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A Panel Data Analysis of Foreign Trade Determinants of Nepal: Gravity Model Approach

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A Panel Data Analysis of Foreign Trade Determinants of Nepal: Gravity Model Approach

Prepared by

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Abstract

This study aims to identify the trade (export, import and trade balance) determinants of Nepal using extended gravity model and recommend specific trade policy to promote foreign trade. The gravity model of international trade takes notion from Newtonian physical science that the gravitational force between any two objects is proportional to the product of their masses and inversely proportional to distance, similarly the trade between any two countries is proportional to the product of their GDPs and inversely proportional to distance. Empirical results based on panel data set containing 21 major trade partner countries for 6 years found that export and import of Nepal is explained by real GDP of trade partner countries. Increase in real GDP of trade partner countries increases both export and import, however export increases at higher rate than import. The trade balance of Nepal is getting worse if real GDP of trade partner country increases, even though export is increasing at higher rate than import. It is because Nepal is importing more than exporting to those countries in an absolute term. Nepal exports more to SAFTA countries than non SAFTA and imports less from the OECD countries than non-OECD. As per basic idea of gravity model, distance to trade partner countries is highly significant implying higher the distance lower the trade. The country specific fixed effect analysis shows that time invariant factors are also significant to determine the trade balance of Nepal.

Key Words: Foreign Trade, GDP, Gravity Model, Panel Data

JEL Classification: C23, F10, F14

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CONTENTS

I. INTRODUCTION

The previous studies done to analyze the direction and pattern of trade generally agree that the countries involved in trade and exchange mutually gain. Such gain from international trade is, however, not uniform and equal to all the countries, depending upon several country specific factors. The international trade related studies done with some extension in an established model including country specific factors can specify the model correctly to explain the variation in international trade. The United National Conference on Trade and Development (UNCTAD) has revealed that in 2011 out of $69.72 trillion world GDP, $18.20 trillion was traded across the countries. Based on the data, the share of international trade on world GDP accounts for 26.10 percent, which reflects growing importance of international trade in the world economy.

Nepal has shown mixed economic performance since last decade. The average GDP growth rate during 2000-2010 is recorded as 3.88 percent. The GDP growth for Fiscal Year (FY) 2011-12 stood at 4.6 percent whereas it was 3.8 percent in FY 2010-11. The sectoral contribution to GDP is estimated as 50.31 percent by tertiary sector, 35.68 percent by primary sector and 14.02 percent by secondary sector in the FY 2011-12, while the share of export in GDP reached 9.8 percent and that of import in GDP stood at32.6 percent during the same period[1].

Based on open economic principle, liberalization and privatization policy has been adopted in Nepal since 1980s with the aim to maximize net economic benefit, that opened up international trade activities in the country. The basic notion for open economic policy was to achieve economic development and growth by attracting domestic and foreign investment, generating employment opportunity and alleviating poverty. The process of opening the economy accelerated further after the restoration of democracy in 1990 by introducing new policies and amending existing policies in order to make them compatible with outward oriented regime. Some of such policies are Industrial Policy 1992, Trade policy 1992, Privatization policy 1994 (GONMOF and ADB, 2010).

The main objective of this study is to test the extended gravity model of international trade in the context of Nepal. The reason for the name is the analogy to Newton's law of gravity: Just as the gravitational attraction between any two objects is proportional to the product of their masses and diminishes with distance, the trade between any two countries is, other things equal, proportional to the product of their GDPs and diminishes with distance (Krugman and Obstfeld, 2009, p.14). It uses panel data set to analyze international trade pattern of Nepal using different dependent variables. It identifies and measures export value determining factors of Nepal with major trade partners in gravity model. Similarly, this study examines the gravity model as determinant for import and trade balance as well. Based on the regression result with gravity model, the study finally recommends specific trade policies to increase net economic benefit from the international trade of Nepal with major trade partners.

II. OVERVIEW OF FOREIGN TRADE OF NEPAL

Nepal signed first trade and transit treaty with India, the largest trade partner, in 1950, then after the treaty has been renewed several times and in March 2007, Nepal and India entered into bilateral trade treaty. After adopting liberalization policy since mid-1980's Nepal opened up border for international trade and moved forward form inward-looking strategy to outward-looking strategy. As a result of open economic policy, Nepal has entered into several bilateral, regional and multilateral trade agreements. Nepal is member of two major regional trade agreements- South Asian Free Trade Area (SAFTA) since 2004 and Bay of Bengal Initiative for multi-sectoral trade and economic cooperation (BIMSTEC) since 2004. Similarly, Nepal is the first least developed country (LDC) to become member of World Trade Organization (WTO) in 2004 by negotiation. All these initiations indicate Nepal's move towards open economic policy and commitment towards international trade and global competition.

[1] The figures are derived from web site of UNCTAD and Economic Survey 2011/12.

The GDP growth rate of Nepal has never been consistent since last decades. Nepal secured highest growth of 8.2 percent in 1994 and lowest growth of 0.12 percent in 2002. The shares of agriculture and non-agriculture sectors to GDP in FY 2011/12 are estimated at 35.1 percent and 64.9 percent respectively. The low growth of Nepal is said to be because of high dependency of agriculture output on monsoon; and poor industrial base. Basic infrastructure development is therefore essential for sustainable economic growth of Nepal. It is important to attract domestic and foreign investment and increase employment opportunity for overall economic welfare.

Kafle (2006) conducted a study to identify the effectiveness of existing trade policy on foreign trade of Nepal realizing the fact that foreign trade as an appropriate means for rapid economic development. The study concludes that Nepal's external sector policy should focus on rapid development in infrastructure establishment of industries that utilizes local resources and fulfill local needs as well as can have production surplus to export, creation of tourism friendly environment and massive promotional activities of tourism etc.

External Sector of Nepal is historically weak with perpetually increasing trade deficit. In the external sector, exports continued to surge in the recent years and imports remained volatile. Although the growth rate of exports outplaced that of imports, trade deficit widened mainly due to relative larger volume of imports (Khatiwada and Sharma, 2002). The import substitution industries and export-oriented industries may help the country to come out of the continuous unbalanced trade. The trade deficit has been mainly financed by remittance inflows, therefore the volume and sign of current account is largely determined by volumes of imports and remittance from abroad.

The economic growth performance of Nepal has not only remained slow but, in relation to the level of investment in the economy, also modest. It may be worth mentioning that, for attaining economic development objectives in an environment of smooth and stable macro economy, saving and investments must be productive. Wide gap between exports and imports should be sustainably narrowed. Toward these ends, excessive consumption and unnecessary imports should be discouraged. Sound framework and incentives should be built to ensure that the resources are productively utilized. The government policies and arrangements should help ensure such a framework (Basyal, 2011).

The share of India in Nepal's total trade has reached at 65.1 percent in FY 2011/12. During same period, out of total export, 66.80 percent has been exported to India and out of total import,64.80 percent is imported from India[2]. Nepal has signed different trade and transit related agreements with 17 different countries[3]. Nepal, a small land locked country, has an intensive trade network around the world. However, the statistics of trade shows that trade of Nepal is not balanced and facing continuous trade deficit situation. Lack of strong industrial base, limited market access and narrow export product line is considered as major problem for Nepalese economy. Developing industrial infrastructure with capacity development based on competitive advantage can help Nepal to improve from large trade deficit.

III. METHODOLOGY

3.1 The Gravity Model

The gravity model of international trade takes notion from Newtonian physical science. 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 distance between them. The relation can be expressed as;

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

[2] Refer to Current macroeconomic situation of Nepal (Based on Annual Data of FY 2011/12) published by NRB.
[3] Refer to the web site of Trade and Export Promotion Center of Nepal (TEPC) for details; www.tecp.gov.np

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

The gravity model was first applied in international trade by Tinbergen (1962), where GF_{ab} is replaced by trade volume TV_{ij}[4], M_a and M_b by GDP of origin country i, Y_i and GDP of destination country j, Y_j and D_{ab} is replaced by the physical distance between countries i and j, D_{ij} from a point of reference. Then the gravity model of international trade can be expressed as;

$$TV_{ij} = A\frac{Y_i\,Y_j}{D_{ij}^2} \tag{2}$$

For the estimation purpose this relationship can be expressed as;

$$TV_{ij} = \beta_0\frac{Y_i^{\beta_1}Y_j^{\beta_2}}{D_{ij}^{\beta_3}} \tag{3}$$

where, β_0, β_1, β_2 and β_3 are the parameters to be estimated. Using natural logarithm, the interpretation of parameter is coefficient of elasticity of trade volume with regard to the explanatory variable. The linear equation can be expressed as;

$$InTV_{ij} = \beta_0 + \beta_1 InY_i + \beta_2 InY_j - \beta_3 InD_{ij} + \varepsilon_{ij} \tag{4}$$

where, ε_{ij} is the error term of the model. In general,β_1, β_2>0 and β_3< 0; as per gravity theory.

Anderson(1979) specified the extended gravity model using population of either country as explanatory variable. The population is regarded as a part of the mass in equation (1) and trade volume is expected to be proportionate to the population. The linear equation further can be expressed as;

$$InTV_{ij} = \beta_0 + \beta_1 InY_i + \beta_2 InY_j - \beta_3 InD_{ij} + \beta_4 InP_i + \beta_5 InP_j + \varepsilon_{ij} \tag{5}$$

where, InP_i and InP_j represents natural log of population of country i and country j respectively. The population of the trade partner countries can be proxy to the market size and therefore they can be positively related to trade components, i.e. β_4 and $\beta_5 > 0$. On the other hand, if we see as increased in population decreases per capita GDP and hence propensity to consumption then it can have negative relation to trade components, i.e. β_4 and $\beta_5 < 0$.

"There is strong empirical relationship between the size of a country's economy and the volume of both its imports and its exports" (Krugman and Obstfeld, 2009). The idea of the gravity model is that the larger economies consume more and produce or sell more. Two larger economies relatively involve in larger amount of trade compared to two smaller economies because of their larger spending on consumption. However, the relationship is constrained by the trade related barriers such as physical distance between countries that can be proxy to transportation costs and other related variables. The size of economy is generally given by its size of total GDP value and market size by population. The gravity model is a natural way to determine the expected trade volume between trade partners, however extension of the model with country or region specific factors can increase accuracy of estimation.

3.2 Data Description

The data set for this study are from various governments and non-government agencies and we constructed a panel data set containing 21 trade partner countries of 6 years from 2005 to 2010. There are no missing values hence the data set is balanced panel with total 126 observations over a period of

[4] The trade volume of Nepal is presented as dependent variable to review the gravity model, however this study uses trade components such as export, import and trade balance as dependent variables with same independent variables.

6 years. The trade data are collected from Trade and Export Promotion Center of Nepal (TEPC) and data of real GDP and population are collected from UNCTAD. All the data are collected online from the web sites of the related organizations that are free to use. The physical distance is taken from www.timeanddate.com. The nominal export and import values expressed in Nepalese currency are obtained from the TEPC and converted into real terms using real exchange rate[5]. Year 2005 is used as base year and period end selling exchange rate of USD is used as nominal exchange rate that is derived from central bank of Nepal (NRB). All currency units are in thousands of USD. The distance between Nepal and its trading partner is measured in kilometers as the theoretical air distance between capital cities of both countries. Population count unit is in 1000s of number. The economic freedom index[6] of Nepal is based on 0 to 100 scale, where 100 represents maximum freedom. The index is mainly developed out of business, trade, fiscal, government, monetary, investment, financial, property rights, corruption and labor freedom. The overall score from all these indices is the economic freedom index that is the weighted average of all 10 indices weighted equally. This index in the model is expected to capture to what extent Nepal trades with economically free country.

3.3 Data Analysis Procedure and Instrument

We estimate the gravity model of international trade by using a panel data set. Panel data approach is preferred for this study because there exist several advantages of using panel data analysis. First, it allows to measure impact of particular period or group on the dependent variable. Second, this approach is useful when estimation model is likely to have time constant individual heterogeneity and need to control for the variables that are unobserved. Third, policy analysis is generally effective with panel data set because it can carry out the study with short time period and among heterogeneous groups. The econometric model used in this study can be easily extended by using more policy variables for policy analysis.

It is well known that ordinary least square (OLS) is not an appropriate estimation device when panel data are used however, we start with the OLS for comparison purpose. Then after, we estimate the model by the two basic panel data regression models: the fixed effect (FE) and random effect (RE) models. The fixed effect model wipes out all unobserved and time constants factors that might be correlated with error term to avoid endogenous problem. Thus, it is good idea to rely on fixed effect when researcher thinks that unobserved factors are correlated to the independent variables. The random effect model is appropriate to estimate the impact of time constant as well as time variant factors. It consistently assumes that time constant variables are not correlated with independent variables and they are important to include in the estimation. Therefore, critical difference between fixed effects and random effects models is that the fixed effect model allows correlation between unobserved effect and the explanatory variable whereas the random effect requires no correlation between them."It is fairly common to see researchers apply both random effects and fixed effects and then formally test for statistically significant differences in the coefficient on the time varying explanatory variables"(Wooldridge, 2009, p.493).

Hausman (1978) proposed a test to decide estimation between fixed effect and random effect. It tests against null hypothesis that the unobserved effect is uncorrelated with the explanatory variables i.e. random effect is consistent. If the test fails to reject the null hypothesis then this means the random effect and fixed effect estimates are similar and random effect model estimators are more efficiently than fixed effect model.

3.4 Econometric Models Specification

The traditional gravity model is expressed in equation (5). In this study, we consider three different types of trade values to investigate the multilateral aspects of Nepalese trade pattern. The dependent

[5] The real exchange rate is calculated by multiplying nominal exchange rate (NRS/USD) by the ratio of CPI of Nepal to CPI of USA and real value of export and import are calculated by dividing nominal values by real exchange rate.

[6] The index is derived from the website of The Heritage Foundation, visit www.heritage.org for detail.

variables are export, import, and trade balance (export - import) of Nepal with same independent variables. Hence, we have three different models to estimate specified in equation (6) through (8).

The econometric model with natural log of export of Nepal as dependent variable following gravity approach of international trade is specified as;

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln D_{ij} + \beta_4 \ln P_{it} + \beta_5 \ln P_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO\_FREE_{it} + \beta_9 ECO\_FREE_{jt} + \varepsilon_{ijt} \quad (6)$$

where, subscript i is for Nepal, subscript j is for 1 to 21 trade partner countries of Nepal and subscript t is for 6 different years from 2005 to 2010. The dependent variable $\ln X_{ijt}$ is natural log of export of Nepal to its trade partner country j at year t. β_0 is intercept of the model and $\beta_1, \beta_2, \ldots, \beta_9$ are corresponding coefficients to be estimated of the independent variables. $\ln Y_{it}$ is natural log of real GDP of Nepal for year t, $\ln Y_{jt}$ is natural log of real GDP of trade partner country j for corresponding year t. $\ln D_{ij}$ is natural log of physical air distance between capital cities of Nepal and its trade partner country j, which is time invariant. $\ln P_{it}$ is natural log of population of Nepal for year t and $\ln P_{jt}$ is natural log of population of trade partner country j for year t. $SAFTA_j$ is dummy variable equal to 1 if the trade partner country j is member of SAFTA, otherwise 0. Similarly, $OECD_j$ is dummy variable equal to 1 if the trade partner country j is member of OECD, otherwise 0. ECO_FREE_{it} is economic freedom index of Nepal and ECO_FREE_{jt} is economic freedom index of partner country j for year t. ε_{ijt} is error term of the model that represents all unobserved factors that explain the dependent variable $\ln X_{ijt}$.

The econometric model with natural log of import of Nepal as dependent variable following gravity approach of international trade is specified as;

$$\ln M_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln D_{ij} + \beta_4 \ln P_{it} + \beta_5 \ln P_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO\_FREE_{it} + \beta_9 ECO\_FREE_{jt} + \varepsilon_{ijt} \quad (7)$$

where, $\ln M_{ijt}$ is natural log of import of Nepal from trade partner j, for year t.

Similarly, the gravity approach is also used to develop the model for trade balance of Nepal. The trade balance is given by $(X_{ijt} - M_{ijt})$ in value and it is specified as;

$$TB_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln D_{ij} + \beta_4 \ln P_{it} + \beta_5 \ln P_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO\_FREE_{it} + \beta_9 ECO\_FREE_{jt} + \varepsilon_{ijt} \quad (8)$$

where, TB_{ijt} is trade balance of Nepal with country j for year t. Note that the dependent variable TB_{ijt} is not transformed into natural log because in many cases Nepal has had negative trade balance or trade deficit i.e. $(X_{ijt} - M_{ijt}) < 0$.

IV. EMPIRICAL RESULTS

We estimate the models in equation (6) through (8) by using 3 different methods; pooled OLS, RE and FE. To choose between RE and FE, Hausman's (1978) specification test is conducted[7]. Failing to reject null through Hausman test suggests that the RE estimators are consistent, otherwise FE.

Panel data analysis is based on strong assumption of no heteroskedasticity and no serial correlation. Therefore, "estimation model with panel data assumes that regression disturbances are homoskedasticity with same variance across time and individuals. This may be restrictive assumption for panels, where the cross-sectional units may be varying size and as a result may exhibit different variation" (Baltagi, 2008, pp.88). Similarly, "ignoring serial correlation when it is present results in

[7] Hausman tests is carried out against null hypothesis H_0: $E(u_{it}/X_{it})=0$, i.e. contemporous correlation between error term and independent variables is zero, which is also a basic assumption of RE model.

consistent but inefficient estimates of the regression coefficient and biased standard errors" (et.al., 2008, pp.92). However, the issue of serial correlation is easily dissolved by various testing methodologies.

In case of RE model, a joint Lagrange Multiplier (LM) test for the error component model is applied to detect the heteroskedasticity and serial correlation. If detected, then generalized least square (GLS) approach is followed to get the estimators robust to heteroskedasticity and serial correlation. In case of FE model, modified Wald test is conducted for groupwise heteroskedasticity and Wooldridge test is done for serial correlation. Based on the detection of either heteroskedasticity or serial correlation or both the robust standard errors are estimated to get the efficient estimators for FE model.

Annex 1, 2 and 3 presents pooled OLS, RE and FE regression results for the models (6), (7) and (8) respectively. Hausman tests suggest that RE is preferred for models (6) and (7) and FE is preferred for model (8). The joint LM test for heteroskedasticity and serial correlation shows the presence of heteroskedasticity and serial correlation in the RE models (6) and (7). Table 1 presents results robust to heteroskedasticity and serial correlation for RE models (6) and (7) in column (1) and (2) using GLS approach. Whereas modified Wald test for groupwise heteroskedasticity and Wooldridge test for autocorrelation is applied to detect heteroskedasticity and serial correlation in FE model (8). Modified Wald test shows heteroskedasticity in the FE model, whereas Wooldridge test for Autocorrelation shows no serial correlation. Therefore, the FE model with robust to heteroskedasticity is presented in column (3) of Table 1 as a final result for interpretation.

Table 1: Final Regression results for Dependent Variables: InX_{ijt}, InM_{ijt} and TB_{ijt}

Dependent Variables	**1** **InX_{ijt}**	**2** **InM_{ijt}**	**3** **TB_{ijt}**
Independent Variables	**Robust RE**	**Robust RE**	**Robust FE**
InY_{it}	7.5005 (15.4650)	-9.1691 (24.5360)	923887.9 (979475.4)
InY_{jt}	1.4266*** (0.1482)	0.5744** (0.2351)	-931074** (376558.7)
InD_{ij}	-0.9223*** (0.1648)	-0.9935*** (0.2615)	-
InP_{it}	-19.8625 (37.4335)	24.2167 (59.3901)	-1791611 (2347783)
InP_{jt}	-0.4654*** (0.1362)	0.1595 (0.2160)	-133514.3 (192237.7)
$SAFTA_t$	4.4166*** (0.5344)	-0.2077 (0.8478)	-
$OECD_j$	0.0056 (0.2413)	-1.0599*** (0.3828)	-
ECO_FREE_{it}	0.1182 (0.1133)	0.0530 (0.1797)	18414.01 (15650.31)
ECO_FREE_{jt}	0.0176** (0.0089)	0.0392*** (0.0141)	-6434.056 (4188.672)
Constant	67.9661 (131.9705)	-101.2826 (209.3777)	23400000** (11400000)
Observations	126	126	126
Wald Chi-square	702.80	124.24	-
Prob. > Chi-square	0.0000	0.0000	-

*Note: The figures in parenthesis are standard errors. ***, ** and * indicate significance level at 1, 5 and 10 percent, respectively.*

Based on GLS result presented in Table 1, real GDP of Nepal has highly positive relation with dependent variable log of export of Nepal, however the estimator has no statistical significance. The coefficient of InY_{jt} is statistically significant at 1 percent which implies that export of Nepal increases by 1.43 percent as real GDP of partner country increases by 1 percent. As expected, distance is negatively related to export and statistically significant at 1 percent level. If distance with trade partner country is higher by 1 percent, then the export of Nepal to the country decreases by 0.92 percent. The population of Nepal and trade partner country is negatively related with the export however, population of trade partner country is only statistically significant. It is quite logical to a see negative relationship between population and export. Increase in population decreases the per capita GDP and hence reduces demand for consumption. If population of trade partner country increases by 1 percent, the export will decrease by 0.46 percent, it shows statistical significance at 1 percent level. The dummy variable of SAFTA is positively related to export at 1 percent level of significance. The result suggests that export is increased by 441.66 percent to the country if it is SAFTA member country, which is very high and has policy significance. The co-efficient for dummy variable of OECD is very small and statistically insignificant. The coefficient of economic freedom index is quite big for Nepal but statistically insignificant. Whereas that of trade partner country is small but statistically significant at 5 percent. The result suggests that the export to trade partner country will increase by 1.76 percent if economic freedom index of the country increases by 1 point. Based on RE model, 83.99 percent variation on dependent variable is explained by independent variables of the model.

The GLS result in Table 1 for dependent variable InM_{ijt} shows that real GDP of Nepal has negative relation with import however, it is statistically insignificant. Whereas real GDP of trade partner country is statistically significant at 5 percent level of significance. If real GDP of a partner country increases by 1 percent, the import of Nepal from the country increases by 0.57 percent. Distance between Nepal and trade partner country is also statistically significant at 1 percent level of significance. If distance between trade partner countries is higher by 1 percent then import from the country lowers by 0.99 percent. The population coefficient of Nepal as well as partner countries show positive relation but statistically insignificant. Dummy variable for SAFTA shows negative relation to import of Nepal but no statistical significance, whereas dummy variable for OECD is significance at 1 percent level and result shows that import of Nepal for the country decreases by 105.99 percent if the country is member of OECD. Economic freedom indices of both Nepal and partner countries show positive relation with import of Nepal however economic freedom of trade partner country is only statistically significant. The result shows that if economic freedom index of trade partner country increases by 1 point then import from the country increases by 3.92 percent. Based on RE model 48.73 percent of variation in dependent variable is explained by independent variables.

Based on FE robust result real GDP of Nepal is positively related to dependent variable trade balance but there is no sign of statistical significance. Whereas real GDP of trade partner county is negatively related to trade balance of Nepal with statistical significance at 5 percent level. The result implies that if real GDP of partner countries increase by 1 percent, the trade balance decreases by 9310.74 thousands of USD. Nepal imports more and exports less as real GDP of trade partner country increases. Khan and Hossain (2010) investigated bilateral trade balance of Bangladesh and found similar result as of Nepal, that the coefficient of relative GDP is negative i.e. -2.29 and highly significant implying trade balance of Bangladesh deteriorates when GDP of partner countries increases relatively more than that of Bangladesh. The population of Nepal and trade partner is negative related to trade balance with no statistical significance. Economic freedom of Nepal is positively related whereas economic freedom of partner country is negatively related, but both show no statistical significance.

Country Specific Fixed Effects on Trade Balance

The country specific fixed effect may be important unobserved factor to understand the relationship between country specific time invariant factors and the dependent variable. The country specific time invariant variables such as religion, culture, race, language, access to seaport, level of economic

development, endowment of natural resources, structure of political economy, physical size and location of the country etc. cannot be estimated with fixed effect model reported in Table 1, however those variables may be important unobserved factors to explain the dependent variable, TB_{ijt}. Country specific effect allows to know the impact of country fixed variable on the dependent variable. In case of Nepal, it is worthwhile to note, on an average, that the country specific fixed features seem to be worsening or improving trade balance of Nepal. The country specific fixed effects can be estimated by including country dummy variables on the equation (8). The estimation equation is expressed as;

$$\begin{aligned} InTB_{ijt} = \beta_0 + \beta_1 InY_{it} + \beta_2 InY_{jt} + \beta_3 InD_{ij} + \beta_4 InP_{it} + \beta_5 InP_{jt} + \beta_6 SAFTA_t + \beta_7 OECD_j + \\ \beta_8 ECO\_FREE_{it} + \beta_9 ECO\_FREE_{jt} + \delta_{j-1} COUNTRY_{j-1} + \varepsilon_{ijt} \end{aligned} \quad (9)$$

where, δ_{j-1} is the coefficient for correspondent country dummy variable $COUNTRY_{j-1}$ for N-1 countries.

Australia is chosen as base group or benchmark group by default; hence, country comparison is made against Australia. The country specific fixed effect for Australia cannot be estimated based on above model. In order to calculate the country specific fixed effect for Australia, expectation rule approach is followed[8]. Based on the approach the country specific fixed effect for Australia is calculated as 135,711 thousands of USD. This figure allows to know the exact amount of country specific fixed effect for each country from the estimation result of dummy variable model (9). The accurate amount of country specific effect is calculated by adding country fixed effect value of Australia i.e. 135,711 on the each country effect coefficient estimated from the dummy variable model equation (9). The dummy variable model is preferred to report over expectation rule approach, even though both provide identical results, because dummy variable model estimates standard error for each country dummies that allows to determine the statistical significance for interpretation. The country specific fixed effect for 20 countries except Australia based on dummy variable model (9) is presented below in Table 2;

Table 2: Country Specific Fixed Effect on Trade Balance[9]

Country	Country Fixed Effect
Bangladesh	-2237299*** (656982.2)
Brazil	321554 (441055.3)
Canada	394271.8*** (111591.1)
China	1288082 (802133.7)
Denmark	-1250157*** (312542.7)
France	966815.6*** (266791.4)
Germany	1306320*** (318539.9)
Hongkong	-1409984*** (305616.4)

[8] The country fixed effects for all partner countries are also calculated based on expectation rule. The model for country effect based on expectation rule and calculated values are presented in Annex 4: Estimation of Country Fixed Effect Based on Expectation Rule.

[9] The result is based on pooled OLS and the coefficients of other independent variables of equation (8) are same as the fixed effect model equation (9) presented in Table 1.

India	-869253.7 (782841.8)
Italy	764568.4*** (242556.2)
Japan	1758077*** (421922.3)
Malaysia	-1654185*** (335402.5)
Netherlands	-207485.8** (79055.14)
New Zealand	-2010763*** (427864.1)
Singapore	-1804301*** (388398.7)
Switzerland	-808695.9*** (227072.6)
Taiwan	-717365.2*** (160804.3)
UAE	-1678409*** (356004.5)
UK	1102093*** (257286.9)
USA	2960144*** (652071.8)
Observations	126
Degrees of freedom	99
R-square	0.9347
Adjusted R-square	0.9176

*Note: The figures in parenthesis are standard errors. ***, ** and * indicate significance level at 1, 5 and 10 percent, respectively.*

The country specific fixed effects on trade balance of Nepal indicate the amount of trade balance due to country specific time invariant variables. The estimated result from the above table shows that except Brazil, China and India all the country specific fixed effects are statistically significant. Among 20 trade partner countries, 11 countries have negative country specific effect, whereas 9 countries have positive country specific effect on trade balance of Nepal. Negative country specific effect indicates increase in trade deficit due to correspondent country's time invariant variables, whereas positive country specific effect indicates decrease in trade deficit due to correspondent country's time invariant variables. Thus, policy concern can be to increase trade with the countries that have positive country specific fixed effects on trade balance because that will improve trade balance by increasing export and decreasing import, at the same time impact of other time variant factors also should be considered to have positive net impact.

Among the 20 countries, Bangladesh has highest negative fixed effect whereas USA has highest positive fixed effect. The country fixed effect for Bangladesh is estimated as -22,37,299 that is significant at 1 percent level, indicates that time invariant factors of Bangladesh is expected to increase trade deficit of Nepal by 22,37,299 thousands of USD than that of Australia. In other words, trade deficit of Nepal increases by 2,101,588[10] thousands of USD due to fixed factors of Bangladesh. Similarly, the country fixed effect for USA is estimated as 2,960,144 that is also significant at 1percent level, indicates that time invariant factors of USA is expected to increase trade balance of

[10] (-2,237,299 + 135,711)

Nepal by 2,960,144 thousands of USD than that of Australia. In other words, trade balance of Nepal increases by 3,095,855[11] thousands of USD due to fixed factors of USA. In the cases of country fixed effect of Bangladesh and USA, trade with Bangladesh deteriorates the trade balance whereas trade with USA improves. Thus, country fixed effect gives indication for proper trade policy to improve trade position of Nepal.

V. SUMMARY AND CONCLUSIONS

International trade has become crucial for economic development of every country. As a result, improving trade position is the concern of all the time. Continuous trade deficit situation of Nepal with most of the partner countries has become serious issue. This study aims to identify the international trade determinants of Nepal based on gravity model and recommend specific trade policy to maximize gain from the trade. There is clear indication from the empirical results of the gravity model that the export and import of Nepal are explained by the real GDP of trade partner country. Higher the real GDP of trade partner country higher will be the export as well as import. The rate of increase in export is higher than import due to real GDP of partner country. Nepal exports more to SAFTA countries than non-SAFTA and import less from the OECD countries than non-OECD countries. Extending the export market to non-SAFTA countries and increasing trade with OECD countries can increase exports and limit imports improving overall trade position of Nepal.

As per basic idea of gravity model, distance to trade partner county of Nepal is highly significant implying that higher the distance lower the trade. The distance can be proxy to transportation cost and cultural differences. The positive relation of economic freedom of trade partner country to export as well as import implies that comparatively Nepal is involved in trade with economically free countries than otherwise. The trade balance of Nepal is getting worse if real GDP of trade partner country increases. It is because increase of import in volume is higher than the export as economy of partner countries grows. The country specific fixed effect analysis shows that time invariant factors are also significant to determine the trade balance of Nepal.

[11] (2,960,144 + 135,711)

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Annex 1: Regression Results for Dependent Variable: InX_{ijt}

Independent Variables	(1) Pooled OLS	(2) RE	(3) FE
InY_{it}	7.5005 (16.1178)	7.8791 (9.2558)	8.2875 (9.1143)
InY_{jt}	1.4266*** (0.15445)	1.3809*** (0.3029)	0.9416 (0.6987)
InD_{ij}	-0.9223*** (0.1718)	-0.9241** (0.4144)	-
InP_{it}	-19.8625 (39.0137)	-20.5222 (22.4035)	-21.7431 (22.0988)
InP_{jt}	-.4654*** (0.1419)	-0.4776* (0.2641)	0.9841 (0.7775)
$SAFTA_j$	4.4166*** (0.5569)	4.0919*** (1.2476)	-
$OECD_j$	0.0056 (0.2515)	0.1752 (0.5704)	-
ECO_FREE_{it}	0.1182 (0.1180)	0.1224* (0 .0678)	0.1325* (0.0672)
ECO_FREE_{jt}	0.0176* (0.0093)	-0.0008 (0.0155)	-0.0349 (0.0226)
Constant	67.9661 (137.5413)	70.7608 (79.0080)	64.6758 (77.7659)
Observations	126	126	126
R-square	0.8480	0.8399	0.1311
Hausman test	Chi square = 6.89, degrees of freedom = 6, p-value = 0.3313		
Joint LM test	LM(Var(u)=0,rho=0) = 146.26 , Prob. > Chi-square(2) = 0.0000		

*Note: The figures in parenthesis are standard errors. ***, ** and * indicate significance level at 1, 5 and 10 percent, respectively.*

Annex 2: Regression Results for Dependent Variable: InM_{ijt}

Independent Variables	**(1) Pooled OLS**	**(2) RE**	**(3) FE**
InY_{it}	-9.1691 (25.5717)	-9.7201 (11.74516)	-9.5809 (11.5750)
InY_{jt}	0.5744** (0.2450)	0.2910 (0.4642)	1.0550 (0.8873)
InD_{ij}	-0.9935*** (0.2725)	-1.1447 (0.7017)	-
InP_{it}	24.2167 (61.8972)	25.4712 (28.4296)	22.3887 (28.0651)
InP_{jt}	0.1595 (0.2251)	0.5038 (0.3979)	2.6673*** (0.9874)
$SAFTA_j$	-0.2077 (0.8836)	-1.1410 (2.0407)	-
$OECD_j$	-1.0599*** (0.3990)	-0.7473 (0.9355)	-
ECO_FREE_{it}	0.0530 (0.1873)	0.0518 (0.0861)	0.0419 (0.0854)
ECO_FREE_{jt}	0.0392*** (0.0147)	0.0567** (0.0221)	0.0609** (0.0287)
Constant	-101.2827 (218.2161)	-103.179 (100.3179)	-122.4085 (98.7611)
Observations	126	126	126
R-square	0.4965	0.4873	0.2374
Hausman test	Chi square = 6.61, degrees of freedom = 6, p-value = 0.3582		
Joint LM test	LM(Var(u)=0,rho=0) = 198.11 , Prob. > Chi-square(2) = 0.0000		

*Note: The figures in parenthesis are standard errors. ***, ** and * indicate significance level at 1, 5 and 10 percent, respectively.*

Annex 3: Regression Results for Dependent Variable: TB_{ijt}

Independent Variables	(1) Pooled OLS	(2) RE	(3) FE
InY_{it}	1231850 (5649668)	1085742 (2376625)	923887.9 (2232283)
InY_{jt}	-152242.2*** (54138.11)	-355101.6*** (102394.1)	-931074*** (171118.4)
InD_{ij}	18701.41 (60208.68)	-15173.62 (164589.9)	-
InP_{it}	-3734178 (13830288.89)	-3242068 (5752860)	-1791611 (5412461)
InP_{jt}	50027.1 (49740.9)	191369.4** (87202.76)	-133514.3 (190419.3)
$SAFTA_j$	-840019.4*** (195210.8)	-1310766*** (468933.6)	-
$OECD_j$	253551.5*** (88142.31)	500928.7** (215166.3)	-
ECO_FREE_{it}	10042.36 (41372.97)	11577.47 (17429.35)	18414.01 (16464.37)
ECO_FREE_{jt}	-2831.511 (3255.086)	-1387.045 (4703.085)	-6434.056 (5540.991)
Constant	20500000 (48200000)	20400000 (20300000)	23400000 (19000000)
Observations	126	126	126
R-square	0.5083	0.4653	0.3106
Hausman test	Chi square = 19.54, dof = 6, p-value = 0.0033		
Modified Wald Test for groupwise Heteroskedasticity	Chi-square = 34968.92; Prob.>Chi-square = 0.0000		
Wooldridge Test for Autocorrelation	F-value = 2.881; Prob. > F=0.1051		

*Note: The figures in parenthesis are standard errors. ***, ** and * indicate significance level at 1, 5 and 10 percent, respectively.*

Annex 4: Estimation of Country Fixed Effect Based on Expectation Rule

The model is specified as;

$$y_{ijt} = \beta_0 + \beta_{ijt}X_{ijt} + c_i + u_{it} \quad (11)$$

$$\hat{c}_i = \bar{y}_{it} - \bar{x}_{it}\hat{\beta}_{ijt} - \hat{\beta}_0 \quad (12)$$

Or, $$\hat{c}_i = \frac{1}{T}\sum_{t=1}^{T} y_{it} - \frac{1}{T}\sum_{t=1}^{T} x_{it}\,\hat{\beta}_{ijt} - \hat{\beta}_0 \quad (13)$$

where, $\hat{c}_i$ is estimated country specific time invariant factors, $\bar{y}_{it}$ expectation of dependent variable for every country, $\bar{x}_{it}$ is expectation of independent variables for the countries and $\hat{\beta}_{ijt}$ is estimated coefficient of the independent variables and $\hat{\beta}_0$ is intercept with FE model[12]. Based on equation (12) and (13) the country specific effects on trade balance of Nepal are estimated and presented below;

Country	Expected Trade Balance	Country Fixed Effect
Australia	-24508.93	**135711**
Bangladesh	26754.06	-2101587
Brazil	-9469.25	457267
Canada	-6069.41	529985
China	-313373.20	1423793
Denmark	-4331.76	-1114439
France	-1388.62	1102527
Germany	-105.16	1442032
Hongkong	-15057.08	-1274268
India	-1459018.00	-733537
Italy	388.94	900282
Japan	-48216.00	1893790
Malaysia	-44973.00	-1518467
Netherlands	-4240.95	-71770
New Zealand	-11074.08	-1875051
Singapore	-56698.52	-1668590
Switzerland	-12628.17	-672978
Taiwan	-13529.06	-581652
UAE	-109310.70	-1542691
UK	-23649.40	1237809
USA	17197.21	3095856

[12] Refer to Table 1 for the estimated coefficients in FE model when dependent variable is TB_{ijt}