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The Editorial Board has the pleasure of releasing this issue of the *NRB Economic Review (Volume 25, Number 1)*. This issue incorporates analytical articles on contemporary issues of the Nepalese economy.

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

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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 deficit of Nepal increases if real GDP of trade partner country increases, even though export is increasing at higher rate than import. This is because Nepal is importing more than exporting to those countries in absolute terms. 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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I. INTRODUCTION

The previous studies conducted 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 the 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 at 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 at 32.6 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 these policies include 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 being 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

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

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; therefore, 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 from 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.

The GDP growth rate of Nepal has never been consistent since the last few decade. 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 due to 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 of Nepal, realizing the fact that foreign trade is an appropriate means for economic development. The study concluded that Nepal's external sector policy should focus on infrastructure development and establishment of industries that utilizes local resources.

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. 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 are considered as major problems for Nepalese economy. Developing industrial infrastructure with capacity development based on competitive advantage can help Nepal to improve from large trade deficit.

III. METHODOLOGY

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;

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

where, GF_{ab} is gravitation force between masses a and b. $M_a M_b$ 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

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

4 The trade volume 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.

countries i and j, D_{ij} from a point of reference. Then the gravity model of international trade can be expressed as;

$$TV_{ij} = A \frac{Y_i Y_j}{D_{ij}^2} \quad \text{..... (2)}$$

For the estimation purpose this relationship can be expressed as;

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

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;

$$InTV_{ij} = \beta_0 + \beta_1 InY_i + \beta_2 InY_j - \beta_3 InD_{ij} + \varepsilon_{ij} \quad \text{..... (4)}$$

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;

$$InTV_{ij} = \beta_0 + \beta_1 InY_i + \beta_2 InY_j - \beta_3 InD_{ij} + \beta_4 InP_i + \beta_5 InP_j + \varepsilon_{ij} \quad \text{..... (5)}$$

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 increase in population decreases per capita GDP then the population 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 *et al*., 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.

Data Description

The data set for this study are from various government and non-government agencies and we constructed a panel data set containing 21 trade partner countries of 6 years from 2005 to 2010. Those 21 trade partner countries are largest partner in terms of imports and exports. There are no missing values; hence the data set is balanced panel with total 126 observations over a period of 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]. Period end selling exchange rate of USD is used as nominal exchange rate that is derived from 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.

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.

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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.

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. Thenafter, 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 constant factors that might be correlated with error term to avoid endogenous problem. Thus, it is a good idea to rely on FE when researcher thinks that unobserved factors are correlated to the independent variables. The RE 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 FE and RE model is that the FE model allows correlation between unobserved effect and the explanatory variable whereas the RE requires no correlation between them. It is fairly common to see researchers apply both RE and FE 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. RE is consistent. If the test fails to reject the null hypothesis then this means the RE and FE estimates are similar and RE model estimators are more efficiently than FE model.

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 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:

$$lnX_{ijt} \beta_0 + \beta_1 InY_{it} + \beta_2 InY_{jt} + \beta_3 InD_{ij} + \beta_4 InP_{it} + \beta_5 InP_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO_{FREE_{it}} + \beta_9 ECO_{FREE_{jt}} + \varepsilon_{ijt} \quad \text{... (6)}$$

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 InX_{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 β_1, β_2,..., β_9 are corresponding coefficients to be estimated of the independent variables. InY_{it} is natural log of real GDP of Nepal for year t, InY_{jt} is natural log of real GDP of trade partner country j for corresponding year t. InD_{ij} is natural log of physical air distance between capital cities of Nepal and its trade partner country j, which is time invariant. InP_{it} is natural log of population of Nepal for year t and InP_{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 InX_{ijt}.

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

$$InM_{ijt} = \beta_0 + \beta_1 InY_{it} + \beta_2 InY_{jt} + \beta_3 InD_{ij} + \beta_4 InP_{it} + \beta_5 InP_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO_{FREE_{it}} + \beta_9 ECO_{FREE_{jt}} + \varepsilon_{ijt} \quad \ldots(7)$$

where, InM_{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;

$$TB_{ijt} = \beta_0 + \beta_1 InY_{it} + \beta_2 InY_{jt} + \beta_3 InD_{ij} + \beta_4 InP_{it} + \beta_5 InP_{jt} + \beta_6 SAFTA_j + \beta_7 OECD_j + \beta_8 ECO_{FREE_{it}} + \beta_9 ECO_{FREE_{jt}} + \varepsilon_{ijt} \quad \ldots (8)$$

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 hypothesis through Hausman test suggests that the RE estimators are consistent, otherwise FE estimators are consistent for interpretation.

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 in size and as a result may exhibit different variation. Similarly, ignoring serial correlation when it is present results in consistency but inefficient estimates of the regression coefficient and biased standard errors (Baltagi, 2008). However, the issue of serial correlation is easily dissolved by various testing methodologies.

7 Hausman tests is carried out against null hypothesis H0: $E(\mathbf{u_{it}}/\mathbf{X_{it}})=0$, i.e. contemporous correlation between error term and independent variables is zero, which is also a basic assumption of RE model.

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. 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}

	1	2	3
Dependent Variables	**InX_{ijt}**	**InM_{ijt}**	**TB_{ijt}**
Independent Variables	**Robust RE**	**Robust RE**	**Robust FE**
InY_{it}	7.5005	-9.1691	923887.9
	(15.4650)	(24.5360)	(979475.4)
InY_{jt}	1.4266***	0.5744**	-931074**
	(0.1482)	(0.2351)	(376558.7)
InD_{ij}	-0.9223***	-0.9935***	-
	(0.1648)	(0.2615)	
InP_{it}	-19.8625	24.2167	-1791611
	(37.4335)	(59.3901)	(2347783)
InP_{jt}	-0.4654***	0.1595	-133514.3
	(0.1362)	(0.2160)	(192237.7)
$SAFTA_j$	4.4166***	-0.2077	-
	(0.5344)	(0.8478)	
$OECD_j$	0.0056	-1.0599***	-
	(0.2413)	(0.3828)	
$ECO_{FREE_{it}}$	0.1182	0.0530	18414.01
	(0.1133)	(0.1797)	(15650.31)
$ECO_{FREE_{jt}}$	0.0176**	0.0392***	-6434.056
	(0.0089)	(0.0141)	(4188.672)
Constant	67.9661	-101.2826	23400000**
	(131.9705)	(209.3777)	(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 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 see a 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 lnM_{ijt} shows that real GDP of Nepal has negative relation with import; however, it is statistically insignificant. 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 goes down 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 takes account of unobserved factor that may be important 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. The country specific fixed effects can be estimated by including country dummy variables on the equation (8). The estimation equation is expressed as;

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

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;

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.

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)
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.*

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.

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 at -22,37,299 that is significant at 1 percent level, indicating 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 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 always the concern. Continuous trade deficit situation of Nepal with most of the partner countries has become a 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 thereby improving overall trade position of Nepal.

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

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

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 deficit of Nepal increases 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 in determining the trade balance of Nepal.

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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;

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

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

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

where, $\hat{c}_i$ is estimated country specific time invariant factors, $\dot{y}_{it}$ expectation of dependent variable for every country, $\dot{x}_{it}$ 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}

Demand for Money in Nepal: An ARDL Bounds Testing Approach[#]

Birendra Bahadur Budha[*]

Abstract

This paper investigates the demand for money in Nepal using the Autoregressive Distributed Lag (ARDL) approach for the period of 1975-2011.The results based on the bounds testing procedure reveal that there exist the cointegration among the real money aggregates (M_1^r *and* M_2^r*), real income, inflation and interest rate. The real income elasticity coefficient is found to be positive and the inflation coefficient is negative. The interest rate coefficient is negative for both of the real monetary aggregates supporting the theoretical explanation. In addition, the error correction models suggest that the deviations from the long-run equilibrium are short-lived in* M_1^r *than* M_2^r*. Finally, the CUSUM and CUSUMSQ tests reveal that the* M_1^r *money demand function is stable, but* M_2^r *money demand function is not stable implying that the monetary policy should pay more attention to* M_1^r *than* M_2^r*.*

Key words: Money Demand, Bounds text, Stability, Nepal.
JEL Classification: E410

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I. INTRODUCTION

A stable money demand function is crucial for the conduct of monetary policy. The stability in the function implies the stability in money multiplier and, thus, ensures the changes in the monetary aggregates to have a specific predictable impact on the real variables. Considering this fact, many of the studies related to the demand for money and its stability have been conducted in developed as well as developing countries. Accordingly, there has also been shift in the technique in studying money demand. The partial adjustment framework and the buffer-stock approach were mostly popular in 1980s particularly before the development of the error correction models. The error-correction models have now become the workhorse of the money demand research and, thus, numerous studies have been conducted on money demand function using the cointegration technique (Sriram, 1999). In Nepal's case, few of the studies on the money demand functions, though, have been conducted using the ordinary least squares (OLS) and the cointegration technique developed by Johansen (1988) and Johansen and Juselius (1990), no in-depth study of this topic has been reported yet using ARDL cointegration technique.

Studies on the demand for money in Nepal, for instance, are by Poudel (1989), Khatiwada (1997), Goudel (2003), Kharel and Koirala (2010) and Budha (2011). Using the OLS method, Poudel (1989) estimated the money demand function for Nepal with data from 1975 to 1987 and found the stable demand function for narrow money with income elasticity coefficient being greater than unity. Khatiwada (1997), using the OLS and stability tests like the Chow test and CUSUM test, with Nepalese macroeconomic data from 1976 to 1996, concluded that the demand for money in Nepal is a stable and predictable function of real income and interest rate. The estimated income elasticity of both broad money and narrow money in his study are more than unity. Moreover, using the cointegration technique of Engle-Granger (1987), Khatiwada found the cointegration among the real money balances, real income and the rate of interest. Kharel and Koirala (2010) has employed the cointegration technique developed by Johansen (1988) and Johansen and Juselius (1990) using the sample period of 1974/75-2009/10 and found similar result as in Khatiwada (1997) that money demand function for both narrow and broad money is a stable and predictable function of real income and interest rate. The disequilibrium, according to the study, corrects more rapidly in narrow money than the broad money.

A policy regime shift, among others, is a major cause of instability in the money demand function. Several reforms, in 1990s and since then, have been carried out in Nepal. Some examples of the reforms are deregulation of interest rate, shift in monetary policy stance, reforms in the capital markets, and enactment and

revision of the several acts and policies (Shrestha and Chowdhury, 2006). These economic reforms have significantly changed Nepal's financial system. Against this backdrop, the study about the stability of money demand function carries out specific importance.

The paper aims to examine the empirical relationship between the real monetary aggregates (M_1^r and M_2^r), real income, inflation rate and the interest rate using the recent econometric technique developed by Pesaran *et al.* (1996, 2001), known as Autoregressive Distributed Lag (ARDL) approach to cointegration. In addition, it attempts to determine the stability of the estimated money demand function.

The rest of the paper is organized as follows. Section II presents the model specification. Section III presents the data and econometric methodology and section IV discusses about the empirical results. Finally, section V presents the conclusion.

II. MODEL SPECIFICATION

It is customary to assume that the desired level of nominal money demand depends on the price level, a transaction (or scaling) variable and a vector of opportunity costs (Goldfeld and Sichel, 1990), which can be written as:

$$(M/P) = f(Y, R_1, R_2 \ldots\ldots) \qquad \ldots\ldots\ldots (1)$$

Where M stands for nominal money demand, P for the price level, Y for the real income which represents the scale variable and R_i for the elements of the vector of the opportunity costs which possibly also includes the inflation rate. A money demand of this type is not only the result of traditional money demand theories but also of modern micro-founded stochastic general equilibrium model (Walsh, 2003). Following Goldfeld and Sichel (1990), the form of money demand function employed in this paper is:

$$lnM_t^r = \beta_0 + \beta_1 lnY_t + \beta_2 \pi_t + \beta_3 R_t + \mu_t \qquad \ldots\ldots\ldots (2)$$

Where M^r stands for real money balances i.e. (M/P), R for interest rate/ own rate of return on money, and π inflation rate- a proxy for expected inflation. μ is a stochastic disturbance term such that μ_t ~N (0, σ^2). Based on the conventional economic theory, the income elasticity coefficient (β_1) is expected to be positive and the coefficient of the inflation (β_2) is expected to have negative sign. The

opportunity cost of holding money (i.e. inflation rate) relative to the real value of physical assets exerts negative effects on money demand as the increase in expected inflation lead to substitution away from money to real assets[1]. On the other hand, following the literature on the speculative demand for money, the coefficient of the interest rate, β_3, is expected to have negative sign. The external monetary and financial factors affect the money demand significantly in an open economy through the exchange rate and expected rate of return on the money (Lestano *et al.*, 2009). The capital account in Nepal's balance of payments is partially liberalized including the restrictions on portfolio investment. Capital outflow by Nepalese residents has been completely restricted except few purposes (Foreign Investment and Technology Transfer Act, 1992). The exchange rate and the foreign interest rate, therefore, are not incorporated in the model assuming that these variables have minimal impacts on the real money balances. Dekle and Pradhan (1999) postulates that a simple linear time trend (T) can be used to capture secular changes in the financial systems due to development of the transaction technology. Accordingly, the linear time trend (T) is included as a proxy for the technological change which may reflect the smooth impact of the new financial technologies toward money demand over time.

III. DATA AND METHODOLOGY

This study is based on the annual data series from 1975 to 2011, which comprises 36 data points. Narrow money (M_1) and broad money (M_2) have been employed as monetary aggregates. Narrow monetary aggregate (M1), according to the broad monetary survey of Nepal Rastra Bank, includes the currency in circulation and the demand deposits whereas the broad monetary aggregate (M_2) includes the M_1 plus the savings and call deposits and time deposits. Real monetary aggregates (M_1^r and M_2^r **)** used in the study are obtained dividing the nominal monetary aggregates by the consumer price index (CPI). The proxy for the price level (P_t) is the consumer price index whereas the real gross domestic product (GDP) is the proxy for the real income (Y). Similarly, the proxy for the interest rate (R_t) is the rate of interest on the saving deposits at the commercial banks[2]. Due the limitations of data, this interest rate on the saving deposits is also used in estimating the money demand function for M_2^r. Because of the unavailability of

[1] Expected rate of inflation stands better for the opportunity cost of holding money where the financial sector is not well developed as in the case of developing countries (Sriram, 1999).

[2] Handa (2009) postulated that near money assets such as savings deposits in commercial banks proved to be the closest substitutes for M1, so that their rate of return seems to be the most appropriate variable for the cost of using M1. But, for the broad money (M2), the interest rate on medium-term or long-term bonds would become most appropriate, since the savings components of the broad definition of money themselves earn an interest rate close to the short rate of interest.

data on the weighted interest rate on saving deposits, the interest rate is calculated by taking the average of minimum and maximum values of the range. The data on these variables were taken from the various issues of the *Quarterly Economic Bulletin* of Nepal Rastra Bank and *Economic Survey* of Ministry of Finance, Government of Nepal.

The autoregressive distributed lag (ARDL) cointegration procedure introduced by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (1997, 2001) has been used to examine the long-run relationship between the money demand and its determinants. This test has several advantages over the well-known residual-based approach proposed by Engle and Granger (1987) and the maximum likelihood-based approach proposed by Johansen and Julius (1990) and Johansen (1992). One of the important features of this test is that it is free from unit-root pre-testing and can be applied regardless of whether variables are I(0) or I(1). In addition, it does not matter whether the explanatory variables are exogenous (Pesaran and Shin, 1997). The short-and long-run parameters with appropriate asymptotic inferences can be obtained by applying OLS to ARDL with an appropriate lag length. Following Pesaran *et al.* (1997, 2001), an ARDL representation of equation (2) can be written as:

$$\Delta lnM_t^r = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta ln\, M_{t-i}^r + \sum_{i=1}^{n} \beta_{2i} \Delta lnY_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta ln\pi_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta lnR_{t-i} + \alpha_1 lnM_{t-1}^r + \alpha_2 lnY_{t-1} + \alpha_3 ln\pi_{t-1} + \alpha_4 lnR_{t-1} + \mu_t \quad \text{.....(3)}$$

Where, Δ is the first difference operator, β_0 the drift component, and μ_t the usual white noise residuals. The coefficients (α_1-α_4) represent the long-run relationship whereas the remaining expressions with summation sign (β_1-β_4) represent the short-run dynamics of the model.

In order to investigate the existence of the long-run relationship among the variables in the system, the bound tests approach developed by Pesaran *et al.* (2001) has been employed. The bound test is based on the Wald or F-statistic and follows a non-standard distribution. Under this, the null hypothesis of no cointegration α_1=α_2=α_3=α_4=0 is tested against the alternative of cointegration $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$. Pesaran *et al.* (2001) provide the two sets of critical values in which lower critical bound assumes that all the variables in the ARDL model are I(0), and the upper critical bound assumes I(1). If the calculated F-statistics is greater than the appropriate upper bound critical values, the null hypothesis is rejected implying cointegration. If such statistics is below the lower bound, the

null cannot be rejected, indicating the lack of cointegration. If, however, it lies within the lower and upper bounds, the results is inconclusive. After establishing the evidence of the existence of the cointegration between variables, the lag orders of the variables are chosen by using the appropriate Akaike Information Criteria (AIC) or Schwarz Bayesian Criteria (SBC).

The unrestricted error correction model based on the assumption made by Pesaran *et al.* (2001) was also employed for the short-run dynamics of the model. Thus, the error correction version of the ARDL model pertaining to the equation (3) can be expressed as:

$$\Delta lnM_t^r = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta ln\, M_{t-i}^r + \sum_{i=1}^{n} \beta_{2i} \Delta lnY_{t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta ln\pi_{t-i} + \sum_{i=1}^{n} \beta_{4i} \Delta lnR_{t-i} + \lambda EC_{t-1} + \mu_t \quad \ldots\ldots\ldots (4)$$

Where, λ is the speed of adjustment parameter and EC is the residuals that are obtained from the estimated cointegration model of equation (3). The error correction term (EC) is, thus, defined as: $EC_t = lnM_t^r - \gamma_1 lnY_t - \gamma_2 \pi_t - \gamma_3 R_t$. Where, $\gamma_1 = -(\alpha_2/\alpha_1)$, $\gamma_2 = -(\alpha_3/\alpha_1)$ and $\gamma_3 = -(\alpha_3/\alpha_1)$ are the OLS estimators obtained from equation (3). The coefficients of the lagged variables provide the short run dynamics of the model covering the equilibrium path. The error correction coefficient ($\boldsymbol{\lambda}$) is expected to be less than zero and implies the cointegration relation. In order to check the performance of the model, the diagnostic tests associated with the model which examines the serial correlation, functional form and heteroscedasticity have been conducted. The CUSUM and CUSUMSQ tests to the residuals of equation have also been applied in order to test the model stability. The CUSUM test is based on the cumulative sum of recursive residuals based on the first set of n observations. For the stability of the long-run and short-run coefficients, the plot of the two statistics must stay within the 5 % significant level.

IV. EMPIRICAL RESULTS

In order to apply the cointegration, the first step is to determine the order of integration of each variable under study. This is because of the fact that ARDL technique cannot be used if the order of the integration of the variables is two or more. The Augmented Dickey Fuller (ADF) test has been employed for this purpose both at the level and difference of the variables. The lag length used for this test is determined using a model selection procedure based on the Schwarz Information Criterion. The statistical results of the ADF tests are reported in table 1.

Table 1 shows that all the variables are stationary in the first difference. Inflation rate is stationary at the level with constant with no trend and constant with trend. Similarly, real money balances, both broad money (M_2^r) and narrow money (M_1^r), are also trend stationary at the level. The ARDL approach to cointegration, therefore, may be better to use since the variables are either I (0) or I (1).

Table 1. Results of ADF tests

Variables	Level		First Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
lnM_1^r	-1.20(0.66)	-4.66(0.00)*	-4.21(0.00)*	-4.14(0.01)*
lnM_2^r	-1.91(0.32)	-5.25(0.00)*	-4.03(0.00)*	-4.05(0.02)**
lnY	1.27(0.99)	-2.35(0.40)	-5.74(0.00)*	-6.03(0.00)*
π	-5.35(0.00)*	-5.26(0.00)*	-9.67(0.00)*	-9.47(0.00)*
R	-1.28(0.63)	-1.57(0.79)	-6.13(0.00)*	-6.06(0.00)*

Notes: 1. * and ** denote the statistical significance at the 1% and 5% level respectively.
2. The numbers within the parentheses for the ADF statistics are the p-values.

In the first stage of ARDL procedure, we impose arbitrary and the same number of lags on each first differenced variables in equation (3) and carry out F-test. The result will depend on the choice of the lag length (Bahmani-Oskooee & Brooks, 2007). Akaike's and Schwarz's Baysian Information Criteria have been employed in order to select the optimal lag length. The LM test has been used in order to test the serial correlation in residuals.

Table 2. Statistics for Selecting Lag Order

	Narrow Money, M_1^r			Broad Money, M_2^r		
Lags	AIC	SBC	LM(1)	AIC	SBC	LM(1)
1	-3.36	-2.78	0.59**	-3.64	-3.06	0.27**
2	-3.16	-2.40	0.66**	-3.40	-2.64	4.18*
3	-3.56	-2.61	0.51**	-3.50	-2.55	0.01**

Note: * and ** refers to marginal significance level at 1% and 10% respectively.

The results for selecting lag order are reported in table 2. The results of both AIC and SBC criteria are similar for the model of broad money. For the model of narrow money, AIC and SBC criteria give the conflicting results. Taking lag of one or three in the model of narrow money does not make any significant difference in the value of F-statistic so the optimal lag length selected and reported for the ARDL equation (3) with no serial correlation problem is one for both M_1^r and M_2^r.

The existence of the long-run relationship between money demand and its components has been tested by calculating F-statistics with one lag. The F-statistics is calculated by applying Wald tests that impose zero value restriction to only one period lagged level coefficient value of the variables. These test results are reported in table 3 with new critical values as suggested by Pesaran *et al.* (2001) and Narayan (2004) for bounds test procedure.

Table 3. Bounds tests for Cointegration Analysis

Order of Lag	1
M_1^r	6.70*
M_2^r	5.86*

Notes:

1. The relevant critical value bounds are obtained from Table C1. iv (with an unrestricted intercept and restricted trend; with three regressors k=3) in Pesaran et al. (2001). These are 2.97- 3.74 at 90 %, 3.38-4.23 at 95% and 4.30-5.23 at 99%.
2. * denotes the significance at 99%.
3. The critical values presented in Pesaran et al. (2001) are based on large samples (Narayan, 2004). For small sample sizes ranging from 30 to 80 observations, Narayan (2004) provides a set of critical values, which are 2.496-3.346 at 90%, 2.962-3.910 at 95% and 4.068-5.250 at 99%.

The computed F-statistics in table 3 was compared with the critical values provided by Narayan (2004) for small samples. The results clearly indicate that, since computed F-statistic is greater than critical values, there exists cointegration between real money balances, real income, inflation rate and interest rate.

The lag length for each variable need not be identical except for the identification purpose above[3]. In this stage, a more parsimonious model is selected for the long-run money demand using the Akaike information criteria. Pesaran and Shin (1997) and Narayan (2004) suggested two as the maximum order of lags in the ARDL approach for the annual data series. The total number of regressions to be estimated for the ARDL *(p, q, r, s)* is $(p+1)^k$, where *p* is the maximum number of lag order to be used and *k* is the number of variables in the equation. As $p=2$ and $k=4$, the total number of regressions to be estimated are 81. For this procedure, the Microfit 5.0 software program has been used and, thus, estimated ARDL *(1, 0, 0, 0)* model for the narrow money and ARDL *(2, 0, 1, 0)* model for broad money based on AIC criterion.

The long-run coefficients of the real money balances (M_1^r and M_2^r) are reported in table 4 and 5. The table 4 shows that the coefficients of real income, inflation rate and interest rate all have the expected sign as suggested by economic theories, but

[3] See Pesaran (2001) and Dagher and Kovanen (2011).

these are statistically insignificant. The long run model of the corresponding ARDL *(1, 0, 0, 0)* for narrow money (M_1^r) can be written as:

$$lnM_1^r = 0.20 + 0.42lnY - 0.003\pi_t - 0.009R_t + 0.04\ t \quad \ldots\ldots\ldots (5)$$

In table 5, the estimated long-run coefficients for broad money demand are presented. The coefficients of real income, although statistically insignificant, have the expected positive sign indicating the positive relationship between real income and money demand. The coefficient of the inflation rate is negative supporting the theoretical explanation. This implies that people prefer to substitute real assets for money balances. Similarly, the coefficient of the interest rate is negative and statistically insignificant. The long-run model of the corresponding ARDL *(2, 0, 1, 0)* for broad money (M_2^r) is:

$$lnM_2^r = 4.91 + 0.06lnY - 0.003\pi_t - 0.004R_t + 0.08\ t \quad \ldots\ldots\ldots\ldots (6)$$

Table 4. Estimated Long-run Coefficients of Real Money Balances

Dependent Variable: Narrow Money Aggregate, lnM_1^r				
	Coefficient	S.E	t-Statistic	p-value
lnY	0.42	0.33	1.29	0.21
π	-0.003	0.005	-0.64	0.53
R	-0.009	0.01	-0.77	0.45
Constant	0.20	3.91	0.05	0.96
Trend	0.04*	0.02	2.69	0.01

Note: * denotes the significance at 99%.

Table 5. Estimated Long-run Coefficients of Real Money Balances

Dependent Variable: Broad Money Aggregate, lnM_2^r				
Regressor	Coefficient	S.E	t-Statistic	p-value
lnY	0.06	0.21	0.30	0.29
π	-0.003	0.004	-0.81	0.43
R	-0.004	0.008	-0.50	0.62
Constant	4.91*	2.54	1.94	0.06
Trend	0.08**	0.01	7.48	0.00

Note: * and ** denote the significance at 99% and 90% respectively.

The short-term dynamics of the model has been examined by estimating an error correction model in equation (4). In the short run, the deviations from the long-run equilibrium can occur because of the shocks in any of the variables in the model. The diagnostic tests, which are used in this paper to examine the properties of the

model, include the test of serial autocorrelation ($\chi 2_{Auto}$), normality ($\chi 2_{Norm}$), heteroskedasticity ($\chi 2_{BP}$) and omitted variables /functional form ($\chi 2_{RESET}$). The results of the short-run dynamic money demand models and the associated diagnostic tests are reported in table 6 and 7.

Table 6 shows that the estimated lagged error correction term (ECM_{-1}) is negative and statistically significant. This result indicates the cointegration among the variables: narrow money, real income, inflation and interest rate. The absolute value of the coefficient of error correction term (i.e. 0.81) implies that about 81 percent of the disequilibrium in the real money demand is adjusted toward equilibrium annually. For instance, if the real money demand (M_1^r) exceeds its long-run relationship with the other variables in the model, then the money demand adjust downwards at a rate of 81% per year. As presented in the table 6, there is no evidence of diagnostic problem with the model. The Lagrange Multiplier (LM) test of serial correlation indicates the evidence of no serial correlation since the estimated LM value or χ2Auto is less than the critical values. The Jarque-Bera normality test implies that the residuals are normally distributed. The Breusch-Pagan test (BP) for heteroscedasticity shows that the disturbance term in the model is homoscedastic. The Ramsey's RESET test for functional specification shows that the calculated RESET statistic or $\chi 2_{RESET}$ is less than its critical values and, thus, the ARDL model is correctly specified.

Table 6. Error Correction Representation of ARDL Model, ARDL (1, 0, 0, 0)

Dependent Variable: Narrow Money, lnM_1^r			
Regressor	Coefficient	t-statistic	p-value
$\Delta lnM_{1,-1}^r$	0.24***	1.70	0.09
ΔlnY	0.31	1.48	0.15
$\Delta\pi$	-0.004**	-0.66	0.03
ΔR	-0.005	-0.66	0.52
Ecm_{-1}	-0.81*	-5.82	0.00
Constant	0.17*	6.89	0.00
Trend	0.03*	5.63	0.00
R^2= 0.63	R^2_{adj}= 0.55	F = 7.92 (0.00)	S.E. = 0.04	DW= 1.88
AIC=-3.47				
Diagnostic test:				
A. Serial correlation		$\chi^2_{Auto}(2)=0.55\ (0.76)$		
B. Functional Form		$\chi^2_{RESET}\ (2)=0.22(0.80)$		
C. Normality		$\chi^2_{Norm}\ = 0.01(0.99)$		
D. Heteroscedasticity		$\chi^2_{BP}\ (2) =5.96(0.47)$		

Notes: 1. *, ** and *** indicate the significance at the 99%, 95% and 90% level respectively.
2. The value in parentheses are the probabilities

Table 7. Error Correction Representation of ARDL Model, ARDL (2, 0, 1, 0)

Dependent Variable: Broad Money, lnM_2^r

Regressor	Coefficient	t-statistic	p-value
$\Delta lnM_{2,-1}^r$	0.17	1.06	0.30
$\Delta lnM_{2,-2}^r$	-0.09	-0.63	0.54
ΔlnY	0.22	1.12	0.27
$\Delta\pi$	-0.004**	-2.45	0.02
$\Delta\pi_{-1}$	-0.0003	-0.02	0.98
ΔR	-0.001	-0.15	0.87
Ecm_{-1}	-0.68*	-5.97	0.00
Constant	0.16*	5.01	0.00
Trend	0.02*	3.11	0.00

R^2= 0.55 R^2_{adj}= 0.40 F = 3.77 (0.01) S.E. = 0.03 DW= 1.85 SBC=-3.66

Diagnostic test:

A.	Serial correlation	$\chi^2_{Auto}(2)=0.45\ (0.79)$
B.	Functional Form	$\chi^2_{RESET}\ (2)=0.42(0.66)$
C.	Normality	$\chi^2_{Norm}\ = 0.01(0.99)$
D.	Heteroskedasticity	$\chi^2_{BP}\ (2)=8.07(0.42)$

Notes: 1. ** indicates the significance at the 99% level.
2. The value in parentheses are the probabilities.

Table 7 presents the results for broad monetary aggregate, M_2^r. The coefficient of the error correction term is negative and statistically significant, indicating the evidence of the cointegration among the broad money and other variables in the model. The high value of the error correction term for M_2 implies relatively faster adjustment in money demand when shocks arise. The coefficient of error correction term (i.e. 0.68) implies that about 68 % of total adjustment takes annually when shock arises. The smaller error correction coefficient of M_2^r than M_1^r implies the slow speed of adjustment when shocks arises. This result is consistent with the previous study by Kharel and Koirala (2010). The diagnostic tests applied to the error correction model indicate that there is no evidence of serial correlation and heterosketasticity. In addition, the RESET test implies the correctly specified ARDL model and the Jarque-Bera normality test indicates that the residuals are normally distributed.

In the final stage, the stability of the long-run coefficients is examined by using the CUSUM and CUSUM squares tests. The graphical presentation of these tests is presented in the figure below.

Figure 1: Cumulative Sum of Recursive Residuals(M1)

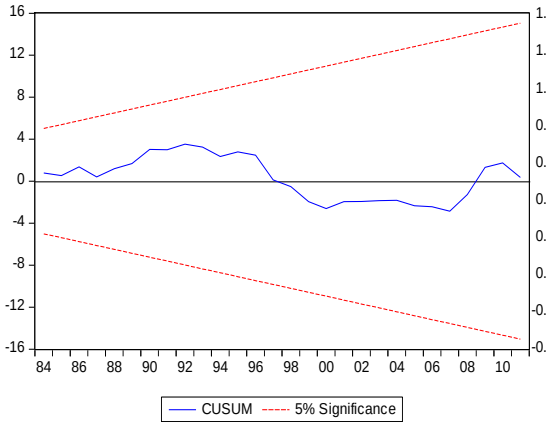


Figure 2: Cumulative Sum of Squares of Recursive Residuals(M1)

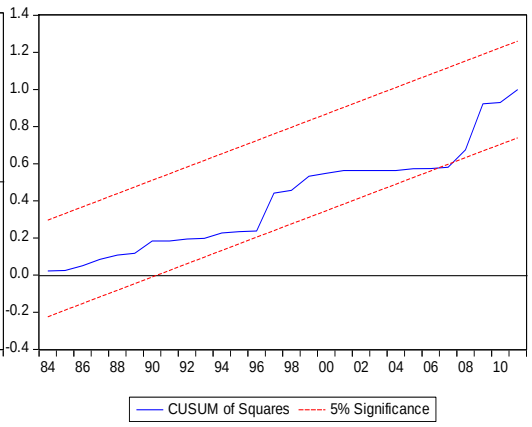


Figure 3: Cumulative Sum of Recursive Residuals (M2)

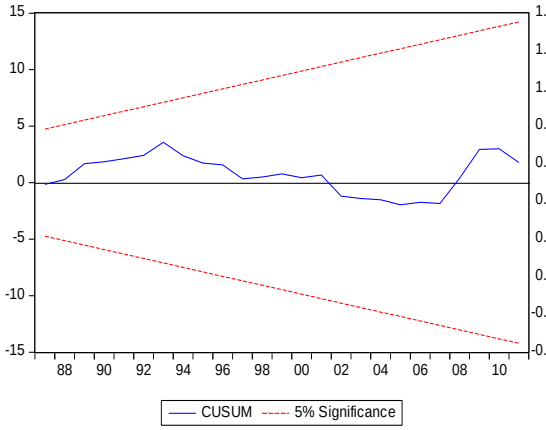
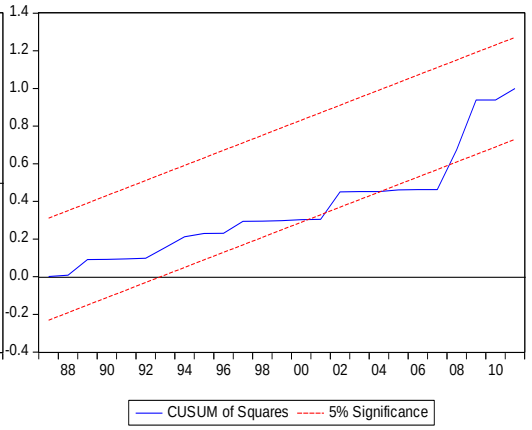


Figure 4: Cumulative Sum of Squares of Recursive Residuals (M2)



Since the plots of CUSUM and CUSUMSQ statistic for M_1^r are within the critical lines at the 5% significance level, the money demand functions for M_1^r is stable. The plot of CUSUM, though, is within the critical lines at the 5% significance level, the plot of CUSUMSQ does not lie within the critical limits implying some instability in the money demand function for M_2^r. Since the plot of CUSUMSQ for M_2^r is returning back towards the critical bands, the deviation is only transitory. The central bank, since the money demand function for narrow money is relatively stable than broad money, should pay more attention to M_1^r for the monetary policy purposes.

V. CONCLUSION

The formulation and implementation of the monetary policy requires the information on the money demand function. As a result of this importance, there are many studies pertaining to the money demand function using various techniques. This paper has estimated the demand for money in Nepal using ARDL approach to cointegration analysis developed by Pesaran *et al.* (1997, 2001). Despite the limitations of the unavailability of data on weighted interest rate and the quarterly series of some variables that may improve the results of the model, this paper may provide some empirical basis for further analysis of money demand function in Nepal.

The bounds test and the estimated coefficient of error correction term indicate that there exists a long-run equilibrium relationship between real money balances (M_1^r and M_2^r), real income, inflation rate and interest rate. The results also show that the real income is positively associated with narrow monetary and broad monetary aggregates while the inflation rate negatively affects the monetary aggregates. The negative association between the inflation rate and real money balances supports the theoretical explanation that the rise in inflation rate causes the fall in demand for money and vice versa. This may result from the people's preferences to substitute physical assets for money balances. In addition, the relationship between the interest rate and monetary aggregates is negative supporting the theoretical explanation. The higher error correction coefficient of M_1^r than M_2^r implies that the speed of adjustment in narrow money is faster than broad money if the shocks arise. By incorporating the CUSUM and CUSUMSQ tests to the cointegration analysis, this paper has also revealed that money demand function for M_1^r is stable, but the money demand function for M_2^r is not stable. This stability tests apparently imply that M_1^r stands as a better monetary aggregate than M_2^r in terms of formulation and implementation of monetary policy.

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Remittance and Trade Deficit Nexus in Nepal: A VECM Approach#

Guna Raj Bhatta*

Abstract

Once Nepal eased the access to the international labor market, there is an increasing trend of Nepalese working abroad, where annually thousands of young people migrate from the country. Consequently, there has been a sharp increment of remittance inflow in the recent years. Since remittance helps people improve the living standards, it has been observed as a good contributor for the poverty reduction in Nepal. Nevertheless, it might further deteriorate the trade balance, causing higher demand for consumable goods, most of which are imported in Nepal. Using cointegration techniques and a Vector Error Correction Model (VECM) based on the monthly data of merchandise import, worker's remittance and trade deficit for ten years period, this paper studies whether remittance causes the merchandise import and trade deficit to raise in the long run. The cointegration equation show that there is a long-run positive unidirectional causality from remittance to import as well as remittance to trade deficit implying that remittance causes merchandise import and deteriorates trade balance.

Key words: Trade deficit, Remittance, Nepal, Import, VECM
JEL Classification: F10, F24, C32

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I. INTRODUCTION

Trade, either domestic or international, is considered as one of the most important factors to achieve sustainable growth, employment generation and welfare of the people. International trade becomes crucial if the country is not self-sufficient in factors of production as well as consumption and capital goods. Considering this fact, Nepal introduced liberalized economic and trade policies in the mid-1980s by pushing tariff walls down and removing import restrictions. However, Nepal has been facing trade deficit, which soared up to 20 percent of the GDP towards the second half of the 1990s especially with India and the rest of the world (Khatiwada & Sharma, 2002; Devkota, 2004). A persistent and soaring deficit in international trade may be less likely to resemble good economic condition of an economy, leaving the question of the nation's sustainability in the international trade and finance (Silwal, 2008).

With the introduction of liberal trade and economic policies, Nepal witnessed most of the young population migrating every year in the search of work abroad in the recent decades because of economic as well as non-economic reasons. The work related emigration, excluding India, increased from about ten thousands in early 1990s to more than 300 thousands in 2010 (DOFE, 2011). This emigration resulted to a sharp rise in contribution of remittance to GDP from 2 percent in early 1990s to 23 percent in 2009 which also strengthened the overall balance of payments position and its share in current account receipts (World Bank, 2011). Out of total 55.8 percent households receiving remittance in Nepal, the share of rural is 58 percent (CBS, 2011). Because of remittance flow to the rural sector, the rural-urban migration has increased sharply. Besides, studies show a significant reduction of poverty incidence and inequality due to the high level of remittance inflow.[1] Such flow of income 'percolates and penetrates' the remote places and the poorest sections of society giving the direct access to finance (NPC & UN Country Team, 2010).

Although remittance income is considered good for the country because of aforementioned primary reasons, the question may arise about its compensation to the negative consequences and to act as a positive force in the sustainable development of the economy (Jovicic & Mitrovic, 2006). Various studies have found that families of migrant workers tend to become more extravagant than before on remittances income for their daily subsistence giving up income generating activities, abuse of such income and other behavioral changes.[2] Furthermore, remittances have a limited impact on long-term growth because it is used mostly for daily consumption purposes by the recipient households (Arunatilake et. al., 2010).

Nepal Living Standards Survey, 2011 finds that out of the total income of remittances receiving households, 31 percent income comes from remittances which are mostly spent

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1 Nepal Living Standards Survey, 2011 shows a significant reduction of poverty incidence and inequality, Nepal Economic Update, 2011 Report of the World Bank postulates that, such a rapid improvement is due to the surging remittance inflow.

2 See Hettige, S. (1991) and Arunatilake et. al. (2010) for details.

on daily consumption (79 percent) followed by repayment of loan (7 percent); capital formation and doing business has a very minimal share however. It is argued that the shortage of labor due to the emigration might compel to keep land barren, reduces the agricultural productivity and ultimately requires importing food grains (Gaudel, 2006). In addition to this, a rise in disposable income may be spendthrift on luxury and branded items, replacing the consumption and production of local goods.

Nonetheless, empirical study about the remittance income and its impact on the import and trade balance by testing the cointegrating relationship has not yet been carried out in the Nepalese context; some studies abroad show consistent results of aforementioned arguments. The estimated vector auto-regression model of Jovicic & Mitrovic (2006) in Serbia for the observed period of 62 months shows an autoregressive character of remittance, a positive coefficient of regression on consumer goods import and a negative coefficient on the lagged industrial output. The short run elasticity is 0.0874 whilst the long run elasticity is 0.563 with the conclusion that remittances cause an upward pressure on the import resulting into a huge trade deficit in the long run.

Hence, being substantial source of foreign currency earnings, the role of remittance in Nepal to the sustainable development may be questioned if the country finances remittance income for the import. In this context, we model the remittance, merchandise import and trade deficit relationship framework to establish whether remittance causes merchandise import leading to a structural cause to surging trade deficit by testing cointegration relationship and employing Error Correction Model. The empirical findings of the study would be crucial to identify the long-run impact of the remittance income into the trade deficit in Nepalese context such that the policy measures can be initiated to mitigate the impact.

There are some limitations in preparing this paper. Nepal faced severe political instability during the period of data coverage. It witnessed not only demolition of many economic infrastructures, but also frequent blockades and several nationwide strikes. These all phenomena might have backed up to rising import owing to the decline in the local industrial output. Further to this, with the three sided open border with India, remitting money into Nepal through unofficial channel may underestimate the official data since the study incorporates only the official figures. Other than remittance, the study does not consider the entire phenomena that might cause import and then trade deficit to rise. Moreover, due to the change in version of BOP compilation in 2001, the study covers the data only from 2001, which might not be able to fully explain the long-run relationship between the variables.

The rest of the paper is structured as follows. The next section elucidates the data and methodology. Section three discusses results and section four concludes the paper.

II. DATA AND METHODOLOGY

The study uses the monthly data of merchandise import (IMPORT), worker's remittance (REMIT) and trade deficit (TD) obtained from Nepal Rastra Bank. Month is a time

variable which starts from 2001 August and ends to 2011 May[3]. The reason behind the span of dataset chosen is the compilation of Balance of Payments statistics to version five from 2001 in Nepal which revises the compiling procedure and the coverage of remittance data so that historical series is fragmented. IMPORT is a merchandise import of goods and services; REMIT is an inflow of the worker's remittances into the country from abroad and TD is a negative trade balance i.e. absolute value of export-import. All the figures are in million Nepali Rupees.[4]

Before introducing the statistical tools for testing stationarity, we did a graphical plot of the series. Moreover, the monthly time series data of import, remittance and trade deficit may exhibit the seasonality pattern as we may observe more import of goods as well as increased flow of remittances during festive season. For this, we did a seasonal graphical plot of all the series and observed whether the average of the data is anomalous in a specific month.

The baseline of the model is adapted from Jovicic & Mitrovic (2006). They use a Vector Auto Regression (VAR) approach in studying the remittances and consumer goods import relation in Serbia by including 62 months' data of remittances inflow, consumer goods import and industry output. In this study, industrial output variable is excluded due to the unavailability of monthly data. Instead of industrial output, the impact analysis to the output is attempted to capture in an indirect approach modeling the import and merchandise trade deficit individually with the remittance data to identify whether remittance promotes export. If remittance contributes export promotion, we can argue its positive impact on output.

In Nepal, increase in disposable income owing to the surge of remittance inflow may be spent on daily subsistence, consumption in durable goods, spending on health and some other necessities. Since studies show a little outlay on capital formation and new establishments, it can be argued that remittance has a little support to the export and a substantial part of it is consumed for financing import. Such a relationship can be modeled as:

$$IMPORT_t = \mu + \beta_1 REMIT_t + \varepsilon_t \quad \text{..... (1)}$$

The research hypothesis of the relationship is that remittance has a significant positive impact to the merchandise import and, in the long run, it leads to deterioration to the trade balance of an economy. The presumption can be rationalized that, in Nepal, most of the consumable goods are imported and remitted income may have a little or no promotion to the export. Then, when import rises significantly and export remains constant, it increases the negative trade balance, leading to a current account balance crisis, unless we receive a huge remittances inflow to correct it. Based on this argument, we develop a subsidiary model with remittance and trade deficit as:

$$TD_t = \mu + \beta_1 REMIT_t + \varepsilon_t \quad \text{..... (2)}$$

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3 Nepali fiscal year starts from mid-July. So, Mid-July to Mid-August is counted as August and so on for the statistical conveniences.

4 One US Dollar is equivalent to 70.79 Nepali rupees as of 2011.07.27.

In order to test whether variables are stationary or not and exist the cointegration relationship, Augmented Dicky Fuller (ADF) test is carried out for unit root and Johansen's unrestricted rank test for cointegration.

In model (1) and (2), there is a presumption that the disturbances (ε_t) are a stationary white noise series. If $IMPORT_t$ and TD_t are cointegrated with $REMIT_t$, this presumption is unlikely to be true. We assume that both series are cointegrated with $REMIT_t$ at order one ($I(1)$), which means the first difference of the variables are stationary ($\Delta IMPORT_t$, $\Delta REMIT_t$ and ΔTD_t are stationary).

The representation theorem of Engle and Granger (1987) establishes a link between the cointegration and Error Correction Model (ECM). Transforming equation (1), there exits β_1 such that:

$$\varepsilon_t = IMPORT_t - \mu - \beta_1 REMIT_t \quad \text{..... (3)}$$

is I(0). If both series are I(1), the partial difference between the cointegrated variables may be stable around the mean.

Then, there exists an Error Correction Model (ECM) for $IMPORT_t$, and $REMIT_t$:

$$\Delta IMPORT_t = \mu_{IMPORT} + \alpha_{IMPORT}\varepsilon_{t-1} + \sum_{h=1}^{l} a_{1h}\Delta IMPORT_{t-h} + \sum_{h=1}^{l} b_{1h}\Delta REMIT_{t-h} + u_{IMPORTt} \quad \text{..... (4)}$$

$$\Delta REMIT_t = \mu_{REMIT} + \alpha_{REMIT}\varepsilon_{t-1} + \sum_{h=1}^{l} a_{2h}\Delta IMPORT_{t-h} + \sum_{h=1}^{l} b_{2h}\Delta REMIT_{t-h} + u_{REMITt} \quad \text{..... (5)}$$

where, $u_{IMPORTt}$ and u_{REMITt} are stationary white noise processes for some number of lags *l*.

Likewise, the same argument and transformation applies with equation (2) to establish an ECM of $REMIT_t$ and TD_t .

The coefficients in the cointegrating equation give the estimated long-run relationship among the variables and coefficients on the VECM describe how deviations from that long-run relationship affect the changes on them in next period. The parameters α_{IMPORT} and α_{REMIT} of the equation (4) and (5) measure the speed of adjustment of IMPORT and REMIT respectively towards the long-run equilibrium.

To find out the proportion of the deviations in import due to the remittance, we did Cholesky decomposition of Vector Autoregressive (VAR). It provides the answer of what is the proportion of the variation in $IMPORT_t$ that is caused by its own shock as well as the shock to the $REMIT_t$ such that:

$$\begin{pmatrix} \varepsilon_{\text{REMIT}} \\ \varepsilon_{\text{IMPORT}} \end{pmatrix} = \Psi \begin{pmatrix} u_{\text{REMIT}} \\ u_{\text{IMPORT}} \end{pmatrix} \text{ where, } \Psi = \begin{pmatrix} \psi_{11} & \psi_{12} \\ \psi_{21} & \psi_{22} \end{pmatrix}$$

By assumption of VAR, $\psi_{12}=0$ meaning that *IMPORT* does not have contemporaneous impact on *REMIT* whilst *REMIT* does have to the *IMPORT*.

$$\text{Hence,} \quad \text{var}\begin{pmatrix}\varepsilon_{\text{REMIT}}\\ \varepsilon_{\text{IMPORT}}\end{pmatrix} = \text{var}\,\Psi\begin{pmatrix}u_{\text{REMIT}}\\ u_{\text{IMPORT}}\end{pmatrix} = \Psi\,\text{var}\begin{pmatrix}u_{\text{REMIT}}\\ u_{\text{IMPORT}}\end{pmatrix} \quad \ldots\ldots\ldots (6)$$

The stability and diagnostics of the model is tested by inverse root test for VEC residuals, cointegration graph and Lagrange-Multiplier (LM) test for autocorrelation in residuals.

III. RESULT ANALYSIS

The graphical plot of the three study variables namely merchandise import (IMPORT), remittance inflow (REMIT) and trade deficit (TD) used in the model show the non-stationary processes behaving as random walk with drift. Moreover, the trends of IMPORT and REMIT and also TD and REMIT show the movements together over time indicating cointegrated relationship (Annex, Graph 1a & 1b). We do not observe a noticeable seasonal pattern in all the three variables in a seasonal graphical plot (Annex, Graph 2a & 2b).

3.1 Unit Root Test

The summary output of Augmented Dickey Fuller (ADF) test for unit root is presented below:

Table 1: Augmented Dickey Fuller (ADF) Test for Unit Root

Variables	Level		First Difference	
	t-stat	p-value	t-stat	p-value
REMIT	-0.017	0.954	-12.274	0.000*
IMPORT	-0.036	0.953	-12.499	0.000*
TD	0.225	0.973	-12.7641	0.000*

** indicates rejection of null hypothesis at 1 percent level of significance.*

Including constant in the equation, the test statistics show that all the three series of IMPORT, REMIT and TD have unit root. At the first difference, all of the included series are stationary (Table 1).

3.2 Cointegration Test

The unit root test shows that merchandise import, remittance and trade deficit are non-stationary at level and stationary at first difference. The Johansen cointegration test results allowing for deterministic trend in cointegration equation with eight lags ordering REMIT, IMPORT and REMIT, TD are presented in Table 2 and 3.

Table 2: Unrestricted Cointegration Rank Test (REMIT and IMPORT)

Hypothesized No. of CE(s)	Trace			Maximum Eigenvalue		
	Trace Statistic	0.05 Critical Value	p-value	Max-Eigen Statistic	0.05 Critical Value	p-value
None*	16.563	15.495	0.034	15.827	14.264	0.028*
At most one	0.735	3.841	0.391	0.735	3.841	0.391

** denotes the rejection of null hypothesis at 5 percent level of significance.*

Table 3: Unrestricted Cointegration Rank Test (REMIT and TD)

Hypothesized No. of CE(s)	Trace			Maximum Eigenvalue		
	Trace Statistic	0.05 Critical Value	p-value	Max-Eigen Statistic	0.05 Critical Value	p-value
None*	18.21576	15.49471	0.0190	17.88747	14.26460	0.0128*
At most one	0.328290	3.841466	0.5667	0.328290	3.841466	0.5667

** denotes the rejection of null hypothesis at 5 percent level of significance.*

The trace statistics of Johansen cointegration tests show that REMIT and IMPORT as well as REMIT and TD are cointegrated with one cointegrating equation, since we reject null of hypothesis of rank 0 and fail to reject null hypothesis of rank 1 at 5 percent level of significance for both relationships of the tested equations (Table 2 and 3). Maximum Eigenvalue tests for the cointegration also show the consistent results; concluding that there is a cointegrating relationship in both cases.

3.3 Statistical Output

We hypothesize that remittance increases import and trade deficit in the long run. Considering the assumption, the variable REMIT is put in the first while ordering for Vector Auto Regression (VAR) model. Using this order, the statistical output of estimated VECM with two lags are presented in Table 4.

Table 4: The Statistical Estimation of the Coefficients with REMIT and IMPORT

Estimated Equation	**Coefficients**	**Adj R^2 and F-Stat**
No. 3 (Cointegration)	$\varepsilon_t = IMPORT_{t-1} + 3935.684 - 1.341 REMIT_{t-1}$ (0.093)*	
No. 4 No. 5 (Error Correction)	$\Delta IMPORT_t = 398.581 - 0.343\hat{\varepsilon}_{t-1} - 0.321\Delta IMPORT_{t-1}$ (218)* (0.096)* (0.099)* $- 0.262\Delta IMPORT_{t-2} - 0.349\Delta REMIT_{t-1} + 0.026\Delta REMIT_{t-2}$ (0.091)* (0.156)* (0.145)	Adj R^2 = 0.32 F-Stat =11.65
	$\Delta REMIT_t = 264.032 + 0.075\hat{\varepsilon}_{t-1} - 0.159\Delta IMPORT_{t-1}$ (150)* (0.065) (0.068)* $- 0.051\Delta IMPORT_{t-2} - 0.314\Delta REMIT_{t-1} - 0.289\Delta REMIT_{t-2}$ (0.062) (0.107)* (0.099)*	Adj R^2= 0.21 F-Stat=6.87
LM Test for Autocorrelation	Lags LM-Stat p-value 1 1.047 0.903** 2 7.118 0.130**	

values in parenthesis are standard errors
**significant at 5% or lower level of significance*
***fail to reject null hypothesis at 1% level of significance*

The coefficients of cointegration equation of Table 4 show the long-rum relationship between the two variables. The parameter of the equation shows that one unit increase in

remittance increases merchandise import by 0.341 units in the long run. On the other hand, the coefficient of ECM; α_{IMPORT} is significant whilst α_{REMIT} is not. The insignificance of α_{REMIT} shows that the deviations from the long run relationship is affected only to IMPORT, not REMIT indicating REMIT a weakly exogenous variable. The weak exogeneity of the REMIT tells us that it does not experience the feedback effect in VECM. The deviation in REMIT in any given time will affect IMPORT by 0.343 in the next period and the effect of such deviation in IMPORT to the REMIT is almost zero.

We also estimate a model of REMIT and TD alike previous to confirm whether REMIT shows the similar result as of IMPORT with TD. The ECM of REMIT and TD also show the identical results with IMPORT. In the long run, the cointegration equation shows, one unit rise in REMIT causes TD to increase by 0.296 units. As aforementioned correlation to IMPORT, REMIT is weakly exogenous variable.

Table 5: The Statistical Estimation of the Coefficients with REMIT and TD

Estimated Equation	Coefficients	Adj R^2 and F-Stat
Cointegration	$\varepsilon_t = TD_{t-1} + 455.45 - 1.296 REMIT_{t-1}$ (0.104)*	
Error Correction	$\Delta TD_t = 395.019 - 0.262\hat{\varepsilon}_{t-1} - 0.310\Delta TD_{t-1}$ (192.104)* (0.081)* (0.094)* $-0.314\Delta TD_{t-2} - 0.333\Delta REMIT_{t-1} - 0.037\Delta REMIT_{t-2}$ (0.089)* (0.133)* (0.125) $\Delta REMIT_t = 269.07 + 0.09\hat{\varepsilon}_{t-1} - 0.193\Delta TD_{t-1}$ (149.13)* (0.063) (0.073)* $-0.045\Delta TD_{t-2} - 0.313\Delta REMIT_{t-1} - 0.293\Delta REMIT_{t-2}$ (0.0069) (0.103)* (0.097)*	Adj R^2 = 0.31 F-Stat =10.87 Adj R^2= 0.22 F-Stat=7.31
LM Test for Autocorrelation	Lags LM-Stat p-value 1 0.583 0.965** 2 3.40 0.493**	

values in parenthesis are standard errors
**significant at 5% or lower level of significance*
***fail to reject null hypothesis at 1% level of significance*

The decomposition of variance using Cholesky of VAR evinces the variations to the IMPORT as well as TD on account of the REMIT. The percent REMIT variance due to the IMPORT is very small whilst the percent IMPORT variance due to the REMIT is very large. The variance to the IMPORT begins from second month from 6 percent, which surges and becomes more than 40 percent within 9 months period. Likewise, the variance to the TD becomes more than 35 percent within the 10 months period. (Annex, Graph 5a, 5b).

The model diagnostics test of the residuals of VECM shows all inverse roots lie within the unit root circle indicating that ε_t is stationary with zero mean (Annex, Graph 3a, 3b). The cointegration graph also confirms that the model is stable since residuals always revert back to the origin in every diversion (Annex, Graph 4a, 4b). In addition, the correlation LM test shows no serial autocorrelation in residuals while incorporating two lags. The LM-Stats and p-values are given in Table 4 and 5.

IV. CONCLUSION

Notwithstanding the fact that remittance has been a substantial source of foreign currency income in Nepal, its pivotal role in development is determined how the recipient households use it. If the country is not self-reliant for the domestically produced goods, a large portion of its spending on consumption may soar up the import. This can lead to a sharp rise in trade deficit over the long run and country can entangle in a remittance-import trap. The paper develops the long-run and short-run relationship between remittance and import and also remittance and trade deficit nexuses by using cointegration technique. The error correction model (ECM) shows the positive relationship of remittance into the import and trade deficit in the long run. This implies that the remittance income seem to have spent mostly on imported goods either for daily consumption or luxury and durable items, which is accelerating import and ultimately inducing trade deficit to rise. Furthermore, the empirical evidence suggests that remittance does not have a direct impact on export.

The argument in remittance income is whether the money sent back home by the migrants is spent wisely and channelized into the productive sector of the economy in order to produce goods and services within the country. Most of the remittance comes from the workers of poor family in blue-colored jobs. Foreign income for them is a means of livelihood for bread and butter, repayment of loan and the rest for improving the quality of life. Hence, channeling remittance into the productive use is a challenging task. The utilization aspects of the remittance income should be emphasized through some policies and rational efforts.The productive use of it towards the entrepreneurship development, capital formation and some others with the emphasis to microfinance and cooperative initiatives may generate income, create employment opportunities at home and gradually substitute the import of agricultural as well as other products for daily sustenance in short run and may promote export in the long run. The household of migrant workers should be encouraged by offering some government incentives as well as bringing the awareness programs to promote saving, establish entrepreneurships and change the consumption patterns.

The study can be extended in many ways. It can be developed as a comprehensive model by including the relevant variables such as industry output, economic growth, exchange rate, price level, the level of income that directly affect imports and exports.

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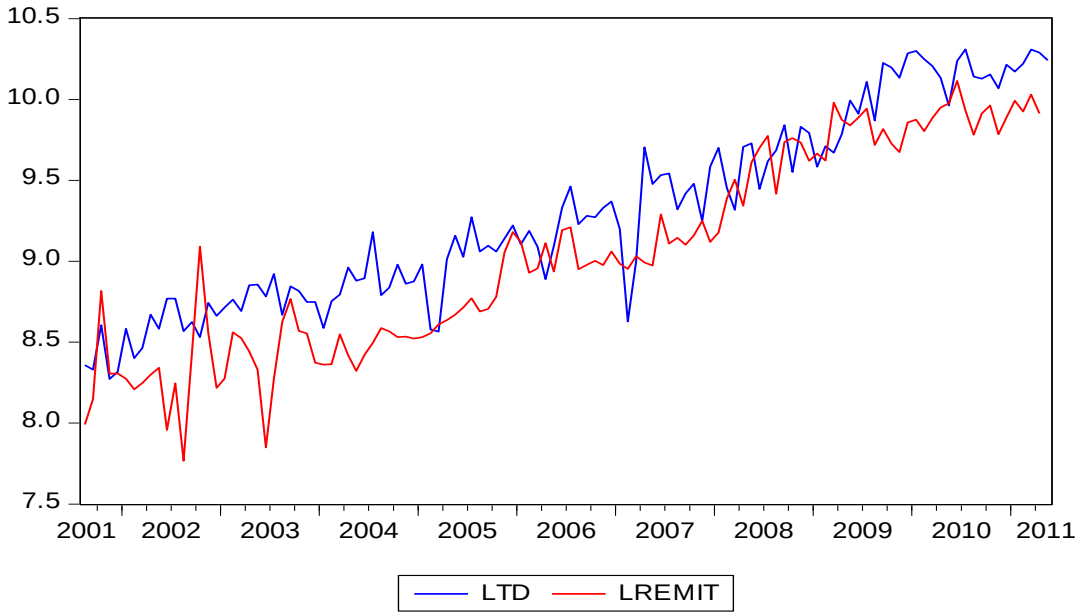
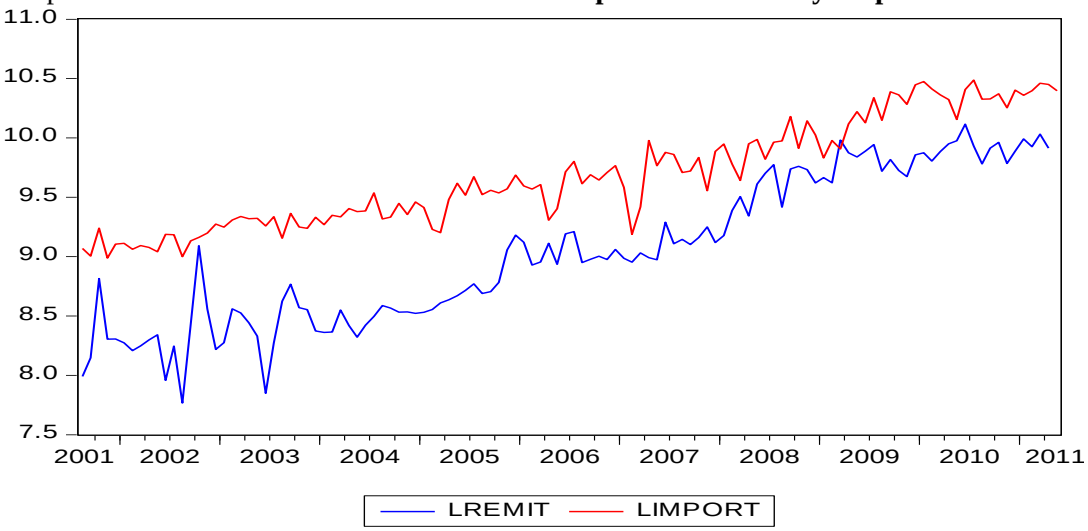
ANNEXES

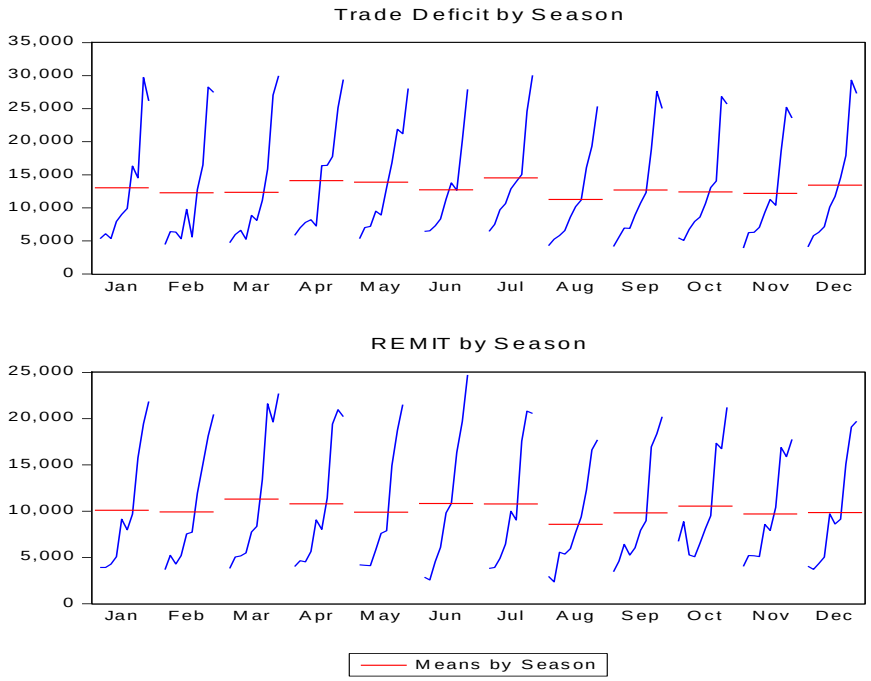
Graph 1a: **The movements of remittance and trade deficit over the ten year period**



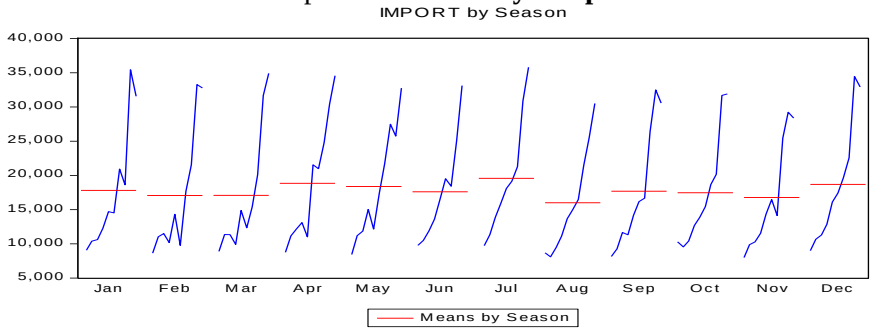
Graph 1b: **The movements of remittance and import over the ten year period**



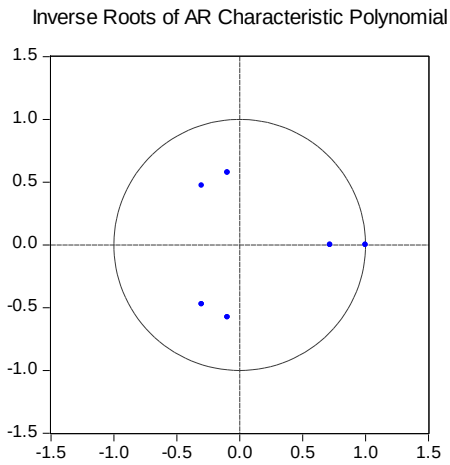
Graph 2a: **Seasonality Graph**



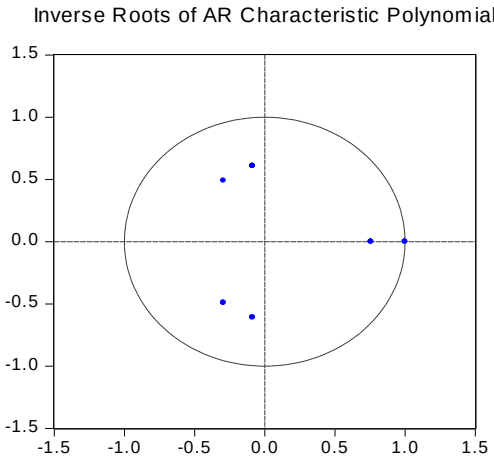
Graph 2b: **Seasonality Graph**



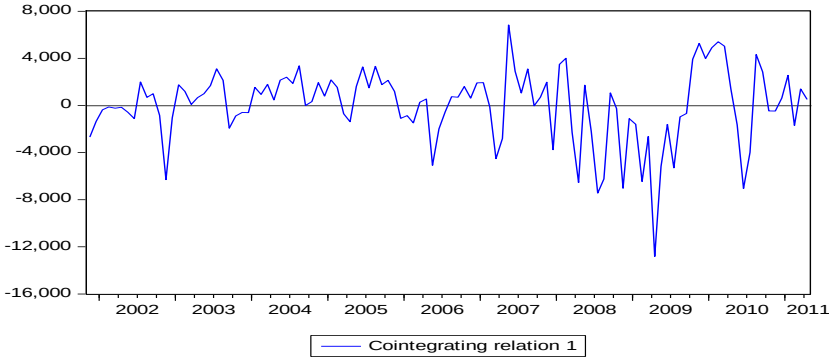
Graph 3a: **Inverse Root Test (REMIT, IMPORT)**



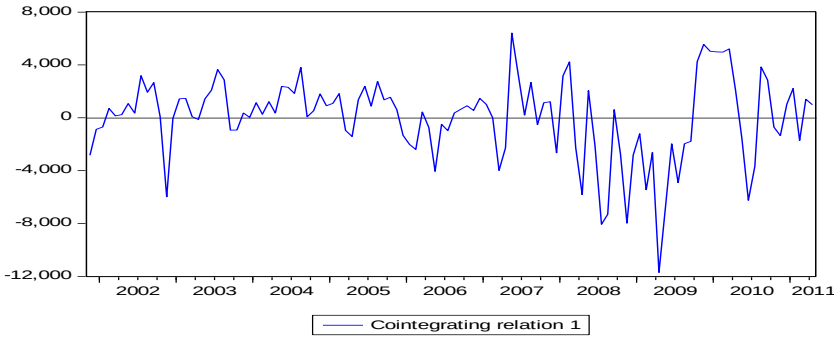
Graph 3b: **Inverse Root Test (REMIT, TD)**



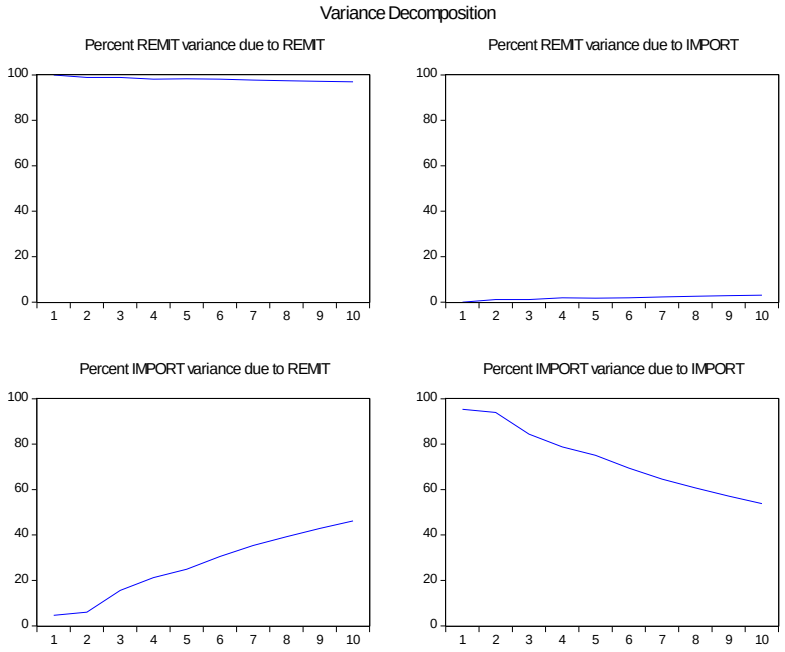
Graph 4a: **Cointegration Graph (REMIT, IMPORT)**



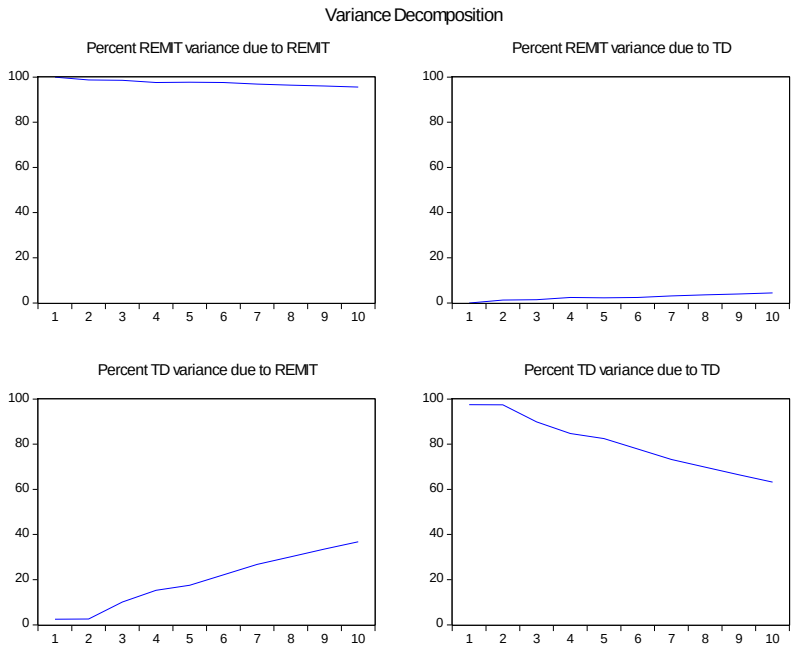
Graph 4b: **Cointegration Graph (REMIT, TD)**



Graph 5a: **Cholesky Decomposition of VAR (REMIT, IMPORT)**



Graph 5b: **Cholesky Decomposition of VAR (REMIT, TD)**



Do Budget Deficits Raise Interest Rates in Nepal?

Shoora B. Paudyal, Ph.D.*

Abstract

This paper examines short term and long term relationship between nominal interest rates and budget deficits for Nepal using the data for 1988 to 2011. Engle and Granger Error Correction Mechanism (ECM) is applied for the analysis. The regression results show that budget deficits and budget deficits- GDP ratio do not have significant effects on nominal interest rates in Nepal. So, budget deficits in Nepal are interest rates neutral. We come to the conclusion that budget deficits are not crowding out the private investment in this country. However, the deficits have been increasing the burden of loans financing current consumption at the expense of the future consumption, which will have serious implications on the growth of economy.

Key words: Budget deficits, interest rates, crowding out, Ricardian neutrality, Engle and Granger ECM
JEL Classification: E43, E62, H6

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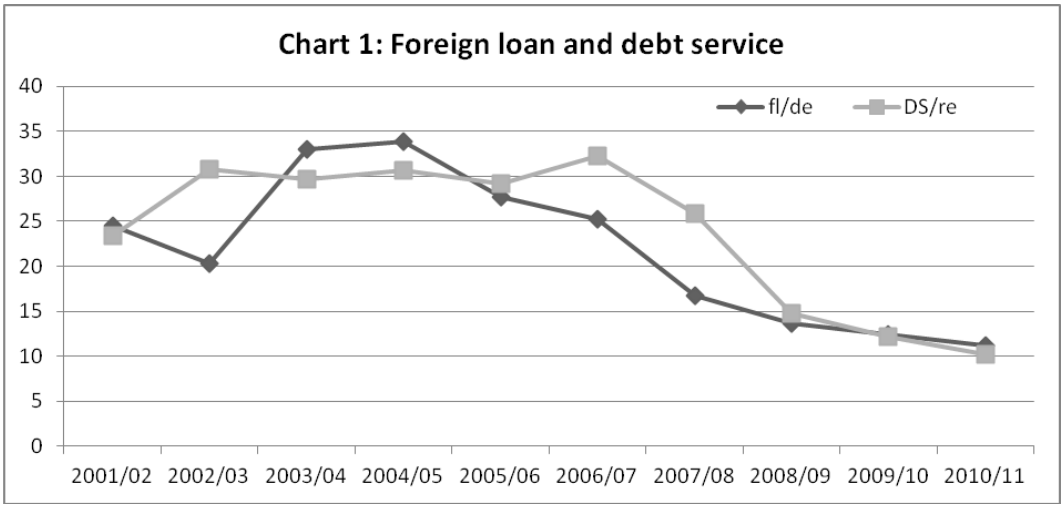
I. INTRODUCTION

Budget deficits have increased in Nepal over the years. By 2010/11, the amount of budget deficits has reached Rs 4962.22 million, accounting for 3.6% of GDP. This proportion accounted for 5.5% for 2000/01 and about 10% for 1988/89 (See, Table A1 in appendices). This clearly indicates that budget deficits have been very higher in the past which have declined over the years. Evidences from the other countries reveal that higher budget deficits have serious impacts on the economy as a whole. The effects of the budget deficits pass through interest rates to the major macroeconomic variables such as investment, employment, price level, consumption, exports and imports in an economy. So it is rational to examine the relationship between budget deficits and interest rates asking the question, do budget deficits raise interest rates in Nepal like in some other countries? Are deficits bad? Generally it has been considered in Nepal that budget deficits crowd out the private investment like in other countries; and it is the major contributor to the price hike. Since political instability prevails in the country for long and economic agendas have not yet received due attention, there are not much debates on it. But, it should be a serious policy concern since Nepal has entered into the market economy. If budget deficits raise the interest rates then one of the consequences is the crowding out of the private investment, which could have many forward consequences including the rise in unemployment rate. Moreover, it is necessary to look for the consequences of budget deficits on the other macroeconomic variables such as investment, consumption, and inflation. As deficits are financed by the foreign loans and internal loans, their immediate effects can be seen on the growth of public debt which, in turn, may produce long term effects including further rise in budget deficits due to debt serving and burden for the future generation. The growth of budget deficits and their sources of finance in Nepal are shown by chart 2 (see Appendices), which shows that the internal loans further exceed the foreign loans as budget deficits increase. It clearly indicates that the proportion of internal loans in budget deficits has increased in recent years. This can lead the economy to a situation of crowding out of the private investment. The growth of the budget deficits and interest rates in Nepal over the years is presented in charts 3 and 4 (see Appendices) disclose that budget deficits are on rise but interest rates and deficits-GDP ratio have declined over the years. Chart 1 also reveals that contribution of foreign loan (FL) to capital expenditure (CE) has interestingly gone down and so is the proportion of debt servicing (DS) to recurring expenditure (RE). The political instabilities may be one of the plausible reasons for this and is term as phenomenon.



Policymakers generally pay their attention on what effects these deficits are having on the economy because it has been long an important policy variable for economic growth and stability. For this reason, attention has been focused in many countries on whether or not budget deficits raise interest rates and affect other macroeconomic variables. But in this paper, we only examine the relationship between deficits and interest rates. Some claim (Aisen and Hausner, 2008; Obi and Naruddeen; Ezeabasili and Mojekwu, 2011; Laubach,2003, 2007; Kameda, 2008; Noula, 2012) that the deficits raise interest rates, while others advocate deficits are interest rates neutral (Ahmad, 1994; Mukhtar and Jakaria, 2008; Hassett, 2001; Chakarbarty, 2012). Various empirical results (Gale and Orszag, 2003[1]; Ussher, 1998; Labonte, 2005) also report that the results are overwhelmingly mixed and this is not a relevant question either.

Deficits are rather rules than exceptions in a developing economy like Nepal. It is also pertinent to know whether deficits are due to policy changes of the government for the economic growth or simply short of revenues over government spending due to the fall in tax revenues or the fall in foreign grants. This should be an important to know how deficits are affecting the important macroeconomic variables such as interest rates. The adjustment in an economy can occur through important policy variable like interest rates to restore at an equilibrium position in both financial market and goods market. For this reason, state's policy intervention mainly through the monetary and fiscal policies is generally considered desirable whenever an economy is at a disequilibrium level.

In short, generally higher budget deficits are responsible for higher interest rate and price level and thereby affect the economic growth and employment crowding out the private

[1] Gale and Orgszag are of view that deficits affect interest rates are less important and more controversial than the impact on national saving and economic growth. They find that other things remaining the equal, deficits reduce national savings and future national income.

sector investment. Furthermore, budget deficits can lead to trade deficits and affect consumption. However, we examine in this paper only the effects of budget deficits on interest rates dividing the paper into five sections: Section I is introduction. Section II discusses conceptual framework, section III analytical framework, while section IV interpretation of regression results. The last section V concludes the paper.

II. CONCEPTUAL FRAMEWORK

In the conventional Keynesian view, budget deficits expand aggregate demand, and thereby short-term economic growth. When private sector spending is slow, aggregate demand declines. This happens generally during recession. Keynesian believes that it can be offset by the higher government spending. Such higher government spending can exceed government revenues. If it exceeds revenue leads to the budget deficits. If a budget deficit is the result of higher government spending, then the additional government spending directly expands aggregate spending or aggregate demand in the economy. If a budget deficit is the result of tax cuts, then aggregate spending is due to an increase in spending by the beneficiaries of tax cut (Gale and Orszag, 2003). The increase in the budget deficit described here is due to policy changes, i.e. tax cut or increase in government spending. Besides, the deficits can occur due to the changes in economy, such as a fall in tax revenue. When per capita incomes fall due to bad performance of an economy taxable income also falls which causes tax revenues fall, and further creates imbalance between government revenues and government spending and the actual deficits would rise. Such deficits are not considered in this paper. In an economy at full employment, output cannot be increased to match the increase in spending because all of the economy's labor and capital resources are already in use. This mismatch between aggregate demand and aggregate supply must be resolved through market adjustment in a fully employed economy. Since all of the economy's resources are already in use, the government is supposed to redirect resources through the policy interventions. This is not possible without a reduction in the resources available to others. In an market economy, this reallocation occurred through higher prices and interest rates[2]. The higher interest rate, in turn, can crowd out the private investment and consumer durables. This is how it pushes price level up and thereby nominal interest rate and real interest rate. This can be explained with the help of famous macroeconomic identity that is written as follows:

$$S - I = Y - E = X - M$$

Where S and I are the national saving and investment respectively, Y and E national income and expenditure; and X and M exports and imports. Budget deficits

[2] This is because, an excess demand in goods market and financial market creates an upward pressure on the prices and interest rates. If higher prices and interest rates are offered, the resources can be available for new uses. So reallocation of resources from one use to another is possible only through the higher price and interest rates. Keynesian explanation for this is that when an economy is at full employment equilibrium, an increase in demand leads to upward shift in AD curve which results in higher price level without any increase in employment and national income.

(Revenue<Government spending) are the outcome of resource gap (S<I)[3] which leads to trade deficits (X<M). So budget deficits and trade deficits are interlinked, and this is more explicitly discussed by two gap model. Furthermore, above identity can be written as following to make this point more clear:

$$Sp + Sg - I = X - M$$

National savings (S), can be split into private savings (Sp) and government savings (Sg). Now we show how budget deficits can lead to trade deficits; and how important is the role of interest rates in this process. A rise in budget deficits, that is, a fall in government saving if not offset by private saving results either in a decrease in investment or in a rise in the external deficits to maintain equilibrium. Conventional views claim that such deficits are not offset by a rise in private saving but reflected in a rise in real interest rate and there by leads to lower aggregate national saving relative to investment demand (Krugman, 1992, 5). However, interest rates can be controlled by the monetary policy of central bank.

The conventional view (Ussher, 1998, Labonte, 2005) in regards to an economy with underemployed labor and capital resources is reverse. Budget deficit as a policy variable is generally the result of a recession or low economic growth. However, the financing of a budget deficit is no longer a zero-sum game in such economy. It is because the increase in aggregate spending caused by the deficits leads to unemployed resources being brought back into use. As a result, it generates new aggregate output to match the increase in aggregate demand or spending without having any inflationary pressure in the economy. This is how expansionary fiscal policy stimulates the economy during a recession. In an underemployed economy, enough unused resources are available to match the increase in aggregate spending entirely. The increase in the budget deficits would be multiplied because of re-employed workers increase their spending as well. So, the total increase in aggregate spending is larger than the increase in the budget deficits. In this case, the budget deficits would be unlikely to have much effect on interest rates like in the developed economies at full employment level.

Capital mobility view (Obstfeld, 1985; Labonte, 2005) offers a different explanation of the relationship between budget deficit and interest rate. Whether budget deficits raise interest rates or not depends largely on where the resources come from for financing such deficits. If such deficit is financed by the domestic resources then that may lead to higher interest rate. But if the resources do come from the other than domestic sector such as

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[3] When planned national resources in government hand are less than the government's planned spending then we call it budget deficits. For this reason, both budget deficits and real sector's gap refer to the same thing. Here planned government spending rises due to the government policy interventions.

foreign sector that does not involve higher interest rates. According to the capital mobility view, because of an inflow of the foreign loans and grants to finance deficits do not affect the interest rates but they crowd out trade sector through rise in price level.

In the Barro-Ricardo view (Labonte, 2005), forward-looking, rational, infinitely-lived individuals see that a budget deficit would result in higher taxes or lower government spending in the future. Therefore, they reduce their consumption and save more today. This is consistent with Milton Friedman's life cycle permanent–income theory which suggests individuals save in the fat years and dis-save in lean years as a logic of all wealth-holding (Cameron, 1991:118). This provides the government with the saving needed to finance its deficit, placing no upward pressure on interest rates; however, they crowd out current private consumption.

From the above discussion, there is apparently less chance of budget deficits raise the interest rates in an economy with huge unemployed resources, where inflow of foreign aid finances the government spending.

III. ANALYTICAL FRAMEWORK

There are several models which can be applied to examine the relationship between budget deficits and interest rates. One of the popular ones mostly used is error correction models. Error correction models are based on the behavioral assumption that two or more time series exhibit an equilibrium relationship. We in economics would like to examine the equilibrium relationship between two or more variables in short or in long run. One of the good merits of these models is that one can examine the short run as well as long run equilibrium. This method was first used by Sargon (1984; Cited in Gujarati, 2007) and later popularized by Engle and Granger (Cited in Gujarati, 2007) for the correction of disequilibrium between two economic variables and is popularly known as Engle and Granger Error Correction Mechanism (Gujarati, 2007; Pindyck and Rubinfeld, 1991). Accordingly, if two variables are co-integrated, the relationship between those two can be expressed as error correction mechanism. This mechanism not only evaluates the state of equilibrium between dependent and independent variables but also directly estimates the speed at which a dependent variable returns to equilibrium level after a change in an independent variable. The ECM (Engle and Granger Error Correction Mechanism), thus, gives a number of desirable properties which are as follows: a) it estimates of short and long term effects; b) it provides easy interpretation of short and long term effects; c) applications to both integrated and stationary time series data; d) can be estimated with OLS; and e) model the theoretical relationships between variables (unlike VAR model). Now we discuss here two steps ECMs for the analysis of time series data, which is as follows:

In the first step, a dependent variable, Y is regressed on an independent variable, X. As the regression of a non-stationary time series on another non-stationary times may produce a spurious regression results, it is necessary to examine whether Y and X series are individually stationary. Dickey-Fuller or Augmented Dickey-Fuller test are generally

used to see whether such time series are individually stationary. The time series with unit root is stationary at first difference, I (1). For instance, Y is regressed on X as follows:

$$Yt = a_t + bX_t + e_t \quad \ldots\ldots\ldots (1)$$

If Xt and Yt are co-integrated, then they have long term or equilibrium relationship. If the computed value of error term in equation (1) is found to be stationary at level, then two time series (Xt and Yt) are said to be co-integrated. In the second step, the first difference of dependent variable, ΔY_t is regressed on the first difference of independent variable, ΔX_t , and previous period's equilibrium error, that is, the computed error term from co-integrating regression, $\gamma\mu\hat{}_{t-1}$.

$$\Delta Y_t = \lambda_1 + \lambda_2 \Delta X_t - \gamma\mu\hat{}_{t-1} + \eta_t \quad \ldots\ldots\ldots (2)$$

Equation (2) reveals that ΔY_t depends on ΔX_t and on the one period lagged of computed error term from co-integrating regression, that is, $\gamma\mu\hat{}_{t-1.}$ The coefficient of the error correction component in the model, γ, measures the speed at which prior deviations from the equilibrium (or disequilibrium) are corrected while λ_2 shows the short run effect of X on Y. Our residual from the co-integrating regression should capture the deviations from the equilibrium of X and Y. Therefore, we can estimate both the short and long term effects of X on Y by including the lagged residuals from the co-integrating regression as our measure of the error correction mechanism.

IV. INTERPRETATION OF REGRESSION RESULTS

We already discuss the analytical framework for the study in the previous section. Under this framework, in this section, time series annual data of average budget deficits and interest rates for Nepal are analyzed, i.e., the ECMs have been applied. Noula (2012) uses this model to analyze the annual data of budget deficits and interest rates for Cameroon. While Mukhtar and Jakaria (2008) apply this framework for the analysis of budget deficits' effect on interest rate using annual data. The dependent variable in their study was interest rates and independent variable- budget deficits. In this study also average lending interest rate (AVR) [4] is dependent variable and budget deficit (BD) is used as an independent variable. Besides, Budget deficits/GDP ratio (BD_GDP) is also regressed on average interest rate. The data are drawn from the various issues of Economic Survey of Nepal Government and from the publications of Nepal Rastra Bank. We use the Engle–Granger two-step method to investigate the relationship between budget deficits and interest rates during 1988-2011. The results from the regression are as follows:

[4] Interest rates are the average annual lending rates of commercial banks (in industry, agriculture, export bills, commercial loans and overdrafts) drawn from various issues of NRB Quarterly economic bulletin.

Table 1: Augmented Dickey-Fuller tests at the level and at the first difference of the variables

	Level	First Difference	1%	5%	10%	Order of Integration
AVR	-0.946	-3.844***	-3.753	-2.998	-2.638	I(1)
BD	2.812	-2.841*	-3.753	-2.998	-2.638	I(1)
BD_GDP	-1.397	- 8.391***	-3.753	-2.998	-2.638	I(1)

****, ** & * significance at 1%, 5% and 10% level*

Table 1 displays that the results of Augmented Dickey-Fuller tests (1979, 1981). Accordingly, AVR, BD and BD_GDP ratio series are found non-stationary at level but stationary at first difference. So, in the second step, the interest rates (AVR) have been regressed on the budget deficits (BD) and on the budget deficits/GDP separately. These regressions examine the long term relationship between interest rates and budget deficits. These regressions are known as co-integrating regression (table 2). So the time series of aforementioned variables are found stationary at first difference. This has paved the road to go for the co-integration regressions displayed in table 2.

Table 2: Dependent variable: interest rate (AVR)

Variables	Coefficient	t-stat	DW-stat	Adj R^2	N=23
C	-10.604	-0.108	1.696	0.88	
BD	7.13E-05	1.227			
AR(1)	0.98	14.278***			
C	10.060	2.246**	1.688	0.88	N=23
BD_GDP ratio	0.065	0.338			
AR(1)	0.926	12.042***			

****, ** & * significance at 1%, 5% and 10% level*

Table 2 presents the two regression results from the autoregressive models, which show that the effects of previous year interest rates on the current year interests are higher but the effects of budget deficits and budget deficits/GDP ratio on current interest rates are lower. Statistically speaking, the effects of BD and BD_GDP ratio on interest rates are insignificant. But in both regressions, these variables have expected positive sign. But the historical data on AVR shows the downward trend and BD upward trend (see chart 2). It seems there is an inverse relationship between these two variables. It implies that budget deficits can cause the interest rates to fall. The market determined interest rates have been introduced in late 1980s cause interest rates in Nepal to fall. So, other things have not been equal during the study period. But the empirical study shows that the coefficients of BD and BD_GDP variables appear with correct sign indicates that there is positive relationship between two and budget deficits can raise interest rates. The poor regression results suggest that relationship between two variables is not so strong in case of Nepal. Statistically speaking, the relationship between two is not different from zero, which implies that interest rates are budget deficits neutral in the long run.

Table 3 Augmented Dickey-Fuller test at level of the computed residuals

Residuals	Level	1%	5%	10%	Order of Integration
Resid01 (AVR on BD)	-4.539***	-3.788	-3.012	-2.646	I(0)
Resid02(AVR on BD_GDP)	-3.989***	-3.788	-3.012	-2.6461	I(0)

****, ** & * significance at 1%, 5% and 10% level*

Table 3 presents the results of Augmented Dickey-Fuller test at level of the computed residuals from the co-integrating regressions given in table 2. The residual series of both regressions are found to be highly significant in Augmented D_F tests at level. It reinforces that both budget deficits and budget deficits/GDP ratio regressions are co-integrating functions implying that there exists long term relationship between interest rates and budget deficits; and between interest rates and BD_GDP.

Table 4: Dependent variable: first difference of rate of interest (D (AVR))

Variables	Coefficient	t-stat	DW-stat	Adj R^2	F-stat	N=22
C	-0.414	-1.741*	1.814	0.02	1.253 (0.308)	
D(BD)	7.66E-05	1.427				
Lag_resid01	0.128	0.556				
C	-0.235	-1.002	1.816	-0.09	0.126 (0.883)	N=22
D(BD_ GDP ratio)	0.070	0.266				
Lag_resid02	1.412	0.409				

****, ** & * significance at 1%, 5% and 10% level*

Table 4 presents the regression results from the two step error correct models. The short term effects of the budget deficits on interest are positive but it is statistically insignificant. The regression results state that interest rates depend on budget deficits and previous period's equilibrium error term. And also interest rates depend on budget deficits/GDP ratio and previous period's equilibrium error term. If the lag of error term is non-zero, then it is the indication that model is out of equilibrium (Gujarati, 2007). However, in our case statistically speaking, the equilibrium error term, that is, one year lag of resid01, is zero. This suggests that AVR will adjust to the changes in BD within the year bringing back the former to its equilibrium level. The positive sign of equilibrium error term (lag_resid01) reveals that AVR is below its equilibrium value and the positive sign of equilibrium error term will push that of the interest rate (AVR) up to its equilibrium value. The coefficient of error term also suggests that equilibrium will be restored quickly. The case with another regression is not different from this regression since coefficient of lag of estimated residual (lag_resid02) is statistically not different from zero. Compared to this with the budget deficit regression, the higher coefficient of estimated residual (lag_resid02) suggests that the equilibrium value of the AVR will be restored more quickly in the case of budget deficits/GDP ratio.

Table 5: Granger causality test

Variables/Lags	1	2	3	4	5
Granger causality test between BD and AVR					
BD does not Granger cause AVR	0.147 (0.705)	0.334 (0.721)	0.433 (0.732)	0.167 (0.951)	0.301 (0.899)
AVR does not Granger cause BD	0.045 (0.834)	0.163 (0.851)	0.145 (0.931)	0.346 (0.842)	0.27740 (0.913)
Granger causality test between BD/GDP and AVR					
BD_ GDP ratio does not Granger cause AVR	3.164 (0.090)	1.942 (0.174)	1.105 (0.379)	0.72561 (0.593)	1.15280 (0.408)
AVR does not Granger cause BD_ GDP ratio	3.871* (0.063)	0.629 (0.545)	1.683 (0.216)	1.387 (0.301)	1.10459 (0.428)

****, ** & * significance at 1%, 5% and 10% level*

Table 5 shows the results of Granger Causality tests. Granger causality tests are useful to find out the direction of effects between two variables. The results are not statistically significant even at 5% level suggest that both BD and BD/GDP ratio do not cause interest rates (AVR) at any lag length. However, the figure on last row in second column in table 5 (significant at 10% level) suggests that, in future, average interest rates can raise the budget deficits, not other way around. These results are consistent with the regression results display in table 4 that indicate that budget deficits do not affect the interest rates significantly in both short term and long term. This study, thus suggests that the budget deficits do not affect nominal interest rates in Nepal, that is, budget deficits are interest rates neutral. However, there exists rather weak relationship between two set of variables.

V. CONCLUSIONS

This empirical study suggests that the budget deficits do not affect nominal interest rates in Nepal, i.e., interest rates are deficits neutral. So budget deficits do not crowd out private investment through the rise in interest rates. This is substantiated by Chart 5, which reveals that private investment and budget deficits follow the upward trend. This is in line with economic theories discussed above where unused resources are waiting for their use in a developing country and with the previous study for Nepal (Pandit, 2005). However, because of private consumption has not declined with the increase in deficits (see Chart 5 appendices), and saving has fallen (Chart 6) it is hard to conclude that Barrow-Ricardian neutrality does hold in case of Nepal. The results seem to support the capital mobility view as discussed above. Because, the deficits have been financed largely by foreign aid in the one hand, and on the other, aggregate consumption has surged over the years because of the inflow of aid money and remittances. Moreover, as interest rates are found deficits neutral largely due to capital mobility, further study on other factors affecting the interest rates is warranted.

The empirical evidence that budget deficits do not raise interest rates, however, is not the evidence that government budget deficits do not impose any burden in the society. The deficit financing through the foreign loans has created intergenerational burden in terms of debt servicing in Nepal. Current consumption has increased at the costs of future consumption since the amount of net outstanding loans has piled up demanding regularly a huge amount for debt servicing. This drains-out the real resources which could be used for the development (see Thapa 2005). This is also evidenced from the share of debt servicing in the government regular expenditure (see table A2 in appendices). Furthermore, an increasing use of internal loans compare to foreign loans in deficit financing (table A2 in appendices) may be indicative that budget deficits will crowd out the private investment. However it may be only a short term phenomenon dictated by political instabilities in the country.

However, foreign aid in terms of grants and loans is not free lunch. Foreign grants may impose many undesirable terms and conditions while foreign loans are the burden for the future generations. Besides, they crowd out the trade sector of the economy.

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APPENDICES

Table A1: Average interest rate, budget deficits and budget deficits/GDP ratio

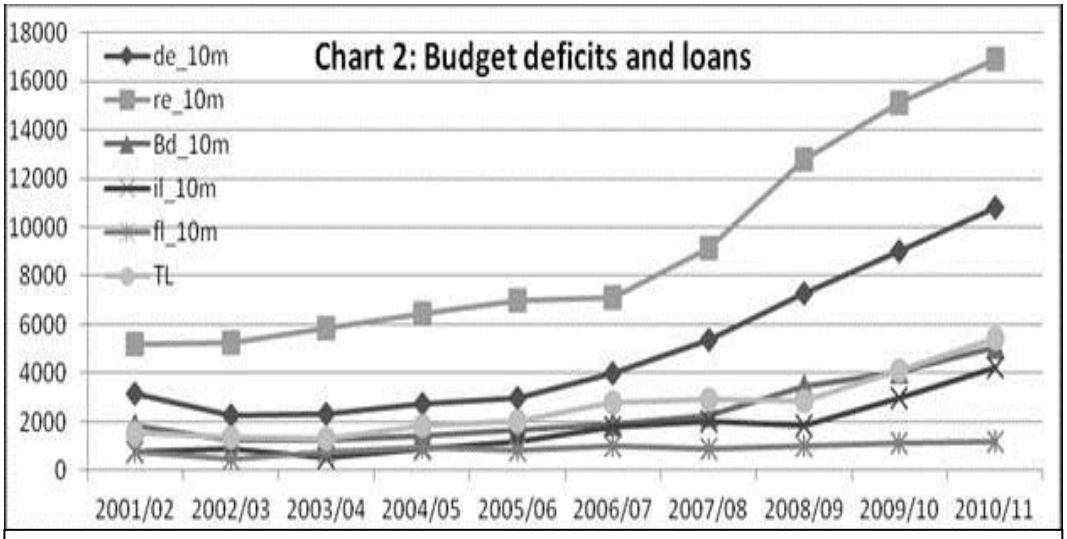
Year	Avr	bd	bd/gdp	Year	Avr	Bd	bd/gdp
1987/88	16.88	2320.7	6.1	1999/00	12.80	10908.0	4.7
1988/89	16.63	5199.9	9.6	2000/01	11.95	15921.2	5.5
1989/90	16.88	4563.5	8.1	2001/02	11.70	18339.0	5.0
1990/91	17.25	3192.7	8.9	2002/03	11.45	12577.0	3.3
1991/92	18.38	4983.4	7.5	2003/04	11.05	12662.8	2.9
1992/93	17.88	8773.3	7.0	2004/05	10.23	14295.4	3.1
1993/94	14.44	5401.3	5.8	2005/06	10.35	16427.8	3.8
1994/95	14.94	5644.1	4.8	2006/07	10.30	18762.8	4.1
1995/96	16.05	8810.7	5.6	2007/08	10.00	22475.8	4.1
1996/97	16.15	7252.5	5.1	2008/09	10.25	34356.1	5.0
1997/98	15.50	11262.4	5.9	2009/10	11.30	40731.8	3.5
1998/99	13.70	8996.4	5.3	2010/11	11.05	50506.3	3.6

Source: Calculated by author from MoF/GoN, Economic Survey, various issues and NRB, Quarterly Economic Bulletin, 2012.

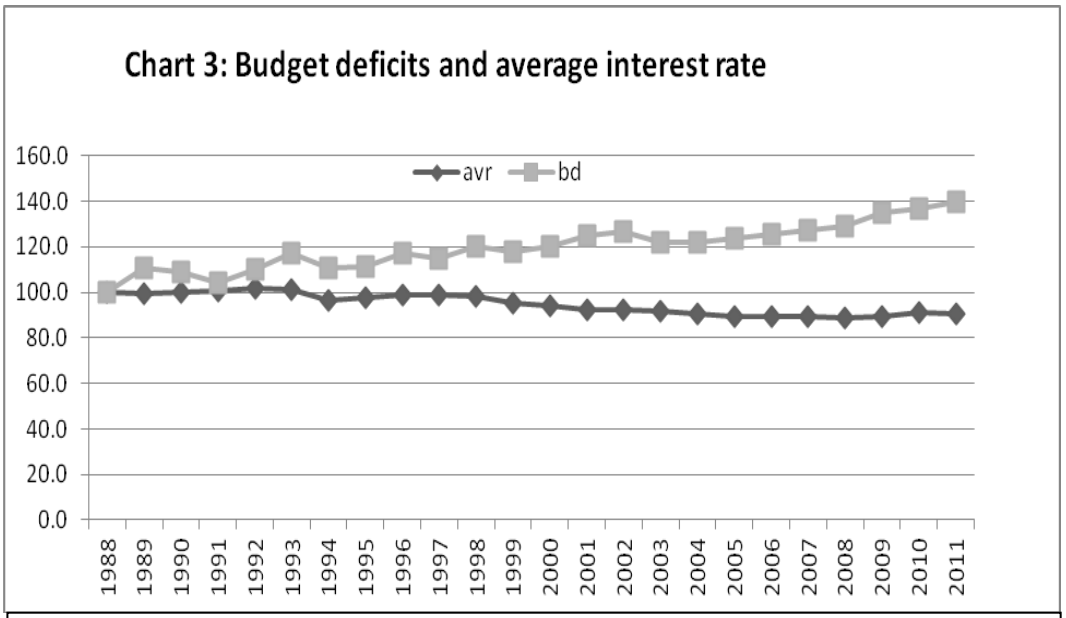
Table A2: Share of foreign loan in capital expenditure and that of debt servicing in recurring expenditure

Year	Capital exp10m (CE)	Recurring exp10m (RE)	Budget deficits	Foreign loans	FL/CE	Internal loan (FL)	Debt servicing (DS)	DS/ RE	NOD10m
2001/02	3148.2	5211.5	18339.0	769.9	24.5	800.0	1220.5	23.4	22012.6
2002/03	2235.6	5248.8	12577.0	454.6	20.3	888.8	1618.1	30.8	22343.3
2003/04	2309.6	5832.4	12662.8	762.9	33.0	560.8	1733.9	29.7	23277.9
2004/05	2734.1	6427.2	14295.4	926.6	33.9	893.8	1975.1	30.7	21964.2
2005/06	2960.7	7000.4	16427.8	821.4	27.7	1183.4	2042.4	29.2	23396.9
2006/07	3973.0	7112.2	18762.8	1005.4	25.3	1789.2	2291.6	32.2	21662.9
2007/08	5351.6	9144.7	22475.8	898.0	16.8	2049.6	2370.5	25.9	24996.5
2008/09	7308.9	12773.9	34356.1	996.9	13.6	1841.7	1883.4	14.7	27704.0
2009/10	9023.8	15101.9	40731.8	1122.3	12.4	2991.4	1843.2	12.2	25624.3
2010/11	10815.3	16882.4	50506.3	1207.6	11.2	4251.6	1722.1	10.2	25955.2

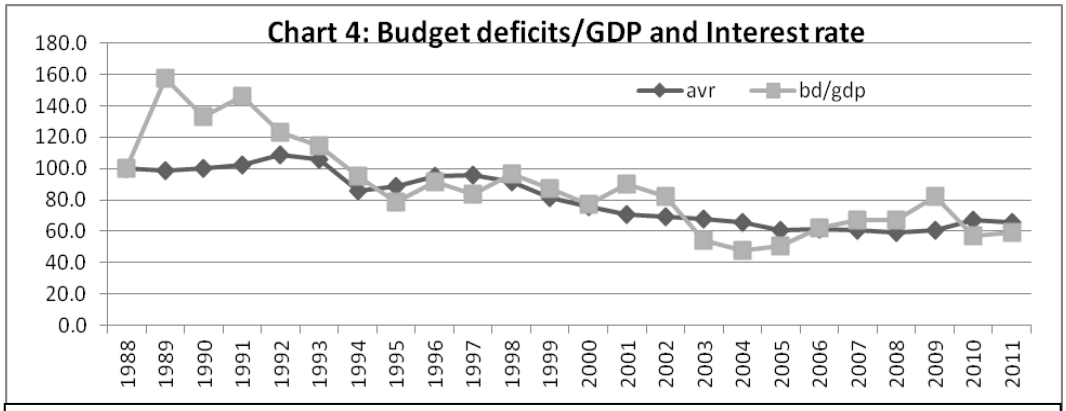
Source: Calculated by author from MoF/GoN, Economic Survey various issues, and NRB Quarterly Economic Bulletin. Notes: 2008/09 onward only principal repayment data are incorporated in debt servicing. NOD10m=net outstanding debts in 10 million Rs.



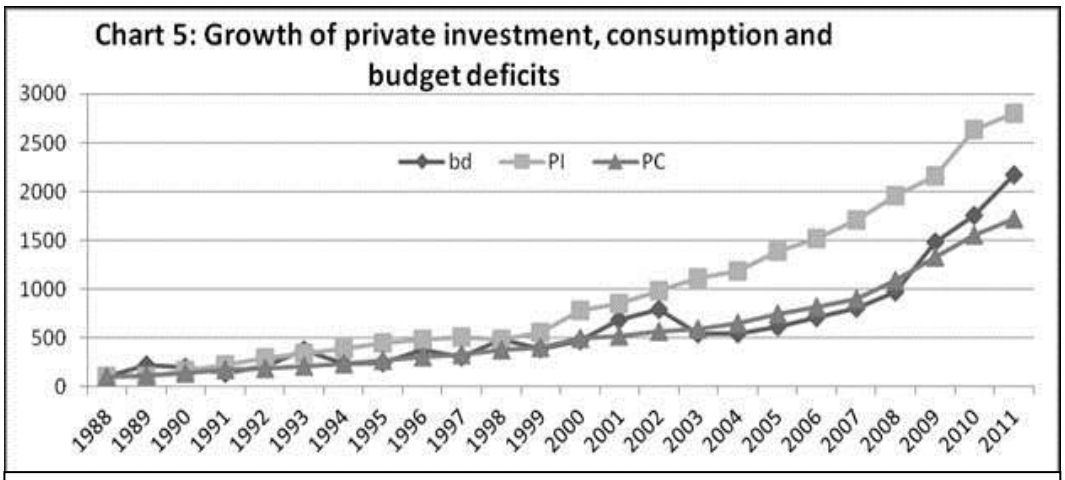
Notes: de_10m=development expenditure at 10 million, re=recurring expenditure, bd=budget deficits, il= internal loans, fl=foreign loan and TL= total loans



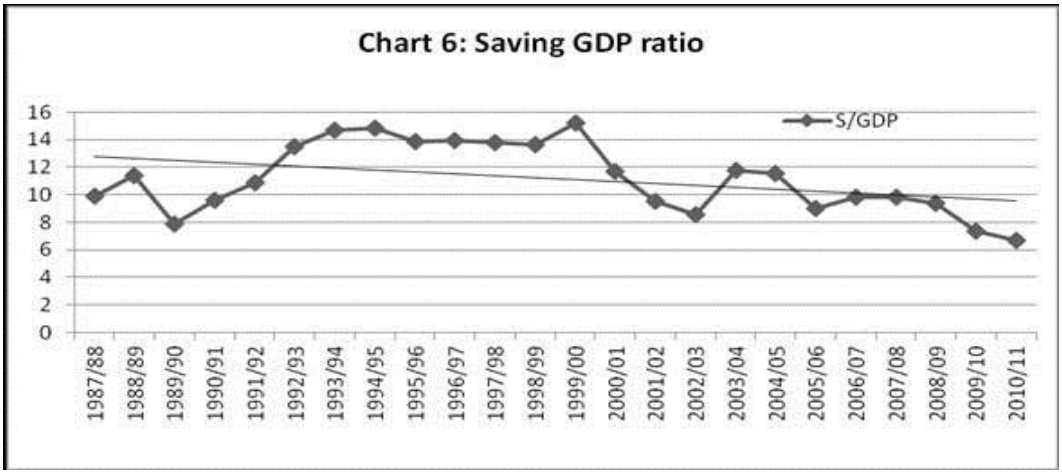
Notes: Indices of bd=log of budget deficits, avr=log of interest rates.



Notes: Indices of bd=budget deficits, avr=interest rates.



Notes: PI=private investment, PC=private consumption and bd=budget deficits



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