is influenced positively by energy use and negatively by shocks to the energy supply. The feedback hypothesis postulates that there is a causal relationship between economic growth and energy use that is bidirectional (Dedeoğlu & Kaya, 2013).

The Nepal government implemented and actively pushed tax advantages for businesses that focus on exports in order to achieve economic growth through exports. From a policy standpoint, understanding the relationships between real GDP, imports, and exports is crucial for designing and assessing present and future macro

policies in order to attain a positive trade balance.

The study's major goal is to determine how exports and imports affect economic expansion. The following secondary goals are to determine the relationship between export, import, and economic growth, and to determine the trend in export, import, and economic growth. Similarly, to advise decision-makers in the external sector to establish economic policies from the perspective of developing countries in order to boost economic growth.

Literature Review

No nation in the world is capable of producing all products and services on its own. Every nation must import to satisfy domestic demand. Every country's economy depends heavily on the interaction between export, import, and economic growth. Numerous studies have been done and are still being done in light of this.

Using 1970 to 2010 sample period Achchuthan (2013) conducted the study on relationship between import export and economic growth in Sri Lanka. On the basis of the result they advocated for encouraging small and medium-sized businesses to focus on exports. In the Sri Lankan environment, export and import have a significant positive relationship. In comparison to consumer and investment products, intermediate goods account for a large portion of imports. The raw materials associated to textiles, in particular, make up the majority of intermediate goods. Flexible fiscal and monetary policies are suggested to be used to establish limits on the import of raw materials to the industry. Similarly, Rajni's (2013) study also demonstrates that the co-integration test based on Johansen's approach demonstrates the co-integration between exports and imports, export and gross domestic product, and import and gross domestic product. The findings of her study support the assertion that exports and gross capital formation are strongly correlated.

In the OECD countries, the relationship between energy usage and GDP, energy use and exports and imports is examined in this study by Dedeoğlu & Kaya (2013). The study also fills this gap by giving fresh analysis of the OECD nations. To investigate the existence of long-run relationships and the causality between pairs of variables, they use the panel co-integration technique and the Granger representation theorem. They discover that there is two-way Granger causation between each pair of the pairs of energy usage and GDP, energy use and exports, and energy use and imports. The findings imply that all couples have positive long-run elasticity.

As per their result energy use-exports pair is a pair in which there is a causal relationship in both directions. Positive causality is the sign. These results suggest that encouraging exports increases energy use and that implementing poorly chosen energy-conserving regulations can reduce exports. Recent global crises have put strain on local demand, and nations are working to boost exports as a result. Countries may tend to enact lax energy conservation policies in this setting. The feedback relationship also suggests that exports should be taken into account in future energy prediction efforts.

According to analysis of Yüksel and Zengin (2016), not all emerging nations have the same link between import, export, and growth rate. In six developing nations—Argentina, Brazil, China, Malaysia, Mexico, and Turkey—they examine the connection between imports, exports, and growth rates. Toda Yamamoto causality analysis was used to test annual data for the years 1961 to 2014. The outcome demonstrates that in Brazil and Mexico there is no association between the three variables, however in Argentina an increase in export leads to a greater growth rate. In China and Turkey, there is a similar causal link between import and export. In Malaysia, export also drives up import.

The research conducted by Hye (2012) ensures that there is a long-run relation between economic growth and imports, exports, and imports. Hye's finding is supported by results of Turan and Karamanaj (2012) that exports, imports, and GDP in Albania have an equilibrium connection over the long run.

Esfahani (1991) analysis confirms that there are statistically significant relationships between rising exports and rising output. The association is mostly attributable to exports' role in reducing import "shortages" that limit production growth. The outcome also demonstrates how crucial export promotion is for nations that are unable to secure enough money or international help. Using the Granger causality test and co-integration models, Uddin et al. (2010) investigates the causal between export, import, and Gross Domestic Product (GDP) for Bhutan. The outcome demonstrates that the co-integration analysis predicts an equilibrium relationship between the variables over the long term.

Since early 1980s, trade liberalization and devaluation, on one side, and the expansion and diversification of output and exports of LDCs, on the other, have not been clearly and consistently correlated, according to study of Shafaeddin (1995). Deindustrialization has been a common side effect of trade liberalization in LDCs, and even when exports increased, supply capacity did not always increase at the same time. In contrast, the article links investment levels and import accessibility to the success or failure of GDP and industrial growth. The author claims that the way trade policy reforms were designed also played a significant role in their failure.

Using secondary sources of data, Akhter (2015) investigates the effects of export and import on economic growth in Bangladesh and the relationship between export, import, and economic growth in Bangladesh. The outcome demonstrates that exports have a positive impact on economic growth, while imports have the opposite effect.

Ojide et al. (2014) uses the Autoregressive Distributed Lag (ARDL) model and co-integration analysis to assess the growth impact of non-oil exports and sustainability of non-oil exports in relation to growth in Nigeria. The co-integration analysis and regression results demonstrate the existence of non-oil export growth evidence in Nigeria, demonstrating the validity of the non-oil export-led growth hypothesis in addition to the export-led growth hypothesis.

According to Sulaiman et al. (2019), Egypt has a long-term association between export, import demand, economic growth, and export and import pricing. Supporting Sulaiman et al. (2019), Fannoun and Hassouneh (2019) demonstrates that exports, imports, and production growth have a long-run equilibrium relationship. Additionally, the data are consistent with a long-run bidirectional causal relationship between output growth, imports, and exports. While Bakari and Mabrouki's (2017) findings indicate that there is no connection between exports, imports, and economic growth in Panama, data on short-run causality support both the export-led import and the import-led export hypotheses.

The empirical findings did support a long-term association between the variables under consideration. According to the findings, export has a long-term, direct, and favorable association with economic growth. Additionally, imports demonstrated a considerable negative link with economic growth and had a long-term detrimental impact on it. Researchers found that a shock to export had a favorable impact on economic growth, but a shock to import had little of an impact, hence a shock to import could not have a beneficial impact on economic growth.

The relationship between imports and exports has been extensively studied, although real GDP inclusion in the model is scarce, according to the review of the literature. The findings of the current studies also do not agree with one another. In light of the foregoing, the current study uses a VAR-based Granger causality test to examine the causal relationship between Nepal's real GDP, imports, and exports.

Data and Methodology

This paper uses annual data covering the period from 1975 to 2020 within a vector autoregressive (VAR) framework to investigate the direction of causality among real GDP, import and export in Nepal. Utilizing the unit root test, the variables are first integrated in a specific order. The series was changed into a log format. The lowering of the Heteroskedasticity problem is a fundamental benefit of transformation into logarithms.

In this study, all the data were obtained from the websites of the country's Finance ministry. The RGDP data shows the measure of economic growth. The natural logarithmic values of the variables were used in the analyses so that result can be interpreted in percentage.

All of the variables in this study are non-stationary at the level of the data but stationary at the first difference. So we can run cointegration test. The outcome demonstrates that cointegration is absent. That indicates that there isn't a long run relationship. Therefore, instead of using the Vector Error Correction Model (VECM), we should use the Vector Autoregressive (VAR).

To evaluate causation in the Granger sense, VAR models are traditionally used. The first difference VAR framework's Granger causality test will be incorrect in the presence of cointegration (Engle and Granger, 1987). The study's entire set of data is in

logarithmic form. As the log transformation shrinks the scale in which the variables are measured, it can lessen the problem of heteroscedasticity (Gujrati, 1995).

Vector Autoregressive (VAR)

Guide line suggests that if there is no cointegration after Johansen test of cointegration among variables, unrestricted VAR model must be run. In this method all the variables are taken as dependent variables. Sims (1980) made VAR models in economics popular. One of the most effective, adaptable, and simple methods for the study of multivariate time series is the vector autoregression (VAR) model. The VAR model has shown to be particularly effective for forecasting and characterizing the dynamic behavior of economic and financial time series. It frequently offers forecasts that are better than those from complex simultaneous equations models and univariate time series models. Typically, forecast error variance decompositions are used to summarize these causal effects. If three different time series variables denoted by Yt1, Yt2 and Yt3 are measured then model will be like as shown in below.

VAR(1) denotes the vector autoregressive model of order 1

$Y1,t = C1 + L1,1\ Y1, t-1 + L1,2\ Y2,t-1 + L1,3\ Y3,t-1 + e1,t$

$Y2,t = C2 + L2,1\ Y1, t-1 + L2,2\ Y2,t-1 + L2,3\ Y3,t-1 + e2,t$

$Y3,t = C3 + L3,1\ Y1, t-1 + L3,2\ Y2,t-1 + L3,3\ Y3,t-1 + e3,t$

Granger causality based on VAR model

Several tests have been created later in the literature that relate to the causality test approach. One of the oldest techniques to measure the causal effect from time series observations is Granger causality. Traditionally, calculating VAR models is used to assess causality in the Granger sense.

Several empirical researches have been carried out in the past to investigate the link between the three variables. However, there doesn't appear to be agreement on the relationship between imports and exports' causative axes. There is a bi-directional causal relationship for some countries, but not for others. However, some countries have a one-way causality from imports to exports, whilst other countries experience the opposite causality from exports to imports.

Stationarity Test

The unit root test was used to test stationarity at a 1% level of significance. The Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP) tests, two asymptotically comparable methods are used to find unit roots in the data (Dickey, 1979; Phillips and Perron, 1988). Integration was differed in the case of non-stationarity of the variables. Therefore, each variable is employed at its level of stationarity. Gujarati (2004) specifies the following for the unit root test:

$$\Delta Yt=\beta_1+\beta_{2t}+\delta Y_{t-1}+\sum_{i=1}^{k} \infty i\ \Delta Y_{t-i}+\varepsilon_t$$

Table: 1

Unit Root Tests

Variables	ADF test statistic, P-value	
	Level	First Difference
RGDP	0.9907	0.00
Ex	0.5177	0.00
Im	0.678	0.002

Model specification:

GDPt = f (export, import)

The function is transformed into a log-linear econometric format:

log (RGDP)t = β0 + β1log (export)t + β2 log (import)t + εt

Where:

β0: The constant term.

β1: coefficient of variable (exports)

β2: coefficient of variables (imports)

t : The time trend.

ε : The random error term.

Lag Selection Criteria

Table 2:

one lag is selected

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-39.33114	NA	0.001507	2.015768	2.139888	2.061263
1	169.0487	377.0683*	1.14e-07*	-7.478510*	6.982033*	-7.296532*
2	174.3712	8.870834	1.36e-07	-7.303391	-6.434556	-6.984929
3	180.8611	9.889340	1.57e-07	-7.183862	-5.942669	-6.728915
4	188.4086	10.42270	1.74e-07	-7.114694	-5.501143	-6.523264

As shown in the above table, asterisk is marked on 1 lag of all criteria. It means that all lag selection criteria suggest to be selected one lag.

Co-integration Test

Johansen Cointegration Test

The co-integration test was used to ascertain whether there is long run relationship among variables in Nepal or not. The Johansen (1988) method was employed to

test for co-integration, which results in two test statistics, the trace test and the maximum eigenvalue test. The test was conducted between real gross domestic product and exports and import. According to Gujarat (2004), co-integration implies the existence of long-run relationship.

Table 3

Trace Test and Max eigenvalue

Test	Unrestricted Cointegration Rank Test				
Trace Test	Hypothesized		Trace	0.05	
	No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
	None	0.262041	18.14803	29.79707	0.5551
Max eigenvalue Test	None	0.262041	13.37015	21.13162	0.4187

As shown in the table, P-values of trace test and max eigenvalue are more than 5 percent, so null hypothesis "there is no cointegration" is accepted. It means there is no cointegration between variables.

Model Identification: VAR Model

lnRGDP = C(1,1)*LRGDP(-1) + C(1,2)*LIM(-1) + C(1,3)*LEX(-1) + C(1,4)
lnIM = C(2,1)*LRGDP(-1) + C(2,2)*LIM(-1) + C(2,3)*LEX(-1) + C(2,4)
lnEX = C(3,1)*LRGDP(-1) + C(3,2)*LIM(-1) + C(3,3)*LEX(-1) + C(3,4)

VAR Model: Substituted Coefficients

lnRGDP = 0.85*LRGDP(-1) + 0.05*LIM(-1) - 0.01*LEX(-1) + 1.40
lnIM = - 0.07*LRGDP(-1) + 1.01*LIM(-1) + 0.00*LEX(-1) + 0.97
lnEX = - 0.96*LRGDP(-1) + 0.32*LIM(-1) + 0.91*LEX(-1) + 9.70

Table 5
significance test of individual variables

Total system (balanced) observations 135				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1) LRGDP(-1)	0.857893	0.062120	13.81033	0.0000
C(2) LIM(-1)	0.052371	0.019091	2.743140	0.0070
C(3) LEX(-1)	-0.012525	0.007850	-1.595460	0.1132
C(4)	1.407100	0.599686	2.346393	0.0206
C(5) LRGDP(-1)	-0.076416	0.305990	-0.249734	0.8032
C(6) LIM(-1)	1.012413	0.094041	10.76566	0.0000
C(7) LEX(-1)	0.000562	0.038670	0.014524	0.9884
C(8)	0.979627	2.953942	0.331634	0.7407
C(9) LRGDP(-1)	-0.969467	0.514650	-1.883739	0.0620
C(10) LIM(-1)	0.325855	0.158169	2.060167	0.0415
C(11) LEX(-1)	0.919339	0.065039	14.13510	0.0000
C(12)	9.709675	4.968296	1.954327	0.0529

According to criteria majority variables must be significant which is measured by p-values. As shown in the table p-values of most of the variables are less than 5 percent. So model must be good fitted.

Equation 1: lnRGDP = C(1)*LRGDP(-1) + C(2)*LIM(-1) + C(3)*LEX(-1) + C(4)
Equation 2: lnIM = C(5)*LRGDP(-1) + C(6)*LIM(-1) + C(7)*LEX(-1) + C(8)
Equation 3: lnEX = C(9)*LRGDP(-1) + C(10)*LIM(-1) + C(11)*LEX(-1) + C(12)

Diagnostic Checking:

Serial correlation

Table 6
Breusch-Godfrey Serial Correlation LM Test:

Dependent Variables	P-value of ObsR-ssquare
RGDP	0.0782
Export	0.33
Import	0.43

As p-values of all equations are more than 5 % in all the models, null hypothesis 'there is no serial correlation' is accepted. It means there are no serial correlation in all the models, which is good for model.

Heteroskedasticity Test

Table 7
Breusch -Pagan -Godfrey

Dependent Variables	P-value of ObsR-ssquare
RGDP	0.33
Export	0.20
Import	0.24

As p-values of all equations are more than 5 % in all the models, null hypothesis 'there is no Heteroskedasticity' is accepted. It means there are no Heteroskedasticity in all the models, which is good for model.

Residual Normality Test:
Table 8
Jarque-Bera

Dependent Variables	P-value
RGDP	0.61
Export	0.56
Import	0.13

As p-values of all equations are more than 5 % in all the models, null hypothesis 'residual is normally distributed' is accepted. It means residual is normally distributed

in all the models, which is good for model.

Granger causality Test:

Table 9

Pairwise Granger Causality Test

Null Hypothesis:	Prob.	Decision
Export does not Granger Cause RGDP	0.11	accept
Import does not Granger Cause RGDP	0.006	Reject
RGDP does not Granger Cause Export	0.05	Reject
Import does not Granger Cause Export	0.03	Reject
RGDP does not Granger Cause Import	0.80	Accept
Export does not Granger Cause Import	0.98	Accept

Source: Authors' computation

Guide line of pair wise granger causality test, they must be at 5% level of significance. If P-value is more than 5 % null hypothesis is accepted. As shown in the table ,surprisingly export doesn't cause real GDP whereas import causes real GDP. Similarly, real GDP causes export and import also causes export. But there is no bi-directional causality between variables.

Variance Decomposition Test: Cholesky Ordering

In multivariate analysis, the basic statistical technique of variance decomposition is used to find structures in a large number of variables that can be simplified (Anderson, 2003). Factor analysis, for instance, are tools that are frequently used. For example, economic forecasting has made substantial use of factor analytical techniques (Forni et al. 2000; Stock and Watson, 1988). The terms "variance decomposition" and "forecast error variance decomposition" are more specifically used in macroeconomic analysis to refer to a particular method for evaluating the relationships between variables given by vector autoregressive (VAR) models. Sims (1980) promoted these models as potential replacements for traditional simultaneous equations models, and then many economists and econometricians have adopted them.

Table 10

Variance Decomposition of Real Gross Domestic Product:

Period	S.E.	LRGDP	LEX	LIM
1	0.021248	100.0000	0.000000	0.000000
2	0.029294	96.64343	0.568470	2.788100
3	0.035700	90.49897	1.592674	7.908354
4	0.041551	83.26718	2.776277	13.95654
5	0.047160	76.07513	3.928196	19.99668
6	0.052614	69.48963	4.956079	25.55429
7	0.057929	63.71064	5.830620	30.45874
8	0.063097	58.74563	6.554691	34.69968
9	0.068110	54.51892	7.144435	38.33664
10	0.072961	50.92905	7.619582	41.45136

Source: Authors' computation

Here real GDP is target. In the short run, shock to real GDP account (contribute) for 90.49 percent variation of the fluctuation which is said to be own shock. Shock to import is 7.90 percent fluctuation in real GDP. Similarly shock to export can cause 1.59 fluctuation in real GDP. Thus, total fluctuation will be 100 percent.

In long run, 50.92 percent can contribute to real GDP itself which is known own shock. Similarly shock in other variables import and export can cause 41.49 and 7.61 percent respectively variation of the fluctuation in real GDP in long run. Here 10th period is considered to be long run.

Table 11

Variance Decomposition of Export

Period	S.E.	LRGDP	LEX	LIM
1	0.176037	31.32905	68.67095	0.000000
2	0.237755	30.01406	68.34731	1.638637
3	0.282116	28.26466	66.90085	4.834495
4	0.319036	26.31792	64.77036	8.911725
5	0.352031	24.35192	62.33007	13.31801
6	0.382591	22.47786	59.84687	17.67527
7	0.411397	20.75278	57.48592	21.76130
8	0.438776	19.19730	55.33535	25.46735
9	0.464898	17.81064	53.43227	28.75709
10	0.489866	16.58106	51.78308	31.63586

Source: Authors' computation

Here export is target. In the short run, shock to export account (contribute) for 66.90 percent variation of the fluctuation which is said to be own shock. Shock to import is 4.83 percent fluctuation in export. Similarly shock to real GDP can cause 28.26 fluctuation in export. Thus, total fluctuation will be 100 percent.

In long run, 51.78 percent can contribute to export itself which is known own shock. Similarly shock in other variables import and real GDP can cause 31.63 and 16.58 percent respectively variation of the fluctuation in import in long run. Here 10th period is considered to be long run.

Table 12

Variance Decompose of Import

Period	S.E.	LRGDP	LEX	LIM
1	0.104664	19.88164	0.484555	79.63380
2	0.148445	19.35283	0.482332	80.16484
3	0.182185	18.89769	0.473899	80.62841
4	0.210661	18.50276	0.460565	81.03667
5	0.235713	18.15730	0.443509	81.39919
6	0.258285	17.85268	0.423770	81.72355
7	0.278939	17.58193	0.402243	82.01583
8	0.298043	17.33939	0.379697	82.28091
9	0.315856	17.12046	0.356787	82.52276
10	0.332569	16.92134	0.334068	82.74459

Source: Authors' computation

Here Import is a target variable. In the short run, shock to Import account (contribute) for 80.62 percent variation of the fluctuation which is said to be own shock. Shock to export is 0.47 percent fluctuation in Import. Similarly shock to real GDP can cause 18.89 fluctuation in import. Thus, total fluctuation will be 100 percent.

In long run, 82.74 percent can contribute to Import itself which is known own shock. Similarly shock in other variables export and real GDP can cause 0.33 and 16.92 percent variation of the fluctuation in import in long run. Here 10th period is considered to be long run.

Conclusion:

The relationship among real GDP, exports and imports is investigated for the Nepal economy over the period 1975-2020, using yearly data. To do so, cointegration test using Johansen's approach as well as vector autoregressive (VAR) technique are used.

The experiments demonstrate that the variables are stationary at their first differences but non-stationary at their levels. But the Johansen Cointegration Test reveals that there is no cointegration. VAR model is then run. The Granger causality test reveals that imports lead to exports.

Results demonstrated a causal relationship among real GDP, exports and imports. Furthermore, Granger has discovered that imports contribute to both export and real GDP. Similarly real GDP affects export whereas export doesn't cause both real GDP and import. Policymakers need to understand how important trade is for promoting economic growth. To support the growth of its exports industry, Nepal continues to rely on imports of goods and services. Because of their heavy reliance on the production and export of basic commodities, least developed nations like Nepal have

become increasingly isolated in global trade. To lower current account deficits, Nepal would benefit from increasing its international trade competitiveness. The easiest way to achieve this is to prioritize research and development, generate export goods with high value added relying on science and technology. Similarly, in order to raise worker productivity, which will immediately spur economic growth and raise living standards in Nepal, there is a need to increase technology imports.

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