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Trade Flow of Nepal: A Gravity Model Approach

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ABSTRACT

The gravity model of panel data analysis is applied in the study to examine the relationship between Nepal's trade volume and economic growth using data from the period 2001 to 2020. The GDP of both Nepal and its trading partners are proven to have a favorable impact on Nepal's trade volume. Trade is preferred to be conducted with the nation having a higher GDP. The population of Nepal has a significant and positive impact on trade. It suggests that encouraging the country's working-age people to find employment will help to advance trade. However, the distance between Nepal and trading partner country of Nepal has negative and significant impact over the trade of Nepal.

1. INTRODUCTION

Due to the close relationship between trade and economic growth, trade is frequently referred to in economics literature as an engine of the economy. It was a widely held belief that trade is one of the main forces behind long-term growth and has a significant impact on both economic and social performance. The discussion of the connection between trade and economic growth in academic and economics literatures has grown in recent years. Additionally, the trade-growth nexus has drawn considerable attention in the context of both developed and developing countries and has emerged as one of the most important macroeconomics concerns (Paudel, 2019).

International trade has made it possible for the global community to live better, more successful lives with higher standards of living than it would have been otherwise. Foreign

trade is seen as a crucial element in accelerating the pace of economic growth. International free trade has been described to as the "engine of growth" that propelled the rise of the economically developed countries of today in the late nineteenth and early twentieth century (Todaro & Smith, 2003).

A country with a surplus of laborers may offer labor-intensive goods for less price, and a country with a surplus of capital may do the opposite. Trade between the two nations may exist as a result of the difference. Trade between two nations is impossible if an item's price is the same in both nation. Business enterprises are encouraged to do trade with other nations when there is higher price of exports and lower price of imports. As a result, nations tend to focus on the economic sectors where they excel. All trade nations profit from increased production and decreased costs because to the division of labor (Bhat, 2014).

Nepal's ability to gain from international trade is anticipated to be hampered by obstacles such as the fulfillment of additional liberalization commitments in several economic sectors and fierce competition from imported goods and services. In this regard, export diversification, both horizontal (into entirely new sectors) and vertical (from primary to production), is essential to not only reduce the danger of trade dependency but also to profit from regional and international commerce. An integrated strategy with three fundamental elements is needed for Nepal's export diversification strategy: the identification of products with comparative advantage, the creation and implementation of sector development strategies, and the creation of negotiation strategies for bilateral and multilateral trade forums.

Day by day, trade has been growing. The nation, Nepal, has consistently followed the path of economic growth despite its growing trade imbalance. Growth is influenced by a number of things. According to Solow, economic expansion is a product of technological advancement. Technological progress allows for more efficient production processes, lower costs of production, and higher levels of innovation, which can lead to the creation of new products and markets (Solow, 1956). The same is true of the endogenous growth hypothesis, which emphasizes that investments in human capital, innovation, and knowledge are important drivers of economic progress. In this regard, trade is essential for the advancement of innovation, technology, and even human capital. No nation can escape their place in the current system of trading partners. Over the past few decades, there has been an increase in the interdependence between various nations, primarily as a result of changes in population, distance between nations, exchange rates, and regime-specific policies. It's widely acknowledged that trade is what drives growth. International trade is essential to Nepal's economic development.

Trade is the cross-border or cross-territorial exchange of capital, goods, and services. Since exports and imports transfer money across an economy, it promotes economic growth. This study's main aim is to investigate the relationship between trade volume and economic growth using the gravity model. However, the specific objective is to determine the contribution of international trade to economic growth of Nepal.

2. LITERATURE REVIEW

Remittances from employees appear to have played a crucial role in Nepal's economy for around 20 years (Paudel & Bhushal, 2021). In addition, result shows that remittances have a statistically significant negative effect on export performance, which is substantially influenced by the size of the trade partner's economy, as shown by the estimation's results and suggest policymakers pay immediate attention to establishing export strategies in order to shift the economy in favor of exports. In this regard, putting a specific emphasis on selling to wealthy economies could be a useful method to improve Nepal's export performance.

Ristanović et al. (2020) have analyzed Serbia's trade based on the experience of neighbouring countries of Croatia and Romania. On employing gravity mode, the study found that the trade exchange with more distanced EU members is less realized. The study suggests that the country should expand its market beyond regional boundaries and consider the unique features of trading countries. It also suggests a new concept of foreign trade, including structural features, specialization, and export diversification, for faster economic growth and improved performance.

Benita (2019) investigated the relationship between bilateral trade openness and per capita GDP for 15 countries in Latin America during the 2008 financial crisis. Mixed outcomes were found when several trade openness metrics were explored by using an enhanced gravity model of trade on Pre-crisis, crisis, and post-crisis eras (2004–2006, 2007–2009, and 2010–2012, respectively). First, a somewhat favorable link between trade openness and growth was discovered. Second, it was discovered that there was a bad correlation between trade openness and growth after removing outliers and taking into account all importer nations.

Paudel and Cooray (2018) conducted a study on the export performance of developing countries: Does landlockedness matter? The study uses a gravity modeling framework to examine export performance in developing nations, focusing on landlocked developing countries (LLDCs) and non-LLDCs. It found that despite recent trade policy improvements, LLDCs' export performance is poorer due to higher trade costs. Economic openness improves export performance, but distance-related trade costs have a greater negative impact. LLDCs need to establish a more trade-friendly environment through tariff cuts, exchange rate revisions, and regional trade agreements.

Bakari and Mabrouki (2018) conducted the study on agricultural exports and agricultural imports on economic growth in North Africa Countries. The study used the correlation analysis and gravity model especially, static gravity model methodology using the annual data from the period 1982 to 2016. The study discovered that although there is a modest association between agricultural exports and GDP, there is a positive correlation between agricultural trade and GDP. Agriculture exports have a favorable impact on economic growth, according to the estimation using the static gravity model. Imports of agricultural goods, however, have no impact on economic expansion.

Sejdini and Kraja (2014) have identified the key developments in Albania's international trade. In addition, a focus was placed on examining the major elements that have contributed to growth. The study used the data from the year 1993 to 2012 from the different 27 countries consisting twelve variables. The study found that the home country imports and exports are stable. The study also offered some theoretical and empirical insights on trade development, with a particular focus on Albania's exports and imports in relation to the Free Trade Agreements. According to the analysis, Albania's trade flows are steady.

Thapa (2013) explored Nepal's trade potential using a gravity model. This essay aims to evaluate Nepal's trading potential for 2009. The outcomes on the bases of gravity model varies: some nations went beyond the limitations, while others are still trading below their potential. The volume of trade may expand in the future due to an increases in GNI in the future on the one hand and a decrease in in distance due to the adoption of appropriate trade facilitation measures on the other side.

Acharya (2013) conducted a study to evaluate the extended gravity model of global trade in relation to Nepal. The researcher discovered that the distance to trading partners is highly significant, indicating that a greater distance will result in less trade. The researcher also comes to the conclusion that the real GDP of Nepal's trading partners accounts for its exports and imports. Additionally, export and import will be higher in a country that is a trade partner if its real GDP is higher. The researcher also comes to the conclusion that the real GDP of Nepal's trading partners accounts for its exports and imports. Additionally, export and import will be higher in a country that is a trade partner if its real GDP is higher. Additionally, because of the real GDP of the partner nation, export growth is outpacing import growth.

Kim and Lin (2009) investigated whether trade openness contributes to long-run economic growth and whether the effect varies with the level of economic development. The study used regression analysis using the data from 1960 to 2000 and found that there exists an income threshold above which greater trade openness has beneficial effects on economic growth and below which heightened trade has detrimental consequences. It implies that greater international trade and integration may contribute to more diverging economies.

Chan and Au (2006) have determined the determinants of china's textile exports to the china's top 10 trading partners. The study used gravity econometric model as the methodology and discovered statistical significance in the relationship between China's textile exports and GDP, real exchange rate, shared membership in free trade agreements for bilateral trading partners, and importers' population growth rate. Graphical distance, on the other hand, does not significantly relate.

Céline et al. (2005) has estimated the panel gravity estimates of aggregate bilateral trade. The study discovered that there has been a notable rise in the absolute value of the elasticity of bilateral commerce to distance. The result was attributed to a considerably greater drop in expenses unrelated to distance (like handling) than in costs linked to distance (like the price

of oil). This positive tendency is eliminated but not reversed in an enlarged version of the model that accounts for these two variables.

Zarzoso (2003) analysed the factors that influence trade flows between 47 nations, with a focus on the effects of preferential trade agreements between the European Union (EU), the North American Free Trade Area (NAFTA), the Caribbean Community (CARICOM), the Centro-American Common Market (CACM), and other Mediterranean nations (MEDIT). The gravity model technique of the study discovered the importance of additional factors that influence bilateral trade flows, including geographic closeness, income levels, population size, and cultural affinity.

Egger (2000) examines a note on the proper econometric specification of the gravity equation. The objective of the study was to shed some light on the problems associated with random effects gravity approaches. The study by using OLS model, FEM estimations and gravity econometric model came to the conclusion that a fixed effects model is preferable both logically and statistically, according to a Hausman test.

3. RESEARCH METHODS

Research Design

This study uses quantitative research to investigate cause-and-effect relationships, using a casual research design. Secondary data was gathered from the World Bank, the Trade and Export Promotion Center of Nepal, and the CEPII gravity database.

Nature and Source of Data

The study is based on panel data set made up of 10 countries having export and import form time period 2001 to 2020.The countries Australia, Canada, China, India, Korea Republic, Malaysia, South Africa, Ukraine, United Arab Emirates, United States were selected based on total trade volume. The annual data has been obtained from the secondary sources. The data of GDP, Population (working age) are taken from World Bank. The distance between Nepal and its trading partner countries are taken from CPEII gravity dataset whereas the data to country-to-country export and import are taken from DOTS.

Model Specification

The gravity model now-a-days has been increasing used for empirical analysis between trade and growth. The larger and the closer the two countries are, the larger the volume of trade between them is expected to be (Salvatore, 2013). The gravity model of international trade technique is used in the study. The gravitational model of international trade is based on Newtonian physics. The Universal Law of Gravity states that the gravitational force is proportional to the product of two masses and inversely proportional to the square of the distance between them. Tinbergen (1962), was the first to use the gravity model in international trade, replacing gravitational force with trade volume of trade, and the masses of two product with GDP of origin country and GDP of destination country, and square of the distance between two masses with the physical distance between nations. Later on, it was

extended by Anderson (1979) by defining extended gravity model including either country's population as an explanatory variable. In order to meet the research objective, this study has used the following extended gravity model

$lnTV_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnD_{ij} + \beta_4 lnPi + \beta_5 lnP_j + \varepsilon_{ij}$
where, ln TV_{ij} = natural log of trade volume of trade of Nepal
lnYi = natural log of GDP of Nepal
lnY_j = natural log of GDP of trading partner of Nepal
ln Dij = natural log of physical distance between Nepal and trading partner of Nepal
lnPi = natural logs of the population of Nepal
lnPj = natural logs of the population of trading partner of Nepal
ε_{ij} = error term

Total volume (TV) is the sum of export and import in the country. Total trade contributes the economic development via growth. Trade helps to grow countries' economy by, creating jobs, which reduces poverty that leads to growth of the country. Gross domestic product (GDP) is a crucial metric that shows whether an economy is growing or shrinking. A country's economic growth can be tracked over extensive time periods using GDP. The broadest quantitative indicator of an economy's overall activity is GDP. Geographical distance represents a barrier to trade. Long distances between two countries increase the cost of transportation, slow down delivery times, and make markets harder to access. Another independent variable in the study is population size. Since, higher the population higher will be the trade volume and vice versa (Acharya, 2012).

4. RESULTS AND DISCUSSIONS

Results

The results of estimation of gravity modeling are shown in Table 1, through fixed effect and random effect panel data estimation.

Table 1

Gravity Modeling Results

Dependent Variable: log total volume of trade of Nepal	Fixed Effect	Random Effect
C	-42.72	-11.69
	(7.868)	(3.467)
Log GDP of Nepal	0.97***	1.05***
	(0.166)	(0.109)
Log GDP of Trading Partners	1.35	0.51***
	(0.219)	(0.136)
Log Population of Nepal	16.94**	18.11**
	(5.588)	(7.438)
Log Population of Trading Partners	1.56**	0.19
	(0.483)	(0.140)

Log Distance	–	-1.49*** (0.240)
Total observation	190	190
Cross-sections included	10	10
R-squared	0.8936	0.6660
Adjusted R-squared	0.8857	0.6570
F-statistics	113.75***	73.40***

Note: ***, ** and * indicate that the statistics are significant at 1%, 5% and 10% level of significance. The figures in the parenthesis are the standard error.
Source: Appendix.

Under fixed effect estimation, the coefficient of log GDP of Nepal is statistically significant at 1 percent level of significance. The log population of Nepal and log population of trading partners are statistically significant at 5 per cent level of significance. The value of R^2 and adjusted R^2 are respectively 0.8936 and 0.8857. The value of F-statistic 113.75 which is significant at 1 per cent level of significance imply that the model is overall significant.

In fixed effect panel data estimation log total volume of trade of Nepal to trading partners is dependent variable whereas log GDP of Nepal, log GDP of trading partners, log population of Nepal, log population of trading partners are independent variables. The coefficient of log GDP of Nepal is 0.97. It shows that total volume of trade is increased by 0.97 percent on an average when GDP of Nepal increased by 1 percent. The coefficient of log population of Nepal is 16.94. It shows that there is positive relationship between trade volume of Nepal and population of Nepal and imply that trade volume of Nepal increased by 16.94 percent when population of Nepal increased by 1 percent on an average. In the same way the coefficient of log population of trading partner of Nepal is 1.56 shows that there is also positive relationship between trade volume of Nepal and population of trading partner of Nepal. The coefficient imply that trade volume of Nepal increased by 1.56 percent when population of trading partner of Nepal increased by 1 percent on an average.

The column of random effect estimation of Table 1 shows that the coefficient of log GDP of Nepal, log GDP of trading partner of Nepal and log distance between Nepal and trading partner of Nepal are statistically significant at 1 percent level of significance whereas log population of Nepal is statistically significant at 5 percent level of significance. The value of R^2 and adjusted R^2 are respectively 0.6660 and 0.6570. The value of F-statistic 73.40 which is significant at 1 per cent level of significance imply that the model is overall significant.

In random effect estimation, total volume of trade of Nepal is positively related with the GDP of Nepal, GDP of trading partners of Nepal, population of Nepal and negatively related with the distance between Nepal and its trading partners. The coefficient of log GDP of Nepal is 1.05. It implies that total volume of trade of Nepal is increase by 1.05 percent on an average when GDP of Nepal increased by 1 percent. The coefficient of log GDP of trading partner of Nepal is 0.51 shows that the total volume of trade of Nepal increased by 0.51 percent

on an average when GDP of trading partner of Nepal increased by 1 percent. Similarly, the trade volume of Nepal increased by 18.11 percent on an average when population of Nepal increased by 1 percent as shown by the coefficient of log population of Nepal. On the other hand, the coefficient of log distance between Nepal and trading partner is -1.49 which is negative. It shows that the total volume of trade of Nepal decreased by 1.49 percent on an average when distance between Nepal and its trading partner increase by 1 kilometer.

The Hausman test is used to determine which model is more appropriate between the fixed effect model and the random effect model. The null hypothesis of the Hausman test is "Random effect model is appropriate". The computed Hausman test result for choosing between the fixed effect model and the random effect model is shown in Table 2.

Table 2

Hausman Test for the Selection of Model

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000

Source: Appendix.

Table 2 shows the result of Hausman test. The test statistic shows that p-value is significant at more than 5 per cent level of significant. More specifically, the test statistic is significant at 100 percent. So, the null hypothesis of random effect model is appropriate is accepted that imply the estimator of random effect model is more appropriate than of fixed effect model.

Discussion

For the fulfillment of the objective of the study the gravity model of panel data analysis has been employed. The study reveal that random effect model is appropriate on the basis of Hausman test of gravity model of panel data analysis. On the basis of random effect model GDP of Nepal and GDP of trading partner of Nepal has positive and significant relationship with total volume of trade of Nepal. It imply that the increase in GDP of trading partner country of Nepal increases the export of Nepal to its trading partner. This finding is in the line of the study conducted by Acharya (2013), Bakari & Mabrouki (2018), Thapa (2013). Similarly, the population of Nepal has also positive and significant relationship with total volume of trade of Nepal. In this context, increase in working age population increases productivity of nation. So, increase in population increases the export performance of Nepal. On the other hand, the distance between Nepal and its trading partner has negative and significant impact on total volume of trade of Nepal. Distance refers the transportation cost of international trade. Higher the transportation cost lower will be the international trade. Thus, if the distance between Nepal and trading partner country increases, trade volume of Nepal goes on decreasing. The result is consistent with the result of Paudel & Cooray (2018); Ristanović et al. (2020).

5. CONCLUSION AND IMPLICATION

It was widely acknowledged that trade was one of the main forces behind long-term prosperity and had a significant impact on social and economic performance. Since there is positive and significant relationship between GDP of Nepal and GDP of trading partner of Nepal with total trade volume of Nepal, trade of Nepal not only depends on its GDP but also depends upon the GDP of trading partner country. A mechanism should be developed to prefer trade with the countries having higher GDP. The working age population of Nepal should not be encourage to migrate to foreign country but should be employed within a country for the promotion of international trade as shown by positive association between population of Nepal and trade volume of Nepal. Distance between Nepal and its trading partner country shows the transportation cost of international trade. So, trading partners country should be chosen if possible having less possible distance to reduce the cost of international trade as there is negative impact of distance between Nepal and its trading partner on total volume of trade of Nepal.

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Appendix

Eviews Results

Fixed Effect Panel Data Estimation

Dependent Variable: LN_TV_IJ
Method: Panel Least Squares
Date: 08/28/22 Time: 17:00
Sample (adjusted): 2002 2020
Periods included: 19
Cross-sections included: 10
Total panel (balanced) observations: 190

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-42.72405	7.868810	-5.429544	0.0000
LN_GDP_I	0.966566	0.166414	5.808201	0.0000
LN_GDP_J	0.350508	0.219294	1.598346	0.1118
D(LN_POP_I)	16.94215	7.588787	2.232524	0.0268
LN_POP_J	1.560133	0.483705	3.225382	0.0015

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.893645	Mean dependent var	18.19458
Adjusted R-squared	0.885789	S.D. dependent var	1.932286
S.E. of regression	0.653017	Akaike info criterion	2.056401
Sum squared resid	75.05186	Schwarz criterion	2.295655
Log likelihood	-181.3581	Hannan-Quinn criter.	2.153319
F-statistic	113.7568	Durbin-Watson stat	0.641759
Prob(F-statistic)	0.000000		

Source : Researcher's calculation using Eviews 10

Random Effect Panel Data Estimation

Dependent Variable: LN_TV_IJ
Method: Panel EGLS (Cross-section random effects)
Date: 08/28/22 Time: 17:03
Sample (adjusted): 2002 2020
Periods included: 19
Cross-sections included: 10
Total panel (balanced) observations: 190
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-11.69050	3.467663	-3.371292	0.0009
LN_GDP_I	1.055231	0.109804	9.610118	0.0000
LN_GDP_J	0.510831	0.136580	3.740160	0.0002
D(LN_POP_I)	18.11115	7.438146	2.434901	0.0159
LN_POP_J	0.194675	0.140810	1.382538	0.1685
LN_DIST_IJ	-1.497750	0.240621	-6.224507	0.0000

Effects Specification		
	S.D.	Rho
Cross-section random	0.472535	0.3437
Idiosyncratic random	0.653017	0.6563

Weighted Statistics			
R-squared	0.666090	Mean dependent var	5.498677
Adjusted R-squared	0.657016	S.D. dependent var	1.138971
S.E. of regression	0.667037	Sum squared resid	81.86859
F-statistic	73.40924	Durbin-Watson stat	0.596503
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.837391	Mean dependent var	18.19458

Source : Researcher's calculation using Eviews 10

Hausman Test for the selection of Model

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LN_GDP_I	0.966566	1.055231	0.015637	0.4783
LN_GDP_J	0.350508	0.510831	0.029436	0.3501
D(LN_POP_I)	16.942149	18.111148	2.263677	0.4372
LN_POP_J	1.560133	0.194675	0.214143	0.0032

Source : Researcher's calculation using Eviews 10