The Economic Journal of Nepal, Vol. 38, No. 3 & 4, July-December 2014 (Issue NO. 144) © CEDECON-TU

Causal Relationship between Government Revenue and Spending in Nepal

Hem Raj Lamichhane[1]

Abstract

The revenue income and expenditure of the government of Nepal is reviewed and analyzed. Service and function wise current expenditure and capital expenditure and tax and non-tax revenue is focused for the study. The major sources of revenue of government of Nepal are tax on income, profits and capital gain, taxes on payroll and workforce, tax on property, tax on goods and services, tax on international trade and transaction and non-tax revenues are collected from property income, sale of goods and services, penalties, fines and forfeiture etc. The main objective of the study is to examine the causal relationship between government revenue and spending/expenditure of government of Nepal. Augmented Dickey-Fuller test (ADF testing) is applied to examine the unit root test. Granger Causality Tests (VAR approaches) is used to see the causality of the variables. The model is not suffering from serial correlation in residual. It does not have heteroskedasticity and residuals are normally distributed. The study found that the variables are co-integrated and have long run association among all three variables i.e. total expenditure, tax revenue and non-tax revenue. Therefore the restricted VAR that is Vector Error Correction Model (VECM) is run. It is also found that there is long run causality from tax and non-tax revenue to total expenditure. The total expenditure lag 1 and lag 2 can jointly cause non-tax revenue meaning that total expenditure can affect the non-tax revenue.

Key words: Public Revenue Income, Expenditure, Granger Causality, Co-integration, Augmented Dickey-Fuller Test.

Introduction

Public expenditure does have important role in functioning of the economy. In order to study the component of government expenditure, Musgrave (1966) divided total public expenditure into defense and civilian expenditure. The civilian expenditures are further classified into public capital formation such as transportation, irrigation etc. and public consumption such as education, health, safety etc., and transfer. The public capital formation is an important aspect at the early stage of development because benefits of such investment are largely external. The demographic factors and the size of population are an important determinant of the level of expenditure and share of public expenditure. The demand for transfer expenditure increases with the growing sense of social responsibility for the welfare of individuals. Therefore, both economic and non-economic factors must be considered while making public expenditure in the name of citizen. There is a significant impact of

1 Mr. Lamichhane is a PhD scholar at Tribhuvan University, Nepal.

government budget deficit on national economy. The fiscal imbalance plays critical role to reduce national savings and tends to shrink economic growth. Therefore, the result of the decreasing of fiscal deficit by reducing government expenditures and/or raising tax and not tax revenues leads to encourage and inspire economic growth in the country. Determination of the interdependence relationship between government revenue and expenditure (two major macroeconomic variables) would help policy makers to identify the source of any fiscal imbalances that might exist. As a result, this would facilitate efforts to develop a appropriate policy and approach for fiscal reforms. Thus, the analyzing of relationship between government expenditure and government revenue does have special interest. However, there is empirically debatable issue in the field of public finance about the causal relationship between government revenue and expenditure (Eita & Mbazima, 2008).

Literature Review

Theoretical Perspective

There are four main hypotheses that help to illustrate the relationship between public revenues and spending. The first one is the tax-and-spend hypothesis (Friedman, 1978), which stresses that raising taxes will lead to more government spending. Similarly, Buchanan and Wagner (1977) state that when government spending is financed by other means than direct taxation, the ultimate outcome is higher budget deficits due to the fiscal illusion resulting from the incorrectly low perception of the price of government spending that is followed by increased demand for public goods and services. A cut in tax leads to higher deficits, which should influence government to reduce its level of spending or increase budget deficits. In other word, higher budget deficits will occurs when tax revenue will decline and government spending will increase. So the solution of budget deficit is to increase in taxes (Moalusi, 2004). The tax leads government expenditure but that the direction of causal relationship is negative (Buchanan and Eagner, 1978).

The second hypothesis is known as the spend-and-tax hypothesis which was originated by Peacock and Wiseman (1979). According to them, the temporary increases in government spending as a result of economic and political crises lead to permanent increases in government revenues. This hypothesis is consistent with Barro’s (1974) view that today’s deficit-financed spending means increased tax liabilities in the future. The third hypothesis proposed by Musgrave (1966) and Meltzer and Richard (1981), is called the fiscal synchronization hypothesis. According to this hypothesis, governments may change expenditure and taxes concurrently. It means that there is bidirectional causality between government expenditure and revenue. This hypothesis believes that today’s deficit finances government's expenditure results future tax increase (Narayan, 2005). The fourth one is the institutional separation hypothesis which is also called ***fiscal neutrality school,*** introduced by Baghestani and McNown (1994), in which government revenues and spending are argued to be independent from each other due to the independent functions of the executive and legislative branches of the government.

More specifically, the problem of budget deficits can be avoided by implementing policies that stimulate government revenue if the “revenue-and-spend” hypothesis holds. Subsequently, if bi-directional causality does not hold, then government revenue decisions are made independently from government expenditure decisions. Third, if the “spend-revenue” hypothesis exists, then government spends first and pay for this spending later by raising revenues (P.K. Narayan and S. Narayan, 2006).

Empirical Perspective

The different literatures suggest that there is still debate about the direction of causal relationship between government revenue and expenditure. It is because there are numerous empirical studies on revenue and expenditure nexus all over the world; however, there is no consensus about the linkage between these variables. The findings seem to be varied from country to country and also within the country. Some of the empirical studies with regards to the relationship between government revenue and expenditure are reviewed. A study found that there was a co-integration relationship between government revenue and expenditure. There is also bidirectional causal relationship between government revenue and expenditure in both long and short run so the synchronization hypothesis is confirmed in 40 Asian Countries during the period of 1995-2008 (Mehrara and Pahlavani Yousef Elyasi (2011). This outcome is same as Musgrave (1966) and Meltzer and Richard (19981). Using the time series data for the period of 1978 to 2011 of Iran applying Toda-Yamamoto Granger causality test, Mehrara and Rezaei (2014) found unidirectional causality running from government revenue and expenditure. The unit root test found the variables to be integrated on order one and the results of the study support the Freidman (1978) and Buchanan and Wegner (1977) hypothesis that government revenues cause government expenditure.

A study for Latin American countries carried out by Shah and Baffes (1994) found bidirectional causality between government revenue and expenditure for Argentina over the 1913-1984, and for Mexico over the period of 1895-1984. However, for Brazil, they concluded unidirectional causality running from revenue to expenditure. Owoye (1995) found bidirectional causality for five of the 7G countries but there was causality running from revenue to expenditure for Japan and Italy. Roshaiza and Loganthan (2008) carried out a study of tax revenue and government spending in Malaysia for the past 36 years by applying and econometrics model. They found that there is existence of a long run relationship between tax revenues and government spending wit unidirectional and bidirectional causality in VAR models for the sample period 1970-2006.

The case of Korea was studied and found the supportive evidence for the tax-spend hypothesis (Park, 1998). A study for the period of 1977-2007 in Namibia was carried out by applying Granger Causality test through co-integrated vector auto-regression (VAR). This study suggests the unidirectional causality from government revenue to government expenditure. This finding indicates the unsustainable fiscal imbalance (deficit) can be mitigated by policies that stimulate government revenue (Eita & Mbazima, 2008). AbuAI-Foul and Baghestani (2004) examined the causal relation between government revenue and spending for Egypt for the period from 1977 to 1998 and Jordan for the period from 1975 to 2001. The empirical findings of Egypt suggest unidirectional causation from revenue to spending with higher revenue leading to higher spending. However, the findings of Jordan suggest bidirectional causation between revenue and spending.

Sources of Revenue Income of Government of Nepal

The revenue and foreign grants are the major sources government income that is 84.9 percent and 14.2 percent respectively in 2011/12. The share of both sources was 88.6 percent and 10.5 percent respectively in 2012/13. Of the government's income sources, tax revenue has annual growth rate of 22.3 percent between 2009/10 and 2012/13 on an average. The contribution of tax revenue is 87.6 percent whereas the share of non-tax revenue is only 12.4 percent in 2012/13 (MOF, 2014). The detail sources of tax and non-tax revenue income of Government of Nepal is described in table 1.

Table 1: Sources of Revenue Income of Government of Nepal

Sources of tax revenue	Sources of non-tax revenue
▪ Tax on income, profits and capital gain (payable by individual and sole traders, Payable by enterprises and corporations, Taxes on investment and other income ▪ Taxes on payroll and works force (social security taxes on payroll) ▪ Tax on property (recurrent taxes on immovable property, taxes on financial and capita transactions) ▪ Taxes on Good and Services (VAT, excise, taxes on special services, taxes on use of goods and on permission to use goods) ▪ Taxes on international trade and transaction (customs and other import duties, taxes on exports, other taxes on international trade and transaction) ▪ Other taxes (registration fees, ownership certificate)	▪ Property income (Interest, Dividends, Rent and Royalty) ▪ Sale of goods and services (Sale of goods, Administrative fees) ▪ Penalties, fines and forfeiture (penalties, fines and forfeiture, voluntary transfers other than grants, voluntary transfers other than grants, miscellaneous revenue ▪ Administrative fee-immigration and tourism, others revenue, capital revenue).

Note: Government of Nepal has started to record its revenue and expenses using Government Financial Statistic (GFS) 2001 since the fiscal year 2011/12. The data of previous fiscal years may therefore differ.
Source: Economic Survey 2013/14, Ministry of Finance, Government of Nepal, 2014.

Expenditure of Government of Nepal

The functional and service description of current and capital expenditure is presented in Table 2. The government income had covered 84.9 percent of total expenditure in 2011/12 while such coverage recorded for 93.1 percent in 2012/13. Of the total capital expenditure, economic affairs hold about 66.5 per cent whereas housing and community amenities cover 13 percent in 2012/13. Moreover, the education holds only 0.3 percent and social security 0.4 percent. The highest share of recurrent expenditure was in education service which was accounted 25.2 percent of the total recurrent expenditure in 2012/13. Similarly; general public service accounted 24.5 percent, economic affairs 14.5 percent and public law and order 14.1 percent in 2012/13. (MOF, 2014). The spending capacity of government entities has not been increased. Capital expenditure has been very low as compared to budgetary allocation.

Table 2: Areas of Current and Capital Expenditure of Government of Nepal

Service/function wise Current expenditure	Service/function wise Capital expenditure
General public services, Defense, Public order and safety, Economic affairs, Environmental protection, Housing and community amenities, Health, Recreation, culture and religious, Education and Social protection.	General public services, Defense, Public order and safety, Economic affairs, Environmental protection, Housing and community amenities, Health, Recreation, culture and religious, Education and Social protection

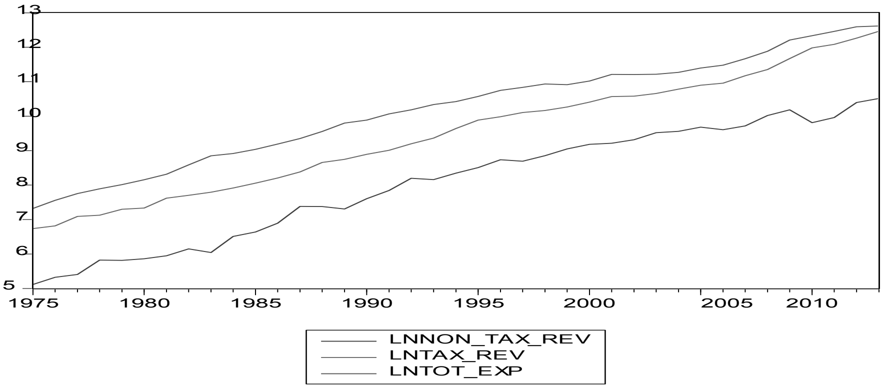
Note: Government of Nepal has started to record its revenue and expenses using Government Financial Statistic (GFS) 2001 since the fiscal year 2011/12. The data of previous fiscal years may therefore differ.
Source: Economic Survey 2013/14, Ministry of Finance, Government of Nepal, 2014.

Capital expenditure is very important to make the infrastructure development possible. (MOF, 2013). Of the total national expenditure, in general, recurrent expenditure occupies one-fourth share as capital expenditure shares merely 15 percent. The expenditure scenario is that recurrent expenditure complies with estimation but capital expenditure remained below par (MOF, 2014).

The Movement of Revenue and Expenditure in Nepal

The share of non-tax revenue in total government revenue seems comparatively lower in Nepal. Figure 1 shows the trend of annual increment of total expenditure (current and capital/development) tax revenue and non-tax revenue from 1975 to 2013 (39 years).

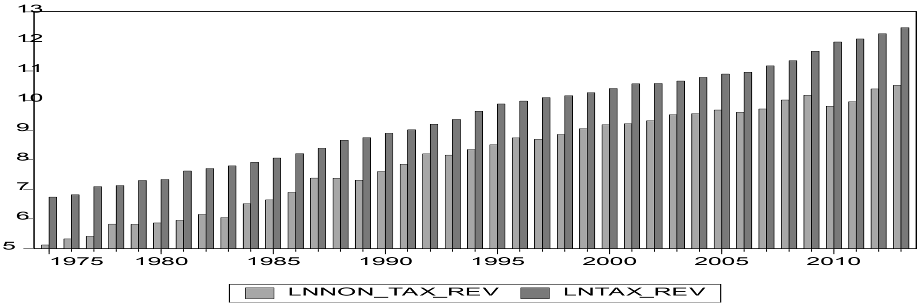
Figure 1: Trend of Total Expenditure, Tax and Non-tax Revenue



Source: Author's calculation based on the data of Economic Survey of Ministry of Finance

The increment of total revenue (tax and non-tax) is presented in figure 2.

Figure 2: Trend of Tax and Non-tax Revenue in Nepal

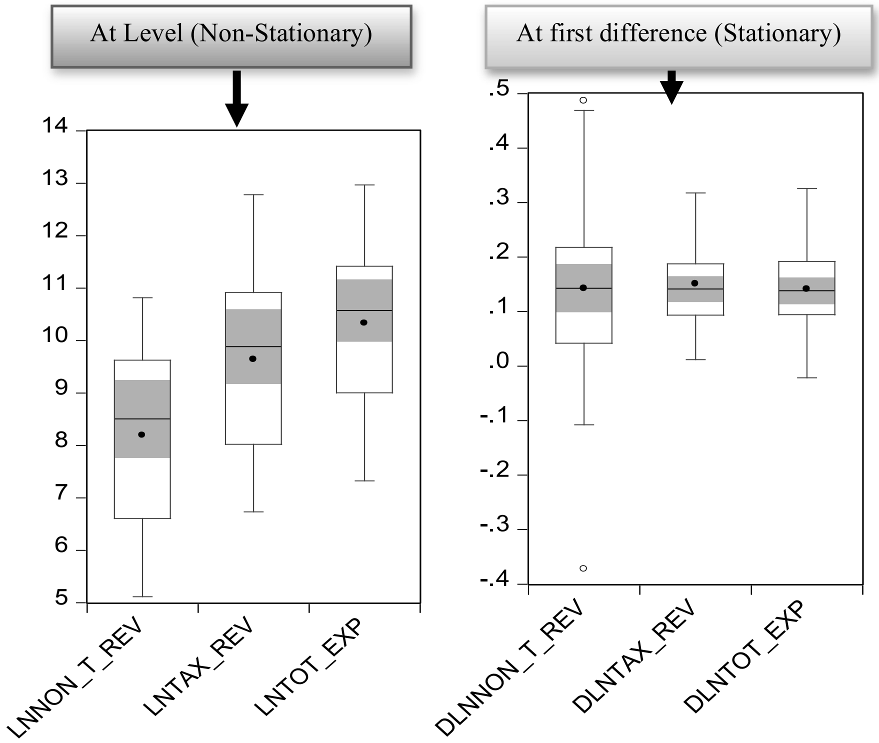


Data and Methodology

This paper evaluates both causality and long-run relationships between government expenditures (GE) and revenues (GR) of Nepal. The tax and non tax revenue are used as proxy of total government revenue and total expenditure (both capital and recurrent) exclusive of repayment and other cost. The Augment Dickey Fuller (ADF) unit root test is used to examine the unit roots and stationary of the variables. The Vector Error Correction Motel (ECM) is used to test the short and long run causality between dependent and independent variables. The original data is converted into log value. The Serial Correlation LM test and normality test also carried out. This study has used yearly direct tax revenues, indirect tax revenues/non-tax revenues and government spending covering period of 1975-

2013 with 39 observations on each of the variables. The data source is the Economic Survey published of Ministry of Finance of Nepal. For data analysis both SPSS version 20 and EViews 9 version data analysis software are used. A graphical depiction of the original and one time lag data shows that the original data is found non-stationary whereas the data converted into first difference became stationary (figure 3).

Figure 3: Box Plot Graph of Variables (Level and First Difference)



Source: Author's calculation based on the data available from Economic Survey of MoF

Correlation between Variables

The Table 3 shows that there is a strong correlation between total expenditure and tax revenue and between total expenditure and non-tax revenue. However, there is stronger correlation between total expenditure and tax revenue (99.4%) compared to the correlation between total expenditure and non-tax revenue (99.0%) and there is also strong correlation between tax and non-tax revenue (98.7%).

Table 3: Result of Pearson Correlations

Variables	LnTot_Exp	LnNoN_T_Rev	LnTax_Rev
LnTot_Exp	1		
LnNoN_T_Rev	.990**	1	
LnTax_Rev	.994**	.987**	1

Note: Double asterisks ** denote correlation which is significant at the 0.01 level (2-tailed). Result from SPSS version 20.

Estimation of Models

The coefficients of tax revenue and non-tax revenue are found significant at 5% confidence interval because their p value is less than alpha value 0.05. The diagnostic factors of tolerance and variance inflation factor (VIF) help to examine he multi-collinearity among the independent variables. The value of tolerance of both variables is 0.25 which is greater than 0.1 and VIF value 39.417 is also greater than 10. So, it can be said there is problem of multi-collinearity of two independent variables (table 4).

Table 4: Coefficients of Model 1:

$$\mathbf{LNTOT\_EXP=a+\beta_1 LNTAX\_REV +\beta_2 LNNON\_T\_REV +e}$$

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.975	.168		11.751	.000		
	Lntot_tax_rev	.588	.088	.645	6.714	.000	.025	39.417
	Lntot_Non_tax_rev	.328	.089	.354	3.680	.001	.025	39.417

Note: Dependent Variable: Lntot_exp

The fitted equation for model 1 from Table 4 is

Total expenditure = 1.975 + .588 Tax Revenue + .328 Non-Tax Revenue
(0.088) (0.089)

In the fitted equation, the t-statistic for estimated β_1 is 0.588/0.088=6.68>2, and t-statistic for estimated β_2 is 0.328/0.089=3.68>2. Therefore, it can confidently say that the true relationship between total expenditure and tax and non-tax revenue is very positive. The Beta value of standardized coefficient of tax revenue .645 is greater than the coefficient of non-tax revenue .354 meaning that there is stronger relationship between total expenditure and tax revenue as compare to total expenditure and non-tax revenue. The un-standardized coefficient shows that the total expenditure increased by .588 million rupees for every one million rupee increase in tax revenue and the total expenditure increases by .328 million rupees for every one million increases in non-tax revenue (table 4).

The coefficients of tax revenue and non-tax revenue are found significant at 5% confidence interval because their p-values are 0.000 and 0.005 are less than alpha value 0.05. The value of tolerance of both variables is 0.25 which is greater than 0.1 and VIF value 40.317 is also greater than 10. So, it can be said there is problem of multi-collinearity of two independent variables (table 5).

Table 5: Coefficients of Model 2:

$$\mathbf{LNTOT\_EXP=a+\beta_1 LNTAX\_REV\ (-1) +\beta_2 LNNON\_T\_REV\ (-1)+e}$$

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.152	.186		11.564	.000		
	DLntot_non_tax_rev	.283	.096	.310	2.961	.005	.025	40.317
	DLn_tax_rev	.623	.095	.687	6.556	.000	.025	40.317

Note: Dependent Variable: Log total expenditure, value of independent variables is in one period lag.

The fitted equation for model 2 from Table 5 is

Total expenditure = 2.152 + .623 Tax Revenue + .283 Non-Tax Revenue

(0.095) (0.096)

In the above fitted equation, the t-statistic for estimated β_1 is 0.623/0.095= 6.5895>2, and t-statistic for estimated β_2 is 0.283/0.096= 2.947>2. Therefore, it can be confidently said that the true relationship between total expenditure and tax and non-tax revenue is very positive. This means that there is no problem of multi-collinearity. The un-standardized coefficient shows that the total expenditure increased by .623 million rupees for every one million rupee increase in tax revenue and the total expenditure increases by .283 million rupees for every one million increases in non-tax revenue (table 5).

Table 6: Coefficients Model 3: LNTOT_EXP=a+β_1LNTOT_REV+e

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.362	.142		9.615	.000		
	Lntot_rev	.911	.014	.995	63.276	.000	1.000	1.000

Note: Dependent Variable: Long total expenditure (Lntot_exp)

The fitted equation for model 3 from Table 6 is

Total expenditure = 1.362 + .911 total revenue

(0.014)

In the fitted equation in table 6, the t-statistic for estimated β_1 is 0.911/0.014=65.071>2. Therefore, it can be confidently said that the true relationship between total expenditure and total revenue is very positive. The coefficient of total tax revenue is found significant at 5% confidence interval because the p-values is 0.000 which is less than 0.05. There is only one independent variable. So, there will not be problem of multi-collinearity in this model. The value of tolerance and VIF is one. The un-standardized coefficient shows that the total expenditure increased by .911 million rupees for every one million rupee increase in total revenue (table 6).

Table 7: Coefficients Model 4:

LNTOT_EXP=a+β_1LNTOT_REV(-1)+e

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.580	.147		10.761	.000		
	DLntot_rev	.903	.015	.995	60.044	.000	1.000	1.000

Note: Dependent Variable: Log total expenditure and value of independent variables is in one period lag

The fitted equation for model 4 from Table 7 is

Total expenditure = 1.580 + .903 total revenue

(0.015)

In the above fitted equation, the t-statistic for estimated β_1 is 0.903/0.015=60.2>2. Therefore, it can be confidently said that the true relationship between total expenditure and total revenue is very positive. The coefficient of total tax revenue found significant at 5% confidence interval because the p-values is 0.000 which is less than 0.05. There is no need to test the multi-collinearity because there is also only one independent variable. So, there is no problem of multi-collinearity in this model. Hence the value of tolerance and VIF is 1.000 of each. This means that there is no warning of multi-collinearity in the model (table 7). The R-square of model 3 and 4 are 0.99. It means that 99 per cent variation in dependent variable (total expenditure) is explained by the variation in independent variable (total tax revenue). The D-W value is very low in model 3 and 4 (0.355 and 0.276 respectively). It indicates that there is first order positive auto-correlation in the residual. The value of AIC is negative. The rule of thumb is that lower the value of AIC better the model. So, it can be said that the models are good fit (table 8).

Table 8: Summary Results of Regression Analysis of Model 3 and 4

Dependent variable: LN (log) total expenditure		**Method: Least square**	
Model 3: LNTOT_EXP=a+β_1LNTOT_REV+e		**Model 4:** LNTOT_EXP=a+β_1LNTOT_REV(-1)+e	
Variables	**Coefficient**	**Variables**	**Coefficient**
C	1.362 (9.615) [0.0000]	C	1.897 (12.758) [0.0000]
LNTOT_REV	0.911 (63.276) [0.0000]	LNTOT_REV (-1)	0.890 (58.121) [0.0000]
F-statistic	4003.881	F-statistic	3605.243
R^2	0.991	R^2	0.990
Adjusted- R^2	0.991	Adjusted- R^2	0.990
AIC	-0.926370	AIC	-0.920975
SIC	-0841059	SIC	-0.8347863
D-W	0.355	D-W	0.276
Prob (F-statistic)	0.000000	Prob (F-statistic)	0.000000

Note: Value of t statistic is in parentheses and value of significance level (Prob.) is in [bracket].
Source: Author's calculation, AIC and SIC is calculated by EViews 9.

Co-integration Testing

Co-integration is a statistical property of a collection (X1, X2, Xk) of time series variables. First, all of the series must be integrated of order 1. Next, if a linear combination of this collection is integrated of order zero, then the collection is said to be co-integrated. Formally, if (X, Y, Z) are each integrated of order one I (1), and there exist coefficients a, b, c such that aX + bY + cZ is integrated of order 0, then X, Y, and Z are co-integrated. Co-integration has become an important property in contemporary time series analysis. Time series often have trends - either deterministic or stochastic. There are mainly three different methods for testing for co-integration.

Multi-co-integration

In practice, co-integration is often used for two I(1) series, but it is more generally applicable and can be used for variables integrated of higher order (to detect correlated accelerations or other second-difference effects). Multi-co-integration extends the co-integration technique beyond two variables, and occasionally two variables integrated at different orders.

Johansen Co-integration Test

The pre-condition is that all variables must be non-stationary at level but when they are converted into first differenced, they will become stationary. Then only we can run Johansen test. In Johansen, data or variables are non-stationary and data must be integrated of some order. In other word, The Johansen test is a test for co-integration that allows for more than one co-integrating relationship, unlike the Engle–Granger method, but this test is subject to asymptotic properties, i.e. large samples. If the sample size is too small then the results will not be reliable and one should use Auto Regressive Distributed Lags (ARDL).

Null hypothesis: The variable is stationary. The correlogram test suggests that the p value of all variables is less than 5 percent at level, so null hypotheses are rejected, meaning that variables are non-stationary. But in first difference, null hypothesis of all variables are not rejected meaning that variables in first difference are stationary. In this circumstance, we can easily run Johansen Co-integration Test.

Table 9: Unrestricted Co-integration Rank Test (Trace)

Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None *	0.857901	80.47656	29.79707	0.0000
At most 1	0.187818	8.280897	15.49471	0.4359
At most 2	0.015654	0.583765	3.841466	0.4448

Note: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; an asterisk* denotes rejection of the hypothesis at the 0.05 level; double asterisk ** denote MacKinnon-Haug-Michelis (1999) p-values

The null-hypothesis is that "there is no co-integration among all three variables." There are two ways of rejecting null hypotheses. One way is that if the Max-Eigen Statistic is greater than 0.05 critical, the null hypothesis is rejected and the another way is that if the p value is less than 5% critical value meaning that both results suggests that there is long run association among three variables. In other words, the three variables move together in long run. Therefore, it can be confidently said that there is a long run relationship among total expenditure, tax revenue and non-tax revenue (table 9 and 10).

Table 10: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized		***Max-Eigen***	***0.05***	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.857901	72.19566	21.13162	0.0000
At most 1	0.187818	7.697131	14.26460	0.4103
At most 2	0.015654	0.583765	3.841466	0.4448

Note: Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level; an asterisk* denotes rejection of the hypothesis at the 0.05 level; double asterisk ** denote MacKinnon-Haug-Michelis (1999) p-values

It is found that the variables are co-integrated or have long run association among all three variables, and then we can run restricted VAR, that is Vector Error Correction Model

(VECM). But if the variables are not co-integrated, we cannot run VECM model, rather we can run unrestricted VAR model.

Vector Error Correction (VEC) Model

The assumptions are that variables must be stationary and co-integrated each other for VEC model. There are three steps in Vector Error Correction Model i.e. lag selection, Johansen Test of Co-integration and formation of Vector Error Correction Model. There are few ways to select lag of variables. Out of the ways, to choose the lowest value of Akaika Information Criterion (AIC) is the best option of selection of lag. The lowest the AIC value, the better the model is. The SC only has suggested lag 1 model but lag 3 has been recommended by LR, FPE, AIC and HQ. The majorities have recommended lag 3, so it is better to select lag 3. So the optimal lag would be 3, so we shall use the lag 3 (table 11).

Table 11: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-67.42425	NA	2.364920	3.698608	3.742147	3.713958
1	14.13377	154.2990	0.030390	-0.655879	-0.568803*	-0.625181
2	14.74816	1.129148	0.031038	-0.635036	-0.504421	-0.588988
3	17.17739	4.333230*	0.028744*	-0.712292*	-0.538138	-0.650894*
4	17.65313	0.822893	0.029595	-0.683953	-0.466261	-0.607206

Note: An asterisk * indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Residual Correlation LM Test

The p value of serial correlation LM test is more than 5% meaning that null hypothesis cannot be rejected. It means that residuals are not serially correlated in the model which is desirable for model (table 12).

Table 12: Breusch-Godfrey Serial Correlation LM Test

F-statistic	2.105562	Prob. F(2,28)	0.1406
Obs*R-squared	4.967933	Prob. Chi-Square(2)	0.0834

Heteroskedasticity Test

The p value of Observed R-square is greater than 5% meaning that this model does not have heteroskedasticity. It means that the model is good (table 13).

Table 13: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.297553	Prob. F(9,28)	0.2820
Obs*R-squared	11.18412	Prob. Chi-Square(9)	0.2633
Scaled explained SS	6.883545	Prob. Chi-Square(9)	0.6492

The Normality Test

The result of histogram normality test shows the probability value is 0.998337 which is greater than 5%. It means that the residuals of this model is normally distributed that is desirable.

Granger Causality Test

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another, first proposed in 1969. Ordinarily, regressions reflect "mere" correlations, but Clive Granger argued that causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series.

A Granger test is a test for whether, controlling for past values of y, x is still a useful predictor of y. Practically, it is the F-statistic on x from a regression of y on lags of y and x.

Granger Causality Tests (VAR Approaches)

The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. If event A happens before B event, then it is possible that A is causing B. However, it is not possible that B is causing A. In other words, events in the past can cause events to happen today. Future events cannot be cause of past events (Gujarati, 2006). A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y. The rule of thumb is that both dependent and independent variables are assumed to be stationary. If not, the variables should be made stationary before testing Granger Causality.

Granger defined the causality relationship based on two principles:

1. The cause happens prior to its effect.

2. The cause has unique information about the future values of its effect.

When in a regression equation it can be said that the explanatory variable X which is indirectly accepted that variable Xt causes variable Yt affects the dependent variable Yt, in the sense that changes in variable X induce changes in variable Y. This is in simple terms the concept of causality. With respect to the direction of causality, it can be distinguished as follows:

a) Unidirectional causality: This is the case when X_t causes Y_t, but Y_t does not cause X,

b) Bidirectional causality: This is the case when variables X_t and Y_t, are jointly determined.

In most cases, the direction of causality is not known and various tests have been suggested to identify the directions. It is the most well known test which was proposed by Granger in 1969. This test being based on the premise that the future cannot cause the present or the past utilizes the concept of the Vector autoregressive model (VAR). Let us therefore consider the two variables, Xt and Yt VAR (k) model (Roshaiza and Nanthakumar, 2008):

$$Y_t = \alpha_{10} + \sum_{j=1}^{k} \alpha_{1j} X_{t-j} + \sum_{j=1}^{k} \beta_{1j} Y_{t-j} + \epsilon_{1t} \quad \text{..............................} (1)$$

$$X_t = \alpha_{20} + \sum_{j=1}^{k} \alpha_{2j} X_{t-j} + \sum_{j=1}^{k} \beta_{2j} Y_{t-j} + \epsilon_{2t} \quad \text{..............................} (2)$$

With respect to this model, the following cases can be distinguished:

a) If $\{\alpha_{11,}\alpha_{12,} \dots \dots \dots \dots \ \alpha_{1k}\} \neq 0 \ and \ \{\beta_{21,}\beta_{22,} \dots \dots \dots \beta_{2k}\} = 0,$ there exists a unidirectional causality from X_t to Y_t, denoted as X □ Y.

b) If $\{\alpha_{11,}\alpha_{12,} \dots \dots \dots \dots \ \alpha_{1k}\} = 0 \ and \ \{\beta_{21,}\beta_{22,} \dots \dots \dots \beta_{2k}\} \neq 0,$ there exists a unidirectional causality from Y_t, to X_t to denoted as Y □ X .

c) If $\{\alpha_{11,}\alpha_{12,} \dots \dots \dots \dots \ \alpha_{1k}\} \neq 0 \ and \ \{\beta_{21,}\beta_{22,} \dots \dots \dots \beta_{2k}\} \neq 0,$ there exists a bidirectional causality from X_t to Y_t, denoted as X □□ Y.

In order to test the hypotheses referring to the significance or lack thereof, the sets of the coefficients of the VAR model equations (1) and (2), the usual Wald F-statistics could be utilized. It examine the long run causal relationship among the variables

The hypotheses in this test may be formed as follows:

H_0: X does not Granger cause Y, i.e. $\{\alpha_{11} \dots \dots \dots \alpha_{12}\} = 0$, if F_c < critical value of F statistics

H_1: X does Granger cause Y, i.e. $\{\alpha_{11} \dots \dots \dots \alpha_{12}\} \neq 0$, if F_c > critical value of F statistics

Results of VAR Model Granger Causality Test

VAR Granger Causality/Block Exogeneity Wald Tests show the following results of causality.

1. Dependent variable is total expenditure

Null hypotheses:

a. Tax revenue lag 1 and tax revenue lag 2 =0,

b. Non-tax revenue lag 1 and non-tax revenue lag 2 =0,

If they are zero meaning that tax revenue and non-tax revenue lag 1 and lag 2 jointly cannot cause total expenditure

The result below in Table 14 shows that tax revenue lag 1 and lag 2 does not cause total expenditure because p=0.0880>5%. Similarly, the non-tax revenue lag 1 and lag 2 also does not cause total expenditure because p value is 0.04191which is greater than 5 percent critical value.

Table 14: Dependent Variable: LNTOT_EXP

Excluded	Chi-sq	df	Prob.
LNTAX_REV	4.861417	2	0.0880
LNNON_TAX_REV	1.739448	2	0.4191
All	6.291138	4	0.1784

2. Dependent variable is tax revenue

Null hypotheses:

a. Total expenditure lag 1 and Total expenditure lag 2 =0,

b. Non-tax revenue lag 1 and non-tax revenue lag 2 =0, The Table 15 shows that total expenditure lag 1 and lag 2 does not cause tax revenue because p=0.1363<5%. Similarly, the non-tax revenue lag 1 and lag 2 does not cause tax revenue because p value 0.1031 is greater than 5 percent.

Table 15: Dependent Variable: LNTAX_REV

Excluded	Chi-sq	df	Prob.
LNTOT_EXP	3.986389	2	0.1363
LNNON_TAX_REV	4.543630	2	0.1031
All	8.099908	4	0.0880

3. Dependent variable is non- tax revenue

Null hypotheses:

a. Total expenditure lag 1 and Total expenditure lag 2 =0,

b. Tax revenue lag 1 and tax revenue lag 2 =0,

Null: Total expenditure lag 1 and lag 2 jointly can't cause non-tax revenue

Table 16 shows that the P value is 0.0144 which is less than 5 percent meaning that we can reject null hypothesis. It means that the total expenditure lag 1 and lag 2 can jointly cause non-tax revenue.

Table 16: Dependent Variable: LNNON_TAX_REV

Excluded	Chi-sq	df	Prob.
LNTOT_EXP	8.477285	2	0.0144
LNTAX_REV	0.417485	2	0.8116
All	12.84946	4	0.0120

Table 17 shows that the p value of total expenditure does not cause non tax revenue is 0.0042 or 0.04 percent which is less than 5 percent. So null hypothesis is rejected, its meaning that total expenditure does cause non-tax revenue. In the other word, expenditure affects non-tax revenue. But the other null hypotheses are not rejected because p values are greater than critical value at 5 per cent.

Table 17: Pair-wise Granger Causality Tests at 2 Lags

Null Hypothesis:	Obs	F-Statistic	Prob.
LNTAX_REV does not Granger Cause LNTOT_EXP	37	2.29453	0.1172
LNTOT_EXP does not Granger Cause LNTAX_REV		1.64721	0.2085
LNNON_TAX_REV does not Granger Cause LNTOT_EXP	37	0.65618	0.5257
LNTOT_EXP does not Granger Cause LNNON_TAX_REV		6.53938	0.0042
LNNON_TAX_REV does not Granger Cause LNTAX_REV	37	1.93655	0.1607
LNTAX_REV does not Granger Cause LNNON_TAX_REV		1.81808	0.1787

Augmented Dickey Fuller (ADF) Unit Root Test

In case of Dickey Fuller Test, these may create a problem of autocorrelation. To tackle autocorrelation problem, Dickey Fuller have developed a test called Augmented Dickey Fuller Test stated below (equation 1, 2 and 3) or there are three different models as follows.

1. $\Delta Yt = \beta_1 + ZY_{t-1} + ai + et\ (equation\ 1) > intercept/constant\ only$ (Model 1)

2. $\Delta Yt = \beta_1 + \beta_{2t} + ZY_{t-1}e + ai + et\ (equation\ 2) > trend\ and\ intercept/constant$ (Model 2)

3. $\Delta Yt = ZY_{t-1} + ai + et\ (equation\ 3) > no\ trend, no\ intercept/constant$ (Model 3)

Hypothesis H_0=Variable is not stationary or got unit root; Hypothesis H_1=Variable is stationary.All the three model must be satisfied to take a decision whether the particular variable has unit root or not. To make the variable stationary, we should go for first order differencing. If series is stationary at level, it is not needed to go for first differencing. Adversely, if series is not stationary at level, it is needed to go for first differencing. It can be said that series is non-stationary at level but stationary at first difference. So, it is integrated of order one or simply can say that it is I (1) series. If the error terms are found to be stationary I (0) at their levels, using Engle and Granger critical values, then the regression of the equation will not be spurious.

There are mainly two approaches of testing Unit Root. If the ρ-value is less than or equal to a specified significance level, often 0.05 (5%) or 0.01 (1%) and even 0.1 (10%), the null hypothesis is rejected, it means that the variable is stationary. If the ρ-value is greater than 5%, null hypothesis can't be rejected meaning that null hypothesis is accepted, null got unit root. In other word, variable is not stationary. Table 20 shows that p values of all three variables are greater than 5% at level series. So, the null hypothesis cannot be rejected meaning that alternative hypothesis is accepted. It means that there is unit root problem in all variables (table 18).

Table 18: Augmented Dickey-Fuller Test (ADF Testing) Statistic

ADF test statistic and Critical value of models		Null Hypothesis: LNTOT_EXP has a unit root at level			Null Hypothesis: LNTOT_EXP has a unit root at first difference		
		Model 1 Constant	Model 2 Constant, Linear Trend	Model 3 None	Model 1 Constant	Model 2 Constant, Linear Trend	Model 3 None
ADF test statistic		-2.013142	-1.829450	2.955781	-4.271765	-4.420682	-2.074173
Critical Value	1% level	-3.615588	-4.226815	-2.628961	-3.621023	-4.226815	-2.628961
	5% level	-2.941145	-3.536601	-1.950117	-2.943427	-3.536601	-1.950117
	10% level	-2.609066	-3.200320	-1.611339	-2.610263	-3.200320	-1.611339
P value		0.2802	0.6700	0.9988	0.0018	0.0061	0.0381
Coefficient of Lntot_Exp (-1) or D(Lntot_exp (-1))		-0.016253	-0.116024	0.007203	-0.096016	-0.737986	-0179708

Note: An asterisk * denotes MacKinnon (1996) one-sided p-values.
Source: Author's calculation from the original data received from Economic Survey of GON/MOF.

If the critical value at 1%, 5% and 10% is less than ADF test statistic in absolute value, it can be rejected null hypothesis and can be claimed that variable is stationary. The Table 18 indicates that, at level, the critical value at level 1%, 5% and 10% is found greater that ADF test statistics in absolute term (value). The p value is also greater than 5 percent of all three models at level. So we cannot reject the null hypothesis meaning that there is unit root problem in all variables. The guideline is that the coefficient of dependent variable must be negative to be the viable variable in the model. It is found that there is negative value of all coefficient at level so all three variables are viable. But we can see different scenario at first difference. The absolute value of test statistic 4.27 is greater that critical value 2.94 at 5% level and the probability value (p) 0.01% is less the 5% so the null hypothesis is rejected and alternative hypothesis is accepted meaning that the first difference of log total expenditure is stationary. The coefficient of variable D(LNTOT_EXP(-1)) is -0.696016, meaning that the coefficient indicates that the model is viable. The same results are found in model 2 and 3 also so the model has no unit root or the data is stationary at first difference.

Conclusions

Decision is that variable total expenditure at level does have unit root meaning that it is not stationary. But when the same variable is converted into first difference, then, the first difference variable that is D(Y) or D (Lntot_exp (-1)) is stationary meaning that there is no unit root. Now we shall use D(Y) variable in the time series model. Because, this variable does not have unit root, meaning that this variable is stationary.

The main objective of this study was to test for Granger-causality between the spending and revenue (tax and non-tax) of Government of Nepal based on the last 39 years data base prepared by Ministry of Finance. This study finds that there is a very strong and positive correlation between total spending and tax revenue (99.4%) and total spending and non-tax revenue (99%). The model is found good fit in first difference. The study also finds that there is a unidirectional Granger-causality running from government spending to tax revenue and non-tax revenue to government spending but bi-directional causality running from tax to non- tax revenue and vice versa.

References

Abuai-Foul, B., & Baghestani, H. (2004). The causal relation between government revenue and spending, evidence from Egypt and Jorda. *Journal of Economics and Finance*, 28 (2), 260-269.

Baghestani, H., & Mcnown, R. (1994). Do revenue or expenditure respond to budgetary disequilibria? *Southern Economic Journal*, 61 (2), 311-322.

Barro, R. J. (1974). Are government bonds not wealth?. *Journal of Political Economy*, Nov-Dec paper 1095-1118.

Buchnan, J. M., & Richard, W. W. (1997). *Democracy in deficit*. New York; Academic Press.

Eita, J. H., & Mbazima, D. (2008). *The causality relationship between government revenue and expenditure in Namibia*. MPRA Paper No. 9154.

Eita, J.H., & Mbazima, D. (2008). *The causal relationship between government revenue and expenditure in Namibia*, MPRA Paper, No. 9154.

Friedman, M. (1978). The limitations of tax limit, policy reviews, 7-14.

Granger, C. (1969). Investigating causal relations by econometric models and cross-spectoral methods. *Econometrics*, 37, 424-438.

Granger, C. (1981). Some properties of time series data and their use in econometric model specification. *Journal of Econometrics,* 16 (1), 121–130. doi:10.1016/0304-4076(81)90079-8.

Gujarati, D. N. (2006). *Basic econometrics*, fourth edition. New Delhi: TATA, McGRAW-HILL, publishing company limited.

Mehrara, M., & Pahlavani, Y. E. M. (2011). Government revenue and government expenditure nexus in Asian countries: Panel cointegration and causality. *International Journal of Business and Social Science*, 2(7).

Mehrara, M., & Rezaei. A. A. (2011). The relationship between government revenue and government expenditure in Iran. *International Journal of Business and Social Science*, 2(7).

Meltzer, A. H., & Richard, S. F. (1981). A rational theory of the size of the government. *The Journal of Political Economy*, 89(5), 914-927.

MOF (Ministry of Finance) (2014). *Economic Survey, 2013/14*. Kathmandu: MOF, Government of Nepal.

Moalusi, D.K. (2004).*Casual link between government spending and revenue, a case study of Botswana*, Fordham Economics Discussion Paper Series, pp. 2007-07.

Musgrave, R. A. (1966). Principles of budget determination. In A. H. Cameron & W. Henderson (Eds.), *Public Finance: Selected Readings*. New York: Random House, 15-27.

Narayan, P. K. (2005). The government revenue and government expenditure nexus: Evidence from developing countries. *Applied Economics*, 38 (3).

Narayan, P.K., & Narayan, S. (2006). Government revenue and government expenditure nexus: Evidence from developing countries. *Applied Economic*, 38.

Owoye, O. (1995). The causal relationship between taxes and expenditure in the G7 countries: Co-integration and error correction models. *Applied Economics Letters* 2(1), 19-22.

Park, W. K. (1998). Granger causality between government revenue and expenditure in Korea. *Journal of Economic Development*, 23 (1), 145-155.

Phillips, P. C. B., & Ouliaris, S. (1990). Asymptotic properties of residual based tests for cointegration. *Econometrica*, 58 (1), 165–193.

Roshaiza, T.,& Nanthakumar, L. (2008). Causality between tax revenue and government spending in Malaysia. *The International Journal of Business and Finance Research,* 2 (2).

Saeed, K.P., & Somaye, S. (2012). Relationship between government spending and revenue: Evidence from oil exporting countries, IJEME 2(2), 33-35. Retrieved from www.ijeme.org © World Academic Publishing.

Shah, A., & Bafffes, J. (1994). Causality and co-movement between taxes and expenditure: Historical evidence from Argentina, Brazil, abd Nexuci. *Journal of Development Economics*, 44 (2), 311-331.

Web pages:

https://www.youtube.com/watch?v=ixra9uT7sy4

https://www.youtube.com/watch?v=FCrrDhYKO8c

https://www.youtube.com/watch?v=cUNA4rVF3xg

https://www.youtube.com/watch?v=Si4P7yOF3nk