Nepal's Trade Flows: Evidence from Gravity Model

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Abstract

This study is carried out to estimate the trade potentiality of Nepal using gravity model. The gravity model simply explains that the volume of trade between pairs of countries is a positive function of the size of two countries and negative function of the distance between them. The study has used coefficients of the model to predict Nepal's foreign trade for the year 2009. The trade potentiality is calculated with the help of the ratio of predicted trade to actual trade. The result is fluctuating: some countries crossed the limits whereas some countries are still below the potential trade. The study has used gravity model to evaluate the determinants of foreign trade of Nepal using secondary data including 19 major trade partners. The estimated result of Nepal's trade potentiality shows that Nepal has exceeded trade potentiality with her 10 trading partners, including giant neighbors India and China, and there remains trade potentiality with 9 trade partners including another neighbor Bangladesh.

I. INTRODUCTION

The theoretical importance of trade for development is very well known since the writings of David Ricardo. According to him, international trade enables a country to take comparative advantage and benefits through specialization both statically and dynamically performing the function of international exchange of goods. Acknowledging the significance of trade in economic development, Nepal has been shifting towards liberal and market-oriented trade policy since the mid-1980s that was accompanied by various reform programs in 1992 (Pant, 2005). Under it, the country has introduced export-oriented policies in order to increase the volume of exports. Likewise, import substitution policies have been removed.

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Trade is a multi-dimensional phenomenon. It is determined by many factors at a time. Both economic (income of a country, tariff structure) and non-economic factors (distance, language, culture) determine it. Various studies have been undertaken on trade. Most of them are concerned with a qualitative question of identifying the trade pattern. Following this modular, the studies on Nepal's foreign trade are qualitative in nature as they focus on volume, direction, composition of trade as tariff rate and tariff structure. Questions such as which countries should trade what goods have also been analyzed. However, a question as to how much of those goods are traded remains an important unsettled issue. Regarding this issue, only very few studies have been carried out by using quantitative methods that contain gravity model (Bhatt, 2005). The importance of gravity model is increasing very fast. This model explains volume of trade between pairs of countries as a positive function of the size of two countries and negative function of the distance between them. The model is popular for empirical research because it explains a very large portion of actual trade flows observed in the world (Berg and Joshua, 2007). Foreign trade is a crucial element in the process of economic development. In view of the crucial role that volume of trade plays in the process of development, it is important to understand its various determinants.

The gravity model is widely used in the empirical literature to evaluate the determinants of bilateral trade. Hassan (2001) examined the issues of whether intra SAARC trade flow is under-rated or over-rated than as predicted by the gravity model. Batra (2004) estimated a gravity model of bilateral trade between India and her 146 trade partners. Sohn (2005) fitted a gravity model of bilateral trade between Korea and her 30 trading partners. Rahman (2010) examined the causative factors of Bangladesh's exports to 35 countries using gravity model. Hatab et al. (2010) examined the determinants of Egyptian agricultural exports using gravity model. In this regard, this study uses the gravity model to evaluate the determinants of foreign trade of Nepal and contributes to the literature on the application of gravity model in Nepal for the researchers, learners, policy makers in particular and for all other interested persons. This study is also valuable, as it evaluates whether Nepal still has some untapped trade potential with its major trading partners. Furthermore, it provides useful indicators for current negotiations for the country specific trade promotional policies and bilateral trade.

To the best of my knowledge, there is no any empirical research using gravity model with latest data of 2009 in understanding the factors influencing Nepal's trade flows with her major trading partners. In this context the general objective of the present study is to estimate the gravity model of Nepal. The specific objectives of the study are as follows: (i) to evaluate the determinants of bilateral trade flows of Nepal and (ii) to explain Nepal's trade potential. The determinants of bilateral trade flows are evaluated in terms of equation 5 and 6 and the second objective has been explained only with the equation 6 as given under the research methodology of the study. This study could include additional explanatory variables such as openness indicator, trade complementary index etc. in the model. However, it has been limited only to independent variables including GNI, per capita GNI and distance. The study is based only on cross section data of merchandise trade at an aggregate level, and not on product specific disaggregated data.

The rest of the paper is structured as below. Section 2 presents an overview on Nepalese foreign trade. Section 3 provides research methodology including theoretical review, present approach, definition and the nature of the data and the selection of the 19 countries. Section 4 outlines results of the empirical analysis. Section 5 addresses conclusions and important policy implications.

II. NEPALESE FOREIGN TRADE: AN OVERVIEW

Nepal is a small country of South Asia. The country is located between China and India. Since the country adopted liberal economic policies from the beginning of 1990s, the government of Nepal has promoted private investment and encouraged foreign direct investment with several institutional and economic reforms. Nepal entered into the WTO in 2004 as a first among the least developed countries, WTO offers substantial potential for its integration with South Asian and other regional as well as global economies.

Nepal's external sector has historically been weak. Its major component, balance of trade, has appeared in deficit continuously (Acharya, 2010). In terms of composition, the merchandise trade constitutes the largest portion of foreign trade of Nepal. The value of the merchandise trade increased rapidly in the last decade of the 20th century and followed the same pattern in the first decade of the 21st century. Its volume increased up to $ 2,256 million in 2000 and reached at $ 6,453 million in 2010 from $ 884.5 millions in 1990. As a result, the trade volume has increased by 2.5 times during the period of 1990 to 2000 and by 2.86 times during the period of 2000 to 2010. During the period from 2000 to 2010 the trade deficit increased very rapidly as compared to the increase in volume of trade. The deficit of trade balance increased from $ 826 million in 2000 to $ 4,551 million in 2010. In this decade the trade deficit has increased by 5.5 times. In 2010, the value of goods imported was equal to $ 5,502 million while the value of goods exported was just equal to $ 951 millions. During this decade, the value of exports increased by just 1.35 times while that of imports increased by 3.6 times.

There are several features of Nepalese foreign trade. First, the commodity pattern of imports and exports indicate that Nepal's foreign trade confirms to comparative advantage theory of international trade. The country's comparative advantage lies in labor intensive manufacturing and agricultural products (Ministry of Industry, Commerce and Supplies; 2004). This type of trade illustrates traditional theory of trade also known as 'inter industry trade.' Second, Nepal's foreign trade is India dependent. About two-thirds of Nepal's trade is with India. Third, there is continuous deficit in Nepalese foreign trade. The volume of trade deficit is continuously increasing. Fourth, Nepal's share in total world trade has been declining. Fifth, Nepal remains dependent on a relatively small basket of exports and a few destination markets (Karmacharya, 2005).

The year 2009 remained a special year in that the world economy experienced steepest global recession after the Great Depression (World Bank, 2011a and Khanal, 2010). World gross domestic product (GDP) contracted 1.9 percent in 2009, with high economies contracting 3.3 percent and developing economies expanding just 2.7 percent down, from 8.6 percent in 2008 (World Bank, 2011a). In 2009, Nepal's gross national

income (GNI) increased by 13 percent and per capita GNI grew by 10 percent. Nepal's total merchandise trade decreased by about 11 percent in 2009 from US$ 5205 million in 2008. The imports followed the same pattern indicating a decrease by 14.5 percent but exports grew nearly by 9 percent. Table 1 presents the summary of the volume of Nepal's foreign trade for the year 2009 while other details are presented in Table 2.

Table 1: Nepal's Foreign Trade in 2009 (in million US $)

Country	Exports	Imports	Trade Volume	Trade Balance
Major countries	837.11 (94.5)	3106.22 (82.7)	3943.11 (85)	- 2268.89
Other Countries	48.89 (5.5)	648.18 (17.3)	697.07 (15)	- 599.29
World	886.0 (100)	3754.40 (100)	4640.4 (100)	- 2668.4

Source: UNCOMTRADE data.
Note: The numbers in parentheses represent percentage.

The volume of Nepal's foreign trade is presented in terms of major countries and other countries. Table 1 shows that Nepal exported almost 95 percent to her major countries and only about 5 percent to other countries. In 2009, Nepal imported 83 percent of her total imports from major countries and only 15 percent from other countries. Out of total trade volume, 85 percent was with major countries and the remaining 15 percent was with other countries.

In 2009, Nepal traded with almost 190 countries (Trade and Export Promotion Centre, 2010). The imported commodities ranged from basic goods to luxurious goods as well as labor intensive goods to capital intensive goods. Being an agricultural country, Nepal imported large amount of agricultural goods from India and China. Such goods included meat, milk, rice, vegetables from India and onion, fish, butter, garlic, apples from China. From Japan, Nepal imported bulldozers, mechanical shovels and excavators. The import list did not show any input type commodities. In the exported items there is an overwhelming domination of woolen goods (carpets, woolen shawls, scarves, mufflers) and cotton goods (cotton dresses, suits) as well as agricultural products such as lentils, skin and hides of goats, and paintings, drawings and pastels.

III. RESEARCH METHODOLOGY

3.1   Theoretical Review

The history of gravity model of international trade starts with the Newton's Law of Gravitation (Head, 2003). The gravity model of international trade is similar to Newton's gravity equation. In 1687, Newton proposed the "Law of Universal Gravitation." This law argues that the attractive force between two objects 'i' and 'j' is given by

$$F_{ij} = G\, M_i\, M_j\, /\, D_{ij}^2 \qquad\qquad (1)$$

Where,
F_{ij} = Attractive force,
M_i and M_j = Masses,
D_{ij} = Distance between the two objects, i and j.
G = Gravitational constant.

Following the Newton's gravity equation as given above, Jan Tinbergen (1962) proposed, more or less, similar functional relation to explain international trade as follows.

$$F_{ij} = G \, M_i^{\alpha} \, M_j^{\beta} / D_{ij}^{\theta} \qquad (2)$$

Where,

F_{ij} = Volume of trade between two countries 'i ' and 'j' (i.e. the sum of the flows in both direction: i. e. exports plus imports). F_{ij} is measured in monetary value.

$M_{i \, (j)}$ = Relevant economic size of country 'i(j)'.

D_{ij} = Distance between the countries i and j (usually measured between centre to centre).

The gravity model of international trade is a simple empirical model for analyzing trade flows between countries. The model states that the bilateral trade flows is directly proportional to the product of the economic size (GDP or GNI) of country 'i' and 'j' and inversely proportional to the distance between the two countries. The simplest form of the gravity model appears in the following form.

$$T_{ij} = A \, (Y_i Y_j)/(D_{ij}) \qquad (3)$$

Where,

T_{ij} = Bilateral trade flows (exports plus imports) between country i and j.

$Y_{i \, (j)}$ = GDP or GNI of country i(j).

D_{ij} = Distance between country i and j.

A = Constant of proportionality.

Taking logarithm, the equation (3) can be written as

$$Ln \, (T_{ij}) = \beta_0 + \beta_1 \, Ln \, (Y_i * Y_j) + \beta_2 \, Ln \, (D_{ij}) \qquad (4)$$

3.2   The Present Approach

This research is based on basic and augmented gravity models. The model is basic because it considers only GNI and distance as independent variables. The model is augmented in the sense that several other variables that may affect bilateral trade have been included in addition to the GNI and distance. The augmented gravity model incorporates GNI per capita as additional variable in the basic model. The basic and augmented gravity models are presented in equation (5) and (6) respectively. The present study fits both the equations. However for the purpose of Nepal's trade prediction for the year 2009, only equation (6) has been considered.

$$Ln \, (T_{ij}) = \beta_0 + \beta_1 \, Ln \, (Y_i * Y_j) + \beta_2 \, Ln \, (D_{ij}) + U_{ij} \qquad (5)$$
$$Ln \, (T_{ij}) = \beta_0 + \beta_1 \, Ln \, (Y_i * Y_j) + \beta_2 \, Ln \, (Y/P_i * Y/P_j) + \beta_3 \, Ln \, (D_{ij}) + U_{ij} \qquad (6)$$

Where,

T_{ij} = Bilateral trade flows (exports plus imports) between country i and j.

$Y_{i \, (j)}$ = GNI of country i(j).

$P_{i(j)}$ = Total mid year population of country i(j)

$Y/P_{i(j)}$ = Per capita GNI of country i(j)

β_0 = Constant of proportionality.

β_1, β_2, and β_3 are the parameters to be estimated.
D_{ij} = Distance between countries i and j.
Ln = Natural logarithm

3.3   Definition of the Data

Bilateral Trade Flows

The bilateral trade flows refer to the sum of monetary value of both exports and imports between Nepal and each trading partner.

Gross National income

Gross National income (GNI) measures total domestic and foreign value added claimed by residents. GNI comprises gross domestic product (GDP) plus net receipts of primary income (compensation of employees and property income) from nonresident sources. When calculating GNI in U.S. dollars from GNI reported in national currencies, the World Bank follows the World Bank Atlas conversion method, to smooth the effect of transitory fluctuations in exchange rates.

Gross National Income (GNI) per capita

Gross National Income (GNI) per capita is GNI divided by the mid-year population. GNI per capita in US dollars is converted using the World Bank Atlas method.

Distance

The distance refers to the distance between Nepal and its trading partners' capital cities measured in terms of kilometer.

The rationale of the independent variables is explained below. The product of GNI serves as a proxy for the two countries' economic size, both in terms of production capacity and the size of the market. Larger countries, in terms of GNI, possess both higher production capacity as well as large domestic markets for the imports. Therefore, an increase in the product of the two countries' GNI is expected to increase bilateral trade volume. Thus, it is expected that our estimated coefficient of β_1 is positive. The product of per capita GNI is an another independent variable that serves as a proxy for the income level as well as purchasing power of the exporting and importing country. Regarding the coefficient to the variable β_2, we do not have any priory information on its sign. The distance between two countries serves as a trade barrier variable such as transport cost, time and other such variables. It is argued that as distance increases, the volume of trade flow between two countries decreases, so that the negative sign of the coefficient on log of distance (β_3) is expected.

3.4   The Nature of the Data

As per the model the study has used quantitative approach based on the cross section data, for the year 2009, of bilateral trade (merchandise) flows between Nepal and her major trading partners, Nepal and her trading partners' GNI, per capita GNI, and the distance between Nepal and its trading partners' capital cities. The units of measure are as follows. The values of bilateral trade flows are measured in terms of millions of US$, the GNI is expressed in terms of billions of US$ and the value of per capita GNI is expressed in terms of US$. The distance is measured in kilometers.

The data have been obtained from the following sources. Data on distance (in kilometers) between Kathmandu (capital city of Nepal, country 'i') and other capital cities of country 'j' (as the crow flies) are obtained from an Indonesian Website:www.indo.com/distance and the Website:www.cepii.fr. The Data on GNI and GNI per capita have been taken from the *World Development Indicators 2011* published by the World Bank. The data of the total trade value is collected from UN COMTRADE data base. The data on trade value, GNI, per capita GNI and distance of Nepal and her trading partners' have been shown in Table 2.

3.5   Sample Countries

This study covers Nepal's 19 trading partners. The selection process of these 19 countries is as follows. According to *A Glimpse of Nepal's Foreign Trade* published by Trade and Export Promotion Centre (2010) there are 30 major exports partners and 30 major imports partners of Nepal in 2010. Among them, 21 are common countries involved in both the exports and imports lists. So at the first stage, the countries which were not involved in both the exports and imports lists were eliminated. Thus, it gave 21 countries. However, the *World Development Indicators 2011* published by the World Bank lack the trade figure of two countries: Taiwan and Saudi Arabia. Finally, this study covers only 19 countries for the study. The names of these countries have been presented in Table 2.

Table 2: Trade Volume, GNI, GNI Per Capita and Distance between Nepal and her Major Trading Partners

Country	Trade Value (Tij) β	GNI*	GNI/Pc*	Dij♣
Australia	35.1	957.5	4377	9744
Bangladesh	66.2	93.5	580	670
Brazil	1.95	1564.2	8070	15053
Canada	22.28	1416.4	41980	11671
China	445.26	4856.2	3650	3148
Denmark	7.42	326.5	59060	6444
France	46.18	2750.9	42620	7245
Germany	64.96	3476.1	42450	6411
Hong Kong	24.57	221.1	31570	3065
India	2694.73	1407.5	1220	806
Italy	16.91	2114.5	35110	6633
Japan	86.32	4857.2	38080	5161
Malaysia	64.18	201.8	7350	3237
Nepal	--	13.0	440	--
Netherlands	13.02	801.1	48460	6984
New Zealand	11.96	124.3	28810	11943
Singapore	98.17	185.7	37220	3523
Switzerland	29.25	505.8	65430	6924
UK	102.41	2558.1	41370	7339
USA	112.28	14233.5	46360	12395

Source: β UN COMTRADE data
* World Development Indicators 2011.
♣ Website:www.indo.com/distance and the Website:www.cepii.fr.
Note:
1. Trade value (Tij) is the sum of total exports and imports, between Nepal (i) and its trading partners, in million US$.
2. The unit for GNI is one billion US$.
3. The unit for per capita GNI is one US$.
4. The distance means great circle distance between Kathmandu, the capital city of Nepal, and the capital city of its trading partners. The unit is in kilometer.

IV. EMPIRICAL RESULTS

4.1 Determinants of Foreign Trade of Nepal

The gravity model of international trade is a popular technique to identify the determinants of bilateral trade flows between countries. The model has both sound theoretical foundations and empirical success. This research employs the gravity model to evaluate the determinants of foreign trade of Nepal. The estimated results of equation 5 and 6 are presented in the Table 3.

Table 3: Estimated Results of Two Gravity Models for Nepal

Dependent Variable: natural log of total trade between countries

Explanatory Variables	Equation 5		Equation 6	
	OLS coef.	Std. coef.	OLS coef.	Std. coef..
Constant	2.461* (3.768)		2.037** (4.163)	
PGNI	0.623** (0.166)	0.567	0.626** (0.171)	0.569
PPGNI	--------	--------	0.064*** (0.226)	0.057
Distance	-1.534* (0.279)	-0.831	-1.608** (0.391)	-0.871
N	19		19	
R^2	0.680		0.682	
Adj R^2	0.640		0.618	
F	16.990		10.705	

Source: Results of equation 5 and 6 as the data given in Table 2 were processed through SPSS 16.

Note:

1) PGNI and PPGNI mean product of GNIs and product of per capita GNIs
2) The numbers in parentheses are standard errors.
3) * means significant at 1% level of significance.
4) ** means significant at 5% level of significance.
5) *** means not significant.

Table 3 presents OLS estimates of the gravity model. From the statistical viewpoint, the estimated regression lines fit the data well and explain more than 60 (actually 64 and 61.8 percent in equation 5 and 6 respectively) percent of the variation in bilateral trade across the countries.

The basic features of the gravity model work well: for the model the GNI and distance have the expected signs with GNI possessing the positive and the distance negative sign and statistically significant; and per capita GNI plays an insignificant role. The positive sign of the GNI explains that as the size of the economies increases the trade value between the countries increases. Likewise the negative sign of the distance indicates that as the distance between two countries increases the trade value between the countries decreases. The coefficient on the GNI variable is positive and statistically significant; other things remaining constant, this explains that the higher the GNI product, the higher is the bilateral trade between the countries and vice versa.

The economic meaning of the OLS coefficient of 0.626 in equation 6 is that holding other things constant, a one percent increase in the size of GNI of given country pairs would increase bilateral trade approximately by 0.626 percent (less than proportionate increase). The estimated coefficient on log of distance has an expected negative sign, statistically significant and approximately near 1.6, indicating that other things holding constant, trade between pairs of countries falls by about 1.6 percent (actually 1.608 percent) for every 1 percent increase in the distance between them and vice versa. The estimated coefficient of

per capita GNI gives it an insignificant role. The coefficients of explanatory variables in equation 5 are similarly defined.

4.2   Nepal's Trade Potentiality with Major Trading Partners

After estimating the gravity model for bilateral trade flows with major trading partners, the present study has also estimated trade potential for Nepal. The value of potential trade (P/A) has been calculated as a ratio of predicted trade (P) to actual trade (A). For this, the data on actual trade were obtained from UN COMTRADE data base. The data on predicted trade were estimated with the help of the coefficients of the gravity model as given in equation 6 in Table 3. The value of trade potential is finally used to analyze the trade direction for Nepal. The implication of the value of P/A is that if it is greater than one (i.e. P/A > 1) this implies that there is room for further increase in trade with the countries. If it is less than one (i.e. P/A < 1) it indicates that there no potentiality of further increase in trade with the countries concerned.

Table 4: Nepal's Actual Trade, Predicted Trade (both in US $ millions) and Potentiality of Trade

Serial No.	Country	Actual Trade Flow (A) ♣	Predicted Trade Flow (P) γ	P/A
1	Australia*	35.10	15.58	0.44
2	Bangladesh**	66.20	236.15	3.56
3	Brazil**	1.95	10.94	5.61
4	Canada*	22.28	17.2	0.77
5	China*	445.26	261.77	0.59
6	Denmark**	7.42	18.24	2.46
7	France**	46.18	56.19	1.22
8	Germany**	64.96	79.16	1.22
9	Hong Kong**	24.75	45.35	1.83
10	India*	2694.73	136.03	0.05
11	Italy**	16.91	54.24	3.2
12	Japan**	86.32	137.38	1.6
13	Malaysia*	64.18	35.74	0.56
14	Netherlands**	13.02	27.76	2.13
15	New Zealand*	11.96	3.52	0.29
16	Singapore*	98.17	32.85	0.33
17	Switzerland*	29.25	21.51	0.74
18	UK*	102.41	52.49	0.51
19	USA*	112.28	66.65	0.59

Source:
♣ UN COMTRADE data base.
γ   Authors calculation based on the coefficients of equation 6 as given in Table 3.
*   means over rated countries and there is no possibility of trade expansion with these countries.
** means under rated countries and there is possibility of trade expansion with these countries.

Table 4 presents Nepal's actual trade, predicted trade and trade potential with different countries. Nepal's trade potentiality is presented in the fifth column as indicted by P/A ratio. Based on the value of P/A, Nepal's trade partners could be divided into two groups: countries with which there is potential for trade expansion (under rated: i. e. P/A >1) and countries with which Nepal has already exceeded trade potentiality (over rated: i.e. P/A < 1). The conclusions are as follows. Table 4 shows that the extent of trade potential is feasible for Brazil, Italy, Bangladesh, Denmark, Hong Kong, the Netherlands, Japan, France, and Germany. The countries with which Nepal has already exceeded potential trade, as predicted by the gravity model, are Australia, Canada, China, India, Malaysia, New Zealand, Singapore, Switzerland, UK, and USA. It is indicated that Nepal has already exceeded trade potentiality with her two giant neighbors.

V. CONCLUSION AND POLICY IMPLICATIONS

Nepal adopted trade diversification policies from the second plan. The country followed market-oriented trade policies since the mid-1980s. Since that date, all the governments have tried to integrate Nepalese economy with regional and world markets. In this process Nepal became a member of WTO, signed on the SAFTA agreements and joined BIMSTEC. In this paper, an attempt has been made to estimate Nepal's trade potential for the year 2009. The paper has evaluated the determinants of trade flows of Nepal with major trading partners using the gravity model approach and the coefficients thus obtained have been used to predict trade potential for Nepal with respect to 19 countries in the sample.

The OLS results reveal that the gravity equation fits well for the data and provides statistically significant income and distance elasticity coefficients. Trade volume between Nepal and her 19 trading partners is positively affected by economic size of the countries while distance plays a negative role and the variable per capita income plays insignificant role. Based on the gravity model the estimation of the Nepal's trade potential confers that Bangladesh, Brazil, Denmark, France, Germany, Hong Kong, Italy, Japan, and the Netherlands reveal potential for expansion of trade. To increase the trade and exploit the trade gap with these countries Nepal needs to adopt suitable trade promotional strategies. The estimation of the trade potentiality indicates that the Nepal's actual volume of trade with rest of the countries in sample has exceeded trade potential. The countries with which Nepal has already exceeded potential trade, as predicted by the gravity model, are Australia, Canada, China, India, Malaysia, New Zealand, Singapore, Switzerland, UK, and USA. However, it does not mean that Nepal can not extend the trade relations with the countries that exceeded her trade potential at present. As a result of increase in the GNI in the future on the one hand and reduction of distance by adopting appropriate trade facilitation measures on the other hand, the volume of trade with a particular country may be increased in the future.

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