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# Trade - Growth Nexus in Nepal: A Gravity Model Approach

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Abstract

**Purpose of the Study:** This study investigates the relationship between trade and economic growth in Nepal, focusing on how factors such as GDP, population, and geographical distance affect Nepal's exports and imports. The research question addresses: "How do these factors influence Nepal's trade dynamics?"

**Methods/Design:** A gravity model framework was used, with panel data analysis employing fixed and random effects models. The Hausman test determined the appropriate model. Data on trade partners' GDP, population, and geographical distance were collected to estimate the model.

**Findings:** The analysis shows that Nepal's exports are positively influenced by the GDP and population of trade partners, while geographical distance negatively impacts trade. Closer countries are more favorable trading partners. The random effects model proved to be the most appropriate estimator, with both the export and import models demonstrating strong explanatory power.

**Conclusion/Implications:** The findings suggest that Nepal should focus on export diversification and strengthen regional trade relations to foster economic growth. Policymakers can use these insights to improve trade strategies and regional cooperation.

**Limitations of the Study:** The study is limited by data constraints and does not account for informal trade flows, which could affect the results.

**Originality of the Study:** This study uniquely applies the gravity model to Nepal's trade context, addressing challenges faced by landlocked developing countries.

***Keywords:*** *: Trade-growth nexus, gravity model, export diversification, Nepal's trade policy, panel data analysis*

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## 1. Introduction

In the literature of economics, trade is often described as an engine of economic growth due to the strong nexus between trade and economic development. It is widely accepted that among the driving factors of long-run growth, trade plays a crucial role in shaping economic and social performance (Krugman & Obstfeld, 2009). The theoretical foundations of the positive links between trade openness strategies, economic growth in developing countries, and poverty reduction stem from two primary sources: gains from trade liberalization based on comparative advantages and growth through economies of scale and technological diffusion (Balassa, 1986; Rodriguez & Rodrik, 2001).

Landlocked countries, particularly those with poor neighbouring states, often suffer adverse effects on their trade and economic development (Hinkle & Fauré, 2006). This issue is significant for various reasons. Firstly, landlocked developing countries lag behind in numerous aspects of development, making it challenging for them to address these issues independently. Without proper growth in these regions, the aspiration for global "Peace and Prosperity" remains elusive in an increasingly interconnected world. The impacts—both positive and negative—can quickly spill over to other nations, as technological advancements from developed countries offer opportunities to developing nations, while poverty in parts of Africa and some Asian countries presents a global challenge (UNCTAD, 2019).

Secondly, many developing countries grapple with poor governance, often synonymous with the adverse consequences of poverty and ineffective internal management. Emphasizing good governance in these nations is essential for breaking the poverty trap, making it a crucial objective for current development initiatives (World Bank, 2017).

he relationship between trade and economic growth has been increasing discourse in academia and economics literature for economic development. There seems a strong nexus between trade and economic growth. Because of this nexus, trade is explained as an engine of economic growth in the literature. Also, the trade-growth nexus has become one of the crucial issues in macroeconomics and has got numerous attentions in the context of developed and developing countries (Paudel,2019).

There has been increasing research and study about the contribution of foreign trade to economic growth. Various factors determine the economic growth of a nation. Foreign trade refers to the exchange of goods and services between one country and another. In the absence of international trade, it would have not been possible for the world community to live a happier and more prosperous life with a high standard of living. Foreign trade is considered an essential factor for accelerating the path of economic development. International free trade has been called the “engine of growth” that propelled the development of today's economically advanced nations during the nineteenth and early twentieth centuries (Todaro & Smith, 2003).

Trade becomes possible because of two factors; an uneven distribution of natural resources and the cost of production varies from country to country. A country with an abundance of manpower may sell labour-intensive items at a lower price and countries with an abundance of capital may do the reverse. The difference may be the reason for trade between the two countries. If the price of an item is the same

in two countries, then trade between them is not possible. The higher price of exports and lower price of imports promote business enterprises to trade in other countries. This leads countries to specialize in the economic activities they are best endowed with. The division of labour helps in more production and lower cost thus bringing benefits to all the trading nations (Bhat, 2014).

Challenges ranging from the implementation of further liberalization commitments in different sectors of the economy to stiff competition from foreign goods and services are likely to make it difficult for Nepal to benefit from international trade. In this respect, export diversification – both vertical (from primary to manufacture) and horizontal (into completely new sectors) – is critical not only to lower the risk of trade dependency but also to benefit from regional and global trade. The export diversification strategy for Nepal requires an integrated approach with three basic components: identification of products with comparative advantage, formulation and implementation of sector development strategy and development of a negotiation strategy for bilateral and multilateral trade forums.

Various factors determine export. The contribution of international trade to the economic growth of Nepal is vital. So, an assessment of the trade growth is necessary for developing countries like Nepal for the best possible inferences in the background of poor trade performance, particularly export performance, of the country.

This paper aims to investigate whether economic growth significantly impacts Nepal's exports. The research addresses key questions about the trends and patterns of exports in Nepal and the association between economic growth and exports and imports with its trading partners. The overarching objective is to explore the relationship between trade and economic growth in Nepal, recognizing that trade involves the exchange of capital, goods, and services across borders, which facilitates monetary movement within the economy. To achieve this, the study focuses on analysing export trends and patterns in Nepal while examining how economic growth influences both exports and imports in relation to its trading partners.

## 2. Literature Review

International trade has emerged as a crucial research area for understanding economic growth, particularly in light of trade liberalization and the export-led development hypothesis. The recent wave of globalization has led many countries to lower trade barriers, although the benefits have not been uniformly distributed across nations. Exports play a vital role in stimulating economic activity by enhancing productivity through economies of scale, fostering technological innovation, and promoting more efficient resource allocation based on comparative advantage. Adam Smith was the pioneer in formalizing the absolute advantage model, which posits that countries should specialize in producing goods in which they have a lower resource cost than others. For instance, if Country A can produce food more efficiently than Country B, and Country B can produce furniture more efficiently than Country A, both would benefit from trading. This specialization enhances overall production efficiency. However, David Ricardo later critiqued this model, introducing the concept of comparative advantage. Ricardo emphasized that countries should produce goods for which they have the lowest opportunity cost, thereby facilitating specialization and improving global production standards (Ricardo, 1817; Deardorff, 2007).

Numerous empirical studies have examined the relationship between trade and economic growth, both in the international context and specifically regarding Nepal. For instance, Oloyede et al. (2021) investigated trade openness and economic growth in Africa's regional economic communities, finding a positive but insignificant relationship between the two. Similarly, Ristanović et al. (2020) applied the gravity model to analyze Serbia's trade dynamics, concluding that geographical proximity significantly influences trade relationships.

Zahonogo (2017) explored the trade-growth nexus in sub-Saharan Africa, revealing a non-linear relationship where increased trade openness positively affects growth up to a certain threshold, beyond which the effect diminishes. Other studies, such as those by Boakey and Gyamfi (2017) and Feddersen et al. (2017), confirmed the positive impacts of exports on economic growth in Ghana and South Africa, respectively, highlighting the necessity for targeted trade policies.

Overall, these studies underscore the multifaceted nature of trade and its critical role in enhancing economic performance, while also indicating that the effects can vary significantly based on regional and contextual factors. The literature review encompasses both theoretical and empirical contexts, revealing a consensus on the positive relationship between trade openness and economic growth, as established by various studies, including those by Oloyede et al. (2021), Boakey and Gyamfi (2017), and Sandri et al. (2016). These studies collectively affirm that increased trade openness correlates with higher economic growth. Additionally, research by Oparanya et al. (2019) and Kabir et al. (2017) underscores the significant connection between a country's GDP and its international trade, suggesting that higher GDP fosters increased trade activity. In the Nepalese context, studies by Paudel and Cooray (2018) indicate that economic openness enhances export performance in landlocked developing countries (LLDCs), while distance negatively affects trade. Acharya (2013) also noted that the GDP of trading partners influences export and import dynamics.

Furthermore, Ghimire (2009) and Sharma and Bhandari (2005) corroborate the notion that trade positively impacts Nepal's GDP and that export growth contributes to overall economic growth. Despite these insights, gaps remain, particularly regarding the nuanced relationship between economic growth and trade in Nepal. As the dynamics of trade and economic growth evolve, this study aims to investigate the impact of economic growth on both exports and imports in Nepal, utilizing recent data from 1982 to 2021 and employing both time series and gravity model methodologies to ensure robust findings.

International trade remains essential for understanding economic growth, especially in the context of trade liberalization and globalization. Export-led growth, driven by the comparative advantage of nations, stimulates economies by enhancing productivity, fostering innovation, and promoting efficient resource allocation. This foundational theory began with Adam Smith's absolute advantage model, which argues that countries should produce goods for which they have a lower production cost. David Ricardo refined this with the comparative advantage concept, suggesting countries benefit more by specializing in goods they can produce at a lower opportunity cost (Ricardo, 1817; Deardorff, 2007).

Empirical research has confirmed trade's positive impact on economic growth in various regions. For example, Oloyede et al. (2021) analyzed African regional communities, observing a positive yet insignificant link between trade openness and growth. Using a gravity model, Ristanović et al. (2020) found that proximity significantly influences Serbia's trade relations. Zahonogo (2017) explored sub-Saharan Africa, identifying a non-linear relationship between trade openness and growth: while initial increases in openness boost growth, the effect diminishes beyond a certain threshold. Studies in Ghana and South Africa by Boakey and Gyamfi (2017) and Feddersen et al. (2017) echoed these findings, highlighting the importance of export-focused policies for growth.

More recent studies continue to refine these insights. Dhakal and Paudel (2023) explored remittances' impact on Nepal's GDP, suggesting remittances support trade indirectly by stabilizing incomes and increasing demand for imports. Nepal Rastra Bank (2023) expanded on this by examining how remittances contribute to investment and economic growth, offering a new perspective on trade dynamics in Nepal. In the Nepalese context, Paudel and Cooray (2018) found that economic openness supports export performance in landlocked developing countries (LLDCs), though distance poses challenges. Acharya (2013) further established that trading partner GDP affects Nepal's trade volume, with increased partner GDP positively influencing Nepal's export-import balance. Ghimire (2009) and Sharma and Bhandari (2005) noted trade liberalization's positive effects on Nepal's GDP, particularly through export growth. More recently, Paudel and Bhusal (2021) used a gravity model to highlight the role of workers' remittances in boosting Nepal's export performance, emphasizing remittances as a crucial factor in the nation's trade framework.

These studies collectively affirm that trade openness, regional dynamics, and economic variables like remittances play vital roles in growth. However, existing literature does not fully explore the specific trade-growth dynamics unique to Nepal, such as the impact of institutional quality, political stability, and evolving global trade policies on trade patterns. Addressing these gaps, this study investigates the relationship between economic growth and Nepal's trade flows from 1982 to 2021, using a gravity model and time-series analysis to contribute more detailed insights into Nepal's evolving trade landscape. This work fills a crucial research gap by focusing on under-explored factors influencing Nepal's trade.

## 3. Methodology

The gravitational model of international trade is based on Newtonian physics. The gravitational force is proportional to the product of two masses and inversely proportional to the square of the distance between them, according to the Universal Law of Gravity. The relation can be expressed as;

$$GF_{ab} = A \frac{M_a M_b}{D_{ab}^2} \qquad \ldots (1)$$

where, $GF_{ab}$ is the gravitation force between masses a and b. $M_aM_b$ is a product of two masses. $D_{ab}^2$ is the square of the distance between two masses and A is a constant.

Tinbergen (1962), as cited from Acharya (2012) was the first to use the gravity model in international trade, replacing $GF_{ab}$ with trade volume $TV_{ij}$, $M_a$ and $M_b$ with GDP of origin country i, Yi, and GDP of destination country j, Yj, and $D^2_{ab}$ with the physical distance between nations i and j, $D_{ij}$ from a point of reference. Then the gravity model of international trade can be expressed as;

$$TV_{ij} = A\frac{Y_iY_j}{D^2_{ij}} \quad \ldots (2)$$

This relationship can be expressed as follows for estimation purposes:

$$TV_{ij} = \beta_0\frac{Y_i^{\beta_1}Y_j^{\beta_2}}{D_{ij}^{\beta_3}} \quad \ldots (3)$$

where, $\beta_0$, $\beta_1$, $\beta_2$ and $\beta_3$ are the parameters to be estimated. Using the natural logarithm, the parameter is interpreted as the coefficient of elasticity of trade volume about the explanatory variable.

The linear equation can also be expressed as follows:

$$\ln TV_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij} + \varepsilon_{ij} \quad \ldots (4)$$

where, εij is is the error term of the model. In general, $\beta_1, \beta_2 > 0$ and $\beta_3 < 0$; as per gravity theory.

Anderson (1979) defined the extended gravity model including either country's population as an explanatory variable. In equation (1), the population is included as part of the mass, and trade volume is assumed to be proportional to the population. The linear equation can also be written as;

$$\ln TV_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln D_{ij} + \beta_4 \ln Pi + \beta_5 \ln P_j + \varepsilon_{ij} \ldots (5)$$

where lnPi and lnPj are the natural logs of the population of countries i and j, respectively. Because the population of trade partner countries can be used as a proxy for market size, they can be positively associated with trade components, i.e. $\beta_4$ and $\beta_5 > 0$. However, if a rise in population reduces per capita GDP, the population may have a negative relationship with trade components, i.e. $\beta_4$ and $\beta_5 < 0$: and negative ralationship with physical distance between the countries, i.e, $\beta_3 < 0$.

There is a strong empirical relationship between the size of a country's economy and the volume of both its imports and its exports (Krugman et al., 2009). The possibility of the gravity model is that the bigger economies consume more and produce or sell more. Two bigger economies moderately include

in bigger measure of exchange contrasted with two more modest economies given their bigger spending on utilization.

The gravity model nowadays has been increasingly used for empirical analysis between trade and growth. Tinbergen (1962) has used gravity model for the first time. Later on Anderson (1979) has defined the extended gravity model including either country's population as an explanatory variable as shown in equation (5). Thus, the following equations are used for this study.

For Export

$$\ln EXPORT_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln POPi + \beta_4 \ln POP_j + \beta_5 \ln DIST_{ij} + \beta_6 BORD + \varepsilon_{ij} \quad \ldots (6)$$

For Import

$$\ln IMPORT_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln POPi + \beta_4 \ln POP_j + \beta_5 \ln DIST_{ij} + \beta_6 BORD + \varepsilon_{ij} \quad \ldots (7)$$

where, $\ln EXPOET_{ij}$ = log of export of Nepal to trading partner country

lnIMPORTij = log of import of Nepal from a trading partner country

lnGDPi = log of GDP of Nepal

$\ln GDP_j$ = log of GDP of trading partner country of Nepal

lnPOPi = logs of the population of Nepal

lnPOPj = logs of the population of the trading partner country of Nepal

lnDISTij = log of physical distance of most populated cities between Nepal and trading partner country of Nepal

BORD = Common border between Nepal and trading partner country of Nepal.
= BORD = 1; if Common boarder , BORD = 0; if no common border

$\varepsilon_{ij}$ = error term

### 3.4.6 Description of Gravity Model Variables

Export is the goods and services produced in the nation and sold to a foreign country. In this study, export refers to the goods and services produced in Nepal and sold to the trading partner country of Nepal. Export is the dependent variable in the study. Export is measured in terms of the US dollar.

Import is the goods and services bought in a domestic country that are produced in a foreign country. In this study, import refers to the goods and services that are purchased from the trading partner country of Nepal by Nepal. Import is measured in terms of the US dollar.

Gross Domestic Product (GDP) is a measure of the total value of all goods and services produced within a country's borders in a given period of time, typically one year. It is often used as an indicator of the economic health and well-being of a country. For gravity model analysis, GDP of Nepal as well as GDP of trading partner country has been taken under the study. Since the per capita GDP of Nepal is static, the country's trade flows depend on the income level of its trading partners (Prasai, 2014). GDP is measured in the US dollar.

Geographical distance represents a barrier to trade. The long distance between the two countries causes higher transportation costs, delay delivery times, and hinder market accessibility. The negative coefficient of this variable would suggest that Nepal trade more with its neighbouring countries (Prasai, 2014). The distance between Nepal and its trading partner is measured in kilometres as the theoretical air distance between the capital cities of both countries (Acharya, 2012). In the increasingly integrated and globalized world, however, the geographic distance among countries might not be as critical as it was in the past. A significant number of countries divided by thousands of miles may get close to each other in education, culture, economics, and technology or access to information through the Internet (Le, 2017).

Population refers to the total population of Nepal as well as total population of trading partners of Nepal.

**Table 1**

*Expected Relation of Export with Explanatory Variables of Gravity Model*

| Dependent Variable | Units | Source | Expected Sign |
|---|---|---|---|
| Export | US Dollar | DOTS | |
| GDP | US Dollar | World Bank | + |
| Population | in number | World Bank | + |
| Distance | in KM | CEPII, Gravity Dataset | – |
| Border | = 1; if Common boarder<br>= 0; if no common border | CEPII, Gravity Dataset | + |

*Source:* Based on different literatures

**Table 2**

*Expected Relation of Import with Explanatory Variables of Gravity Model*

| Dependent Variable | Units | Source | Expected Sign |
|---|---|---|---|
| Import | US Dollar | DOTS | |
| GDP | US Dollar | World Bank | + |
| Population | in number | World Bank | + |
| Distance | in KM | CEPII, Gravity Dataset | – |
| Border | = 1; if Common boarder<br>= 0; if no common border | CEPII, Gravity Dataset | + |

*Source:* Based on different literatures

# 4. Result and Discussion

## 4.1 Descriptive Statistics

The main characteristics of a dataset can be summed up and described using descriptive statistics. Data can be organized and summarized in a meaningful fashion using descriptive statistics, which can then be used to make judgments or draw conclusions about the data. The descriptive statistics for gravity variable of the study is shown in the Table 3

**Table 3**

*Descriptive Statistics for Gravity Variables*

| | Log export of Nepal to trading partners | Log import of Nepal from trading partners | Log GDP of Nepal | Log GDP of trading partners | Log population of Nepal | Log population of trading partners | Log distance between Nepal and trading partners |
|---|---|---|---|---|---|---|---|
| Mean | 16.69 | 18.02 | 23.45 | 28.55 | 17.09 | 18.65 | 8.6 |
| Mean | 16.69 | 18.02 | 23.45 | 28.55 | 17.09 | 18.65 | 8.65 |
| Median | 16.42 | 18.04 | 23.79 | 28.59 | 17.10 | 18.20 | 8.88 |
| Maximum | 20.30 | 22.84 | 24.25 | 30.69 | 17.18 | 21.06 | 9.40 |
| Minimum | 12.20 | 12.77 | 22.51 | 26.03 | 17.01 | 16.78 | 6.68 |
| Std. Dev. | 1.60 | 2.00 | 0.59 | 0.98 | 0.04 | 1.32 | 0.76 |
| Skewness | 0.31 | 0.10 | -0.26 | 0.20 | -0.18 | 0.71 | -1.54 |
| Kurtosis | 3.56 | 3.24 | 1.61 | 2.77 | 2.73 | 2.28 | 4.72 |
| Jarque-Bera | 6.03 | 0.84 | 18.16 | 1.75 | 1.74 | 21.11 | 103.89 |
| Probability | 0.04 | 0.65 | 0.0001 | 0.41 | 0.41 | 0.00002 | 0.000 |
| Sum | 3321.99 | 3604.25 | 4667.95 | 5683.10 | 3402.80 | 3713.20 | 1721.52 |
| Sum Sq. Dev. | 513.07 | 796.42 | 71.15 | 191.07 | 0.39 | 349.55 | 115.12 |
| Observations | 199 | 200 | 199 | 199 | 199 | 199 | 199 |

*Source: Researchers' calculation*

Table 3 shows the descriptive statistics of variables used under the study for gravity model for export. As shown in the table, average log value of export is 16.69, average log value of import is 18.02, the average log value of GDP of Nepal is 23.45, the average log value of GDP of trading partners of Nepal is 28.55, the average log value of population of Nepal is 17.09, the average log value of population of trading partners of Nepal is 18.65 and the average log value of distance between Nepal and trading partner of Nepal is 8.65. The maximum and minimum value of log export are 20.30 and 12.20 respectively. In the same way, the maximum and minimum value of log import are 22.84 and 12.77 respectively. Moreover, the maximum and minimum value of log GDP of Nepal is 24.25 and 22.52 respectively whereas the maximum and minimum value of log GDP of trading partners of Nepal are respectively 30.69 and 26.03. In addition, the maximum and minimum of log of population of Nepal is 17.18 and 17.01 respectively, and that of log of trade partners of Nepal is 21.06 and 16.78 respectively. Similarly, the maximum and minimum value of log of distance between Nepal and trade partners of Nepal are 9.40 and 6.68 respectively.

Skewness aids in identifying the type and degree of the concentration of the observation towards the higher or lower values of the variable. It is seen in the table that the log value of export of Nepal, log value of import of Nepal, log value of GDP of Nepal and log value of population of trading partner of Nepal are positively skewed whereas the log value of export and log value of GDP of trading partner of Nepal, log value of population of Nepal and log value of distance between Nepal and trading partner of Nepal are negatively skewed.

Kurtosis enables us to gain insight into the nature and structure of the distribution's peakedness or flatness. Kurtosis value of less than 3 imply that the distribution is Platykurtic which imply the frequency curve is flatter whereas the Kurtosis value of more than 3 imply that the distribution is Leptokurtic that imply the frequency curve has high peak. The log value of all variables GDP of Nepal, GDP of trading partners of Nepal, population of Nepal and population trading partner of Nepal has less 3 Kurtosis value indicates that the curve of corresponding variables are Platykurtic in nature. On the other side, the log value of variable export of Nepal, import of Nepal and distance between Nepal and trade partner of Nepal has more than 3 Kurtosis value indicates that the curve is Leptokurtic.

The distribution's normality is indicated by the Jarque-Bera probability. The null hypothesis for the test is that the distribution is normally distributed whereas the alternative hypothesis is that the distribution is not normally distributed. In the Table 6.1 the p-value for the log value variables export of Nepal, GDP of Nepal, population of trade partners of Nepal and distance between Nepal and trade partner of Nepal are less then 0.05 indicating that the variables are normally distributed whereas the log values of variables import of Nepal GDP of trade partner of Nepal and population of Nepal are greater than 0.05 indicating that the variables are not normally distributed.

## 4.2 Estimation of Gravity Model for Export

The gravity model is a widely used economic model that explains patterns of international trade based on the distance between countries and their relative size of economic strength. The gravity model suggests that countries that are closer to each other and have larger economies will trend to trade more with each other, all else being equal. The model has been found to be a useful tool for predicting the pattern of trade between countries and for assessing the impact of trade policies on trade flows. The estimation of gravity model for export as given as below:

### 4.2.1 Hausman Test for the Selection of Model for Export

Hausman test is used to find the appropriate model among the fixed effect model and random effect model. The Hausman test is carried out with the null hypothesis "Random effect model is appropriate". The computed result of the Hausman test is presented in the Table 4.

**Table 4**

*Hausman Test for the Selection of Model for Export*

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 0.000000 | 5 | 1.0000 |

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

*Source: Researchers' calculation*

Table 4 shows the result of Hausman test. The test statistic shows that p-value is significant at more than 5 per cent level of significant. A high p-value (typically above 0.05) suggests that the random effects model is appropriate than of fixed effect model for export.

### 4.2.2 Gravity Model Estimation Results for Export

The results of estimation of gravity model for export is shown in the following Table 4. Table 5 shows the result of gravity model through fixed effect and random effect panel data estimation for export where log export of Nepal to trading partners is dependent variable.

**Table 5**

*Gravity Modeling Results for Export*

| Dependent Variable: log export of Nepal to trading Partners | Fixed Effect | Random Effect | Random Effect |
|---|---|---|---|
| C | -46.36 | 24.74 | -6.75 |
| | (41.13) | (38.61) | (49.08) |
| Log GDP of Nepal | -0.22 | -0.01 | -0.19 |
| | (0.19) | (0.18) | (0.22) |
| Log GDP of Trading Partners | 1.40*** | 1.39*** | 1.49*** |
| | (0.16) | (0.15) | (0.16) |
| Log Population of Nepal | -2.71 | -2.12 | 0.03 |
| | (2.45) | (2.44) | (3.11) |
| Log Population of Trading | 3.27*** | -0.24 | -0.39 |
| Partners | (1.25) | (0.35) | (0.36) |
| Log Distance Between Nepal and | – | -2.33*** | -2.41*** |
| Trading Partners | | (0.52) | (0.53) |
| Common Boarder | – | -1.70 | -1.37 |
| | | (1.31) | (1.34) |
| Governance Indicators | – | – | 0.51 |
| | | | (0.41) |
| Total observation | 199 | 199 | 189 |
| Cross-sections included | 10 | 10 | 10 |
| R-squared | 0.8978 | 0.4549 | 0.4728 |
| Adjusted R-squared | 0.8906 | 0.4378 | 0.4524 |
| F-statistics | 125.02*** | 26.70*** | 23.19*** |

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

*Source: Researchers' calculation*

Under fixed effect estimation, the coefficient of log GDP of Nepal and log population of trading partners are statistically significant at 1 per cent level of significance. The value of R2 and adjusted R2 are respectively 0.8978 and 0.8906 which are high, and the value of F-statistic 125.02 which is significant at 1 per cent level of significance imply that the model is overall significant.

In fixed effect panel data estimation where log export 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 1.40 of log GDP of trading partners shows that export of Nepal is increased by 1.40 per cent on an average when GDP of trade partner of Nepal increased by 1 per cent. Similarly, the coefficient 3.27 of log population of trading partners shows that the export of Nepal increased by 3.27 percent on an average when the population of trade partner of Nepal increases by 1 per cent.

The random effects estimation column in Table 5 shows that the coefficients for the log of GDP of trading partners and the log of distance between Nepal and its trading partners are statistically significant at the 1 percent level. The values of $R^2$ and adjusted $R^2$ are 0.4549 and 0.4378, respectively. Additionally, the F-statistic value of 26.70, which is significant at the 1 percent level, indicates that the model is overall significant.

In random effect estimation, there is positive relation between GDP of trading partner of Nepal, with export of Nepal, and inverse relation between GDP of Nepal, population of Nepal, population of trading partner of Nepal, distance of trading partner with Nepal and common boarder of Nepal and trading partner with export of Nepal. The coefficient 1.39 of log GDP of trading partners shows that export of Nepal is increased by 1.39 per cent on an average when GDP of trade partner of Nepal increased by 1 per cent. On the other hand, the export of Nepal decreased by 2.33 per cent on an average when the distance between trading partner of Nepal increased by 1 Kilometre as shown by the coefficient of log distance between Nepal.

The last column of Table 5 shows of random effect estimation with governance indicator as independent variable. The coefficient of log GDP of trading partners and log distance between Nepal and trading partners are statistically significant at 1 per cent level of significance. The value of R2 and adjusted R2 are respectively 0.4728 and 0.4524, and the value of F-statistic 23.19 which is significant at 1 per cent level of significance imply that the model is overall significant. The coefficient 1.49 of log GDP of trading

partners shows that export of Nepal is increased by 1.49 per cent on an average when GDP of trade partner of Nepal increased by 1 per cent. On the other hand, the export of Nepal decreased by 2.41 per cent on an average when the distance between trading partner of Nepal increased by 1 Kilometer as shown by the coefficient of log distance between Nepal and trading partners

## 4.3 Estimation of Gravity Model for Import

A well-known economic theory called the gravity model describes international trade patterns in terms of distance and the relative strength of economic power between countries. The gravity model predicts that countries with larger economies and closer geographic proximity will trade more. The model has shown to be a useful tool for predicting patterns of global commerce and assessing how trade policies impact trade flows. The estimation of gravity model for import as given as below:

### 4.3.1 Hausman Test for the Selection of Model for Import

The computed result of Hausman test for the selection among fixed effect model and random effect model for import is presented in the Table 6.

**Table 6**

*Hausman Test for the Selection of Model for Import*

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 0.000000 | 5 | 1.0000 |

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

*Source: Researchers' calculation*

Table 6 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 per cent. So, the null hypothesis of random effect model is appropriate is accepted that imply the estimator of random effect model for import is more appropriate than of fixed effect model for import

### 4.3.2 Gravity Model Estimation Results for Import

The results of estimation of gravity modeling for import is shown in the following Table 7. Table 7 shows the result of gravity modeling through fixed effect and random effect panel data estimation for import where log import of Nepal from trading partners is dependent variable

**Table 7**

*Gravity Modelling Results for Import*

| Dependent Variable: log Import of Nepal from Trading partners | Fixed Effect | Random Effect | Random Effect |
|---|---|---|---|
| C | -82.06<br>(47.62) | 0.44<br>(47.71) | -82.65<br>(58.28) |
| Log GDP of Nepal | 1.22***<br>(0.25) | 1.26***<br>(0.24) | 1.17***<br>(0.27) |
| Log GDP of Trading Partners | 0.035<br>(0.19) | 0.06<br>(0.15) | 0.10<br>(0.16) |
| Log Population of Nepal | 2.99<br>(3.08) | 3.13<br>(3.06) | 4.10<br>(3.74) |
| Log Population of Trading Partners | 1.05**<br>(0.45) | 0.46*<br>(0.26) | 0.53*<br>(0.27) |
| Log Distance Between Nepal and Trading Partners | – | -1.02**<br>(0.51) | -1.10**<br>(0.54) |
| Common Boarder | – | 0.35<br>(1.42) | -0.04<br>(1.49) |
| Governance Indicators | – | – | 0.16<br>(0.48) |
| Total observation | 200 | 200 | 190 |
| Cross-sections included | 10 | 10 | 10 |
| R-squared | 0.8940 | 0.6907 | 0.6971 |
| Adjusted R-squared | 0.8866 | 0.6810 | 0.9855 |
| F-statistics | 120.70*** | 71.83*** | 59.86*** |

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: Researchers' calculation*

Under fixed effect estimation, the coefficient of log GDP of Nepal and log population of trading partners are statistically significant at 1 per cent level of significance. The value of R2 and adjusted R2 are respectively 0.8940 and 0.8866 which are high, and the value of F-statistic 120.70 which is significant at 1 per cent level of significance imply that the model is overall significant.

In fixed effect panel data estimation where log import of Nepal from trading partners is dependent variable whereas log GDP of Nepal, log GDP of trading partners, log population of Nepal and log population of trading partners are independent variables. The coefficient of log GDP of Nepal is 1.22. This shows when GDP of Nepal is increased by 1 per cent, the import of Nepal increased by 1.22 per cent on an average. Similarly, the import of Nepal increased by 1.05 per cent on an average when population of trading partner of Nepal increased by 1 per cent as shown by the coefficient of log population of trading partners. The column of random effect estimation Table 7 shows that the coefficient of log GDP of Nepal is statistically significant at 1 per cent level of significance, the coefficient of log distance between Nepal and trading partners is statistically significant at 5 per cent level of significance whereas the coefficient of log population of trading partners is statistically significant at 10 per cent level of significance. The value of R2 and adjusted R2 are respectively 0.6907 and 0.6810, and the value of F-statistic 71.83 which is significant at 1 per cent level of significance imply that the model is overall significant.

In random effect estimation, the coefficient of log GDP of Nepal is 1.26. This shows when GDP of Nepal is increased by 1 per cent, the import of Nepal increased by 1.26 per cent on an average. Likewise, the coefficient 0.46 of log population of trading partners shows that the import of Nepal increased by 0.46 per cent on an average when population of trading partner of Nepal increased by 1 per cent. On the other hand, the import of Nepal decreased by 1.02 per cent on an average when the distance between trading partner of Nepal increased by 1 Kilometer as shown by the coefficient of log distance between Nepal and trading partners

The last column of Table 7 shows random effect estimation with governance indicator as independent variable for robustness analysis. The coefficient of log GDP of Nepal is statistically significant at 1 per cent level of significance, the coefficient of log distance between Nepal and trading partners is statistically significant at 5 per cent level of significance whereas the coefficient of log population of trading partners is statistically significant at 10 per cent level of significance. The value of R2 and adjusted R2 are respectively 0.6971 and 0.6855, and the value of F-statistic 59.86 which is significant at 1 per cent level of significance imply that the model is overall significant. The coefficient of log GDP of Nepal is 1.17. This shows when GDP of Nepal is increased by 1 per cent, the import of Nepal increased by 1.17 per cent on an average. Likewise, the coefficient 0.53 of log population of trading partners shows that the import of Nepal increased by 0.53 per cent on an average when population of trading partner of Nepal increased by 1 per cent. On the other hand, the import of Nepal decreased by 1.10 per cent on an average when the distance between trading partner of Nepal increased by 1 Kilometer as shown by the coefficient of log distance between Nepal and trading partners

## 5. Conclusion

The gravity model analysis for Nepal's export and import data indicates that the random effects model is appropriate for both exports and imports, as confirmed by the Hausman test. Based on this model, the GDP of Nepal's trading partners shows a positive and significant relationship with Nepal's exports,

aligning with findings by Paudel and Cooray (2018), Acharya (2013), and Oparanya, Mdadila, and Rutasitara (2019). In contrast, the distance between Nepal and its trading partners has a negative impact on exports, consistent with the studies of Paudel and Cooray (2018) and Ristanović, Primorac, and Kozina (2020).

To assess the robustness of these results, a governance indicator (GI) – an average of rule of law and control of corruption – was introduced into the random effects model. The inclusion of GI had no significant effect, reinforcing that the findings hold consistently regardless of this variable.

Similarly, for imports, both the fixed and random effects models were tested, and the Hausman test results favored the random effects model. According to this model, Nepal's GDP, population, and distance from trading partners all significantly relate to Nepal's imports. Specifically, Nepal's GDP has a positive effect on imports, suggesting that as Nepal's economy grows, so does its import demand. The population of Nepal also has a positive correlation with imports, reflecting an increased need for goods to meet domestic demand. However, as with exports, distance has a negative impact, indicating that imports are more feasible from closer countries, which is consistent with Ristanović, Primorac, and Kozina (2020).
In terms of policy implications, the positive relationship between the GDP of trading partners and Nepal's exports suggests that Nepal should prioritize trade with economically stronger countries. The negative impact of distance on both imports and exports supports a focus on strengthening trade with geographically closer nations to reduce logistical costs. Additionally, Nepal's GDP positively influences imports, underscoring the need to encourage imports of capital goods and technology that contribute to economic growth, rather than an over-reliance on consumable imports.

The study's key findings indicate that Nepal's exports are positively influenced by the GDP of its trading partners and negatively affected by distance, while imports are similarly impacted by GDP, population, and proximity to trading partners. These results suggest that Nepal should target economically stronger, geographically closer nations for trade expansion. The findings remain robust with or without the inclusion of governance indicators, reinforcing their reliability.

Finally, while this study provides valuable insights, further research could focus on exploring additional variables, such as sector-specific trade policies or infrastructure factors, to gain a more comprehensive understanding of Nepal's trade dynamics. These insights could better inform strategies for sustainable trade growth and economic resilience.

## 6. Scope for Future Research

Future research could delve into additional factors influencing Nepal's trade relationships beyond GDP and distance. Analyzing elements like cultural ties, trade agreements, and historical trade patterns could offer richer insights into trade flows. Furthermore, exploring non-economic variables such as political stability and bilateral relations may deepen the understanding of Nepal's export and import dynamics. Longitudinal studies tracking these relationships over time in response to shifting global economic conditions would also be valuable. Additionally, qualitative research, including interviews with trade experts and policymakers, could complement these quantitative findings, providing a more nuanced view of the trade landscape and informing effective trade policy.

## 7. Conflicting Issues

The findings of this study do not present any conflicting issues with existing literature. The results align with previous studies, such as those by Paudel and Cooray (2018) and Ristanović, Primorac, and Kozina (2020), which support the observed relationships between GDP, distance, and trade dynamics. The consistent outcomes reinforce the validity of the analysis conducted in this study. Therefore, no declaration of conflicting issues is necessary.

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