EFFECTIVENESS OF VAT ON NEPALESE ECONOMY PROXIED TO GDP WITHOUT AGRICULTURE

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ABSTRACT: This paper pursues to examine the contribution of Value added tax (VAT) on Nepalese economy (GDP) in aggregate level without agriculture. It, therefore, analyzes the influence of VAT on GDP in aggregate level without agriculture. This study adopts descriptive and explanatory research design and attempts to conclude the liaison between VAT and the GDP without agriculture, exchange rate, market capitalization money supply and government spending at real price being the overriding variables included in the model. In order for the specification of a model of cointegrated regression model with a time series data of the variables are employed for the study period of 25 years, from 1999/2000 to 2023/24. The values of all the variables are converted into real price (constant price) by GDP deflator. The GDP deflator and CPI year 2013/14 have been assumed equivalent to the base year 2013/14 according to Nepalese fiscal year. Meanwhile it is observed that residuals are not normally distributed, autocorrelation and multicollinearity problem in the model, it is necessary to improve the non-normal distribution, autocorrelation and multicollinearity problem in the model. Therefore, the data are transposed into first difference and run the model with error correction model(ECM_{t-1}). The R^2 shows that the explanatory power of the model is 0.528 indicating that 52.89 % of the variation of GDP is explained to the extent of 52.8 by percent variation of the independent variable in the model. The diagnostic test suggests that the residuals do not violet classical assumptions. The lagged residuals from II equation of Table 2 ECM_{t-1} are statistically significant indicating the acceptable ground to take variable as cointegrated set. The result allows long-run and short-run dynamics of all the relationship between GDPWA and VAT. The estimated coefficient of VAT in error correction model shows that one percent point rise in VAT has led to 0.438 percent point increase in real GDPWA in short-run, whereas it is found 0.558 percent point in long-run. It means that short-run marginal productivity of VAT is 0.438 percent point, whereas its long-run percent point is 0.558.

Keywords: Effectiveness, Agriculture, Economy, VAT.

INTRODUCTION

Taxation is regarded as the only practical means of raising revenues in the contemporary world to finance government spending on goods and services for its citizens, setting up an efficient and equitable tax system (Adhikari, 2003). The value-added tax (VAT) is the single most important development in the tax system during the last fifty years in terms of its contribution to government revenue, its rate, its base, and its geographical coverage. As such, the VAT has become

a standard element of the fiscal system in developed as well as developing countries throughout the world (Luitel, 2005). The VAT is said to be neutral, successful in collecting revenue even from 'hard-to-tax sectors,' and less susceptible to evasion. While only eight countries had implemented VAT in the 1960s, now more than 160 countries have adopted value-added tax as a revenue-raising device (Cnossen 1998, Ebril, Keen, Bodin, and Summers 2001, OECD 2018). The increasing popularity of VAT can be attributed to its characteristics.

The VAT is a broad-based indirect tax. The term 'value added tax is not universal; the term 'VAT is preferred to say 'goods and service tax,' GST (Khadka, 2008). It is a modern tax system intended, when fully operational, to improve the collection of tax revenue, to increase efficiency, and to minimize tax evasion. The value-added tax is not a perfectly new form of taxation. It is a commodity-based refined form of sales tax. It is a modified form of sales tax, entertainment tax, hotel tax, and contract tax that is escaped from the cascading effect. Except for a few exceptions, it is levied on value added at each stage in the process of production as well as distribution. These stages may be as important as manufacturing, wholesale, and retail. From the economic point of view, a properly implemented value-added tax is equivalent to a corresponding single-stage tax. The unique nature of VAT is its potential scope in identifying and taxing the economic contribution or added value made by any economic operator in connection with any activity of a business or any commercial nature. Unlike a traditional sales tax that is imposed at the point of sale, a VAT is imposed on goods and services at each stage of the production and distribution. It is imposed only on the value-added amount. It provides the facilities of tax credit and refund. It has a catch-up effect, which facilitates controlling the under- and over-invoicing. Under this system, consumers have to pay comparatively less tax than sales tax. Because sales tax is based on sales or turnover amount in every stage, and VAT is based on value-added amount. Usually VAT is based on consumption. Basically, there are two types of VAT: the consumption-type VAT and the income-type VAT. Nepal has adopted consumption-based VAT without agriculture.

LITERATURE REVIEW

Several tools and procedures are available for assessing the effectiveness of VAT and its contribution to the economy. VAT is of German and American parentage. Shortly after the First World War, the basic principles were developed in both nations (Adams, 1921; Siemens, 1921). In the 1950s there was a revival of interest in VAT in Western Europe and America (Laure, 1952; Huiscamp, 1954; Schmblders, 1956; Shoup, 1955). Studenski (1940) constructed a general ethical philosophical foundation for the use of VAT and developed and related to VAT a "cost of services variant" of the benefit principle of taxation justice. In the same year, Senator O'Mahoney introduced the value-added concept in proposed federal legislation (O'Mahoney, 1940). .

Recent research focuses on analyzing the relationship between VAT revenues and economic growth without agriculture, either using a regression model in which the explanatory variables are the tax revenues of each type of tax and GDP is the variable explained (Kalaš et al., 2018), or applying

VAR models (Mutaşcu and Dănuleţiu, 2011) or by checking the Granger causality (Al-Abbadi and Abdel Khaliq, 2017). In the same line, Romer and Romer (2010) conducted their research focusing on the impact of fiscal policy changes on economic activity. The unrestricted VAR and structural VAR models were also applied to assess the macroeconomic effects of fiscal policy (Afonso and Sousa, 2011). In fact, this approach constitutes a return to the way of looking at taxation from an economic point of view. Economists' concerns were almost exclusively related to the influence of public spending on economic growth rather than the influence of taxation, the main growth models being analyzed comprehensively by Barro, R. & Sala-i-Martin, X.I. (1995). When tax revenues are taken into account, the meaning of the analysis is one from taxation to economic activity (Leibfritz et al., 1997; Perotti, 2004).

In the literature it is sometimes argued that indirect taxes have a dominant role in the whole tax structure of developing countries like Nepal. Most of the revenue has been raised from indirect taxes, as it is an easy, less expensive, and opportune method for a developing economy. Six of the eight countries that form part of the SAARC comprise Nepal, India, Bangladesh, Maldives, Sri Lanka, Bhutan, Afghanistan, and Pakistan. The VAT was introduced by Pakistan in 1990, Bangladesh in 1991, Nepal in 1997, Sri Lanka in 1998, India in 2003, and the Maldives in 2011. Afghanistan and Bhutan still do not levy VAT. Afghanistan and Bhutan levy a standard destination-based consumption-type tax credit method, VAT, that extends right through the retail level (Khadka, 2015).

In the NRB working paper (2017), the autoregressive distributed lag (ARDL) approach to cointegration developed by Pesaran et al. (1999) to estimate the elasticity and buoyancy coefficients of various revenue heads finds that long-run buoyancy coefficients are greater than unity for all revenue heads except for custom duty, whereas elasticity coefficients except for VAT are smaller than unity. Short-run buoyancy and elasticity coefficients for all revenue heads tend to be smaller than unity. It also finds OLS estimates of these coefficients to be spurious for the sample from 1975 to 2016. These coefficients will be biased if the data-generating process (DGP) excludes tax exemption. All components of revenue besides income tax and VAT are found to be neutral to inflation. Bilquees (2004), Gillani (1986), Upender (2008), Rajaraman (2006), and Acharya (2011) used the OLS method to estimate the tax elasticity and buoyancy in Pakistan and India. Bilquees (2004) found tax elasticity and buoyancy less than unity in Pakistan during 1975 to 2004, whereas Gillani (1986) had found Pakistan's tax system elastic and buoyant during the period 1971-82. Upender (2008) found higher tax buoyancy during the pre-reform period in India compared to the post-tax reform period. Ashraf and Sarwar (2016) employed a pooled OLS estimator to examine the role of institutions on tax buoyancy using a panel data set from fifty developing countries. Their findings appeared with distortionary effects of corruption on tax collection, and tax buoyancy and elasticity were found to be high in countries having democratic systems of governance. Yousuf and Huq (2013) used cointegration techniques and found buoyancy coefficients higher than elasticity coefficients in Bangladesh. Bruce, Fox, and Tuttle (2006) computed long-run elasticity for sales and income tax for each of the states using a single-equation cointegration method, namely dynamic ordinary least squares (DOLS) (Stock and Watson, 1993).

METHODOLOGY

To examine the contribution of value-added tax (VAT) and economic growth proxied by PGDP at the aggregate level without agriculture, the study employs a descriptive and explanatory research design, considering VAT as the independent variable and GDP as the dependent variable at the aggregate level without agriculture , along with remittance, exchange rate, market capitalization, money supply (M1, M2), and government spending as intervening variables. In so doing, it is hypothesized that there is a significant positive impact of VAT on GDP without agriculture. Similarly, it is also hypothesized that the overriding variables of government spending and money supply have a positive relationship, while exchange rate and market capitalization have a negative one. In the process of using and testing the relationship between remittance and GDP with other intervening variables, the error correction model (ECM) is used. Various other tests, such as the unit root test, DF and ADF, autocorrelation, partial correlation, correlogram test, Durbin Watson, HDW, Jarque-Bera normality test, serial correlation test, heteroscedasticity, Glejser test, specification test, test of exogeneity, structural break test, multicollinearity test, Ramsey test, and Chow test, have also been used to justify the model. The quantitative data used in the study have been collected from the Economic Survey published annually by MOF, Annual Reports of IRD, annual customs statistics, various publications of NRB and CBS, and other published sources.

The data points for these variables include annual observations from the fiscal year 1999/2000 to the fiscal year 2023/24. The values of all variables are converted into real prices (constant prices) by the GDP deflator. Particularly, real PGDP without agriculture , real remittance, real money supply, real market capitalization, and real exchange rate are calculated as nominal exchange rate (i.e., NPR to USD) multiplied by GDP deflator or CPI of USD divided by CPI of Nepal (i.e., base year 2013/14 = 100) over a 20-year period. The GDP deflator and CPI for the year 2013/14 have been assumed equivalent to the base year 2013/14 according to the Nepalese fiscal year. The simple linear model has been converted into a natural log-linear model. In order for the specification of a model of cointegrated regression model with a time series data of the variables, the study period of 20 years from 2003/04 to 2022/23. Econometrically, the modeling of such behavior requires a stationary data process, which is absent in many of the economic variables (Wood, 1995).

Model specification

In order for the specification of a model of cointegrated regression model with a time series data of the variables are employed for the study period of 20 years, from 1999/2000 to 2023/24. Econometrically, the modeling of such behavior requires a stationary data process, which is absent in many of the economic variables (Wood, 1995). Modeling economic behavior requires the consideration of the fact. As GDP is important for economic planning of the country, this requires knowledge of the status of the economy and its behavior.

The model employed in this study is the cointegration approach. There is various literature available on this approach. The important contributions are made by Engle and Granger (1987, 1991) and Dickey et al. (1991), Wood (1995), and Perman (1989, 1991, 1993), who argued for the need for the stationary data series to employ cointegration theory. Many of the economic variables do not possess the

characteristics of stationarity; it is necessary to keep in mind the type of data series used in the model. Valid estimation and inference are not possible when a set of non-stationary variables is cointegrated. After the estimation of three different equations to find out appropriate variables for the estimation, an Error Correction Model (ECM) is employed for VAT productivity measures with the use of lagged dependents, which also facilitates obtaining the short- and long-term effects of value-added tax. The first difference data is used for ECM. The cointegration of a set of variables provides sufficient ground for specifying a corresponding error correction or dynamic equation for these variables and is compatible with long-run equilibrium behavior.

Model specification: GDP as dependent, VAT revenue and other intervening variables as independent variables.

In order to examine the impact of VAT revenue on national economic development provided by GDP as a dependent variable, consider VAT as an independent variable and exchange rate, remittance, market capitalization, money supply (M_1 M_2), and government spending as intervening variables. The relationship between the variables is specified as below:

$$GDPWA_{ct} = f\ (VAT_{ct},\ Exr_{ct},\quad R_{ct},\quad MC_{tc},\quad MS_{ct},\quad GS_{ct}\ )$$

The relationship and impact of VAT on GDP has specified as: `

$$lnGDPWA_{ct} = \beta_0 + \beta_1\ lnVAT_{ct} + \beta_2 lnEXR_{ct} + \beta_3 lnR_{ct} + \beta_4\ lnMC_{ct} + \beta_5 lnMS_{ct} + \beta_6 lnGS_{ct} + \dots\ \dots\ + e_i \quad (1)$$

$$lnGDPWA_{ct} = \beta_0 + \beta_1\ lnVAT_{ct} + \beta_2 lnEXR_{ct} + \beta_3 lnR_{ct} + \beta_4\ lnMC_{ct} + \beta_5 lnMS_{ct} + \dots\ \dots\ \dots\ + e_i \quad (2)$$

$$lnGDPWA_{ct} = \beta_0 + \beta_1\ lnVAT_{ct} + \beta_2 lnEXR_{ct} + \beta_3 lnR_{ct} + \beta_4\ lnMC_{ct} + \beta_5 lnGS_{ct} + \dots\ \dots\ \dots\ + e_i \quad (3)$$

where,

$lnGDPWA_{ct}$ = Represents Gross Domestic Products without agriculture at constant price at time‘t’ in logarithm.
$lnVAT_{ci}$ = Represents Value Added tax revenue in constant price at time‘t’ in logarithm.
$lnEXR_{ct}$ =Represents Exchange Rate at constant price at time‘t’ in logarithm.
lnR_{ct}= Represents Remittance at constant price at time‘t’ in logarithm.
$lnMC_{ct}$= Represents Market capitalization at constant price at time‘t’ in logarithm.
$lnMS_{ct}$=Represents Money Supply at constant price at time‘t’ in logarithm.
$lnGS_{ct}$ =Represents Government spending at constant price at time, ‘t’ in logarithm.

H_{01}: *VAT has significant impact on GDPWA on aggregate level with other intervening variables.*

Many of the economic variables do not possess the characteristics of stationary; it is necessary to keep in mind the type of data series used in the model. Valid estimation and inference are not possible when a set of non-stationary variables is cointegrated. After the estimation of three different equations to find out appropriate variables for the estimation, an Error Correction Model (ECM) is employed to measure the VAT productivity with the use of lagged dependent variable also facilitates obtaining the short- and long-term effects of remittance on the GDP. The first difference data is used for ECM. The cointegration of a set of variables provides sufficient ground for specifying a corresponding error correction or dynamic equation for these variables and is compatible with long-run equilibrium behavior.

Unit root test

A unit root test verifies whether a time series variable is non-stationary using an autoregressive model. A well-known test that is valid in large samples is the augmented Dickey–Fuller test. The optimal finite sample tests for a unit root in autoregressive models are developed. Dickey and Fuller (1979) developed a procedure for testing whether a variable has a unit root or, equivalently, that the variable follows a random walk. Hamilton (1994) described the four different cases to which the augmented Dickey–Fuller test could be applied. In the process of checking whether the variables have a unit root or not. If the absolute test statistic is more than the critical value, then the null hypothesis that the series is non-stationary cannot be accepted. Those are the guidelines. However, if the absolute test statistic is less than the critical value, the null hypothesis can be rejected and the alternative hypothesis will be accepted. It is evident from Table 1 that the variable lnGDPWAct has the p-value that is 0.5581 > 0.05, so it cannot reject the null hypothesis, meaning that the variable lnGDPct at level has a unit root. The test statistics guidelines indicate that if the test statistic is more than the critical value at 5%, it cannot reject the null hypothesis, but the test statistic (-1.404466) and the critical value at 1%, 5%, and 10% are less than the test statistic. So it cannot reject the null hypothesis, meaning that lnGDPct has a unit root, and all the other variables, lnVATct, lnMCct, lnRct, lnEXRct, lnMSct, and lnGDPWAct, have a P-value > 0.05, so it cannot reject the null hypothesis, meaning that all the variables have a unit root at level. In addition, the coefficient at lag one is also negative, i.e., -0.047171 of all the variables, so the model is viable. When the variables are converted to first difference, after the first differences level of the probability or the p-value, that is 0.0081<0.05. So, the null hypothesis is rejected, meaning that lnGDPWAct has no unit root or stationary after the first difference, including all variables in the model.

Correlogram test

A stationary time series is one whose statistical properties, such as mean, variance, autocorrelation, etc., are all constant over time. In various time lags, the probability value, or p-value, < 0.05 indicates the null hypothesis cannot be rejected, which means that the variables have autocorrelation at the level. By checking all the variables, including variables lnGDPWAct, lnVATct, lnRemitTct, lnEXRct, lnRct, lnMCct, and lnMSct. In various time lags, the probability value, or p-value, < 0.05 indicates the null hypothesis cannot be rejected, meaning that the variables have autocorrelation at a level. At the first difference level correlogram, an image of correlation statistics is ups and downs and highs and lows. Changes indicate very low changes and ups and downs, which means there is no presence of autocorrelation. This randomness is ascertained by computing autocorrelations for data values at varying time lags. In various time lags, the probability value, or p-value, > 0.05 indicates the null hypothesis can be rejected, which means that the variables have no autocorrelation at the first difference level. All the inclusion variables have checked their autocorrelation by using a correlogram.

RESULT AND DISCUSSION

The logical relationship as specified in the research framework

hypothesizes that national GDP without agriculture (GDPWA) is positively affected by VAT revenue, remittance, and money supply, while there is a negative effect of market capitalization and government spending. For the purpose of examining the factors affecting national economy without agriculture GDP (GDPWA), the empirical models have been specified. As given in equations I, II, and III.

$lnGDPWA_{ct}$= β_0+ β_1 $lnVAT_{ct}$+ $\beta_2 lnEXR_{ct}$+$\beta_3 lnR_{ct}$+β_4 $lnMC_{ct}$+$\beta_5 lnMS_{ct}$ +$\beta_6 lnGSP_{ct}$++ e_i (I)

$lnGDPWA_{ct}$ = β_0+ β_1 $lnVAT_{ct}$+ $\beta_2 lnEXR_{ct}$+$\beta_3 lnR_{ct}$+β_4 $lnMC_{ct}$+$\beta_5 lnMS_{ct}$+… …+ e_i … (II)

$lnGDPWA_{ct}$= β_0+ β_1 $lnVAT_{ct}$+ $\beta_2 lnEXR_{ct}$+$\beta_3 lnR_{ct}$+β_4 $lnMC_{ct}$+$\beta_5 lnGSP_{ct}$+ … … + e_i… (III)

Where,

$lnGDPWA_{ct}$ = Represents Gross Domestic Products without agriculture at constant price at time 't' in logarithm.

$lnVAT_{ci}$ = Represents Value Added tax revenue in constant price at time 't' in logarithm.

$lnEXR_{ct}$ = Represents Exchange Rate at constant price at time 't' in logarithm.

lnR_{ct} = Represents Remittance at constant price at time 't' in logarithm.

$lnMC_{ct}$ = Represents Market capitalization at constant price at time, 't' in logarithm.

$lnMS_{ct}$ = Represents Money Supply at constant price at time 't' in logarithm.

$lnGSP_{ct}$ = Represents Government spending at constant price at time, 't' in logarithm.

The model of regression equations I, II and III specifies for economic development without agriculture as the dependent variable in aggregate level and the Value Added Tax revenue (lnVAT) as the independent variable and the exchange rate (lnEXRct), remittance (lnRct), market capitalization (lnMCct), money supply (lnMSct), and government spending (lnGSct) as intervening variables.

The long-run cointegrating economy of the country (GDP) is estimated using ordinary least squares (OLS). In this study, regression has been used to predict the productivity of VAT revenue collection. Different test statistics have also been employed to identify the violation of multiple regression assumptions. This represents the second model of the specified model. The results are presented in the table 1.

The results of the models describe the direction and magnitude of the relationship between dependent variable economic development without agriculture (GDPWA), independent variable, VAT revenue and other intervening variables in the specified model. The constant β_0 of the entire model has positive, which means that the model has been positive impact on economic development without agriculture (GDPWA). The regression results of all the three different equations provide equation II as an appropriate model. It is because the sign of the coefficient of all the variables are as per the expectations. The coefficient of VAT revenue, remittance, market capitalization and money supply are positive while sign of exchange rate appeared with negative. Moreover, the coefficient of the variable including in the equation II also provides more satisfactory results as compared to other two equations 1 and 3.

Table 1. Regression of GDP without agriculture with VAT and other intervening variables

Parameters/variables	Equation: I	Equation: II	Equation: III
Constant (β_0)	3.43825*	3.08796*	3.17605*
	[0.467248]	[0.160873]	[0.43857]
	{7.35850}	{19.19504}	{7.24182}
VAT revenue (β_1)	0.59824**	0.447860*	0.442073*
	[0.199118]	[0.0626837]	[0.167388]
	{3.00730}	{7.147777}	{2.64102}
Exchange rate (β_2)	−0.106648	−0.105458	−0.0939558
	[0.093615]	[0.0923954]	[0.0959691]
	{-1.137080}	{−1.14139}	{-0.979031}
Remittance (β_3)	0.0391805	0.0462038***	0.0502720**
	[0.027257]	[0.0254700]	[0.0267950]
	{1.437461}	{1.824025}	{1.87614}
Market Capitalization (β_4)	−0.00681	0.00580	0.0206855
	[0.029848]	[0.0294351]	[0.0289024]
	{0.228376}	{0.197078}	{0.715704
Money Supply (β_5)	0.067377	0.0430533	---
	[0.049464]	[0.0385091]	---
	{1.362147}	{1.1179999}	---
Government Spending (β_6)	0.226329	---	0.0105864
	[0.282932]	---	[0.229874]
	{-0.799943}	---	{0.046037}
Adjusted R^2	0.983742	0.988328	0.987288
Durbin –Watson	1.5875	1.236159	1.281280
F-statistics	192.6067	237.0996	217.4700
Jarque-Bera statistic	9.705785	6.553252	9.25365
Breusch-Godfrey LM χ^2:	1.418	3.586	3.4450
Breusch- pagon χ^2:	5.140	4.878	4.099
Glejser test χ^2:	5.288	6.141	4.391
RAMSEY TEST: $F_{(1,12)}$:	8.8923	10.0872	9.697879
ARCH Observed: R^2:	0.669	0.581	0.393
Chow test $F-statistics_{(7,6)}$:	96.593815	390.8634	212.0615

Figures in parentheses [ ], { } indicates standard error and t-statistics of the concerned variables and p-values

(*) *Significant at (0.01) 1% level*

(**) *Significant at (0.05) 5% level*

(***) *Significant at (0.10) 10% level*

It is because the coefficient of all the variables is significant too. This indicates the inclusion of appropriate and relevant variables in the model. The regression coefficient also shows the presence of regression, as the F-test is significant at more than the 99 percent confidence limit. Similarly, the coefficient of determination R^2 is 0.988, indicating that 98.8 percent of the variations in GDP are explained by the variation of the regressors included in the model.

Durbin Watson test: Durbin Watson d statistics of the model is 1.5875, 1.236 and 1.281 that are shown in Table 1 using VAT and 5 intervening variables with 25 observations and the table values of upper and lower bound at 5% level. The result of DW test has been reported in Table 1, with the table values of upper and lower bound of d at 5 percent level. The econometric theory points out that the d-statistics has to lie between (d_U) and$(4 - d_U)$ to confirm autocorrelation in the model. From the result, it shows that d-statistics 1.5875, 1.2361 and 1.2812 lie between upper bound (d_U) and $(4 - d_U)$ [i.e. d_U< d <$4 - d_U$]. Thus, it confirms absence of auto correlation in the entire model, whereas the value of DW d statistics lies in indecisive area.

Normality test: Table 1 presents the application of the JB statistic which is 9.7057, and the probability of obtaining such a statistic under the normality assumption is 0.007<0.05. Therefore, the null hypothesis has been rejected indicating that the error terms are distributed normally.

Serial correlation test: ***Null hypothesis: There is no serial correlation in the residuals.*** Observed χ^2 is 1.41805 and the p-value is 0.2337>0.05. So, the null hypothesis is not rejected that means there is no serial correlation in the model.

Heteroskedasticity test: Null hypothesis: ***there is no heteroskedasticity.*** The observed χ^2 is 5.14015 and p-vale i.e. 0.5770>0.05. Therefore, null hypothesis is not rejected, implying that there is no heteroskedasticity in the residuals of this model.

Glejser test: *The observed value* χ^2 is 5.28810 and p-value i.e. 0.6417>0.05. So it cannot reject null hypothesis, which means there is no heteroskedasticity in the residuals of this model.

Specification test: ***Null hypothesis: dependent variable is stable.*** The $F_{(1,12)}$: 8.8923 and p-value i.e. 0.0114 < 0.05. Hence, it cannot reject null hypothesis,

indicating that the predicted value or value of dependent variable is stable over the study and prediction period.

Structural break test: $F_{(7,6)}$: 96.593815 and p-value i.e. 0.0176<0.05. So, it can reject null hypothesis and accept the alternative hypothesis, implying that there is no structural break on time series data used for the model of the study period.

Table 2. Multicollinearity test

Multicollinearity test: Variables	VIF (I)	VIF(II)	VIF (III)
VATLOGC	150.399	15.299	100.165
EXRLOGC	2.611	2.611	2.862
RLOGC	8.355	7.488	7.610
MCLOGC	10.231	14.412	12.758
MSLOGC	14.438	6.346	-----
LNGSPDC	161.664	-----	100.571

The values 150.399, 10.231, 14.438, and 161.664 are fairly large. The VIF for the predictor indicates that the variance of the estimated coefficient of Weight is inflated by a factor of VIF because Weight is highly correlated with at least one of the other predictors in the model, or the VIF>10. Therefore, the null hypothesis can be rejected and the alternative hypothesis accepted. That means explanatory variables are collated, or the model has a multicollinearity problem. Again, this variance inflation factor indicates that the variance of the weight coefficient is inflated by a factor.

From the above three equations I, II and III, the second equation II is being employed for the error correction model. The time series data is in the model involves at first difference. The residual of the equation II is taken as independent variable as shown in equation IV as (ECM_{t-1}) *in Table 2. Since it is observed that residuals are not normally distributed, autocorrelation and multicollinearity problem in the model, it is necessary to improve the non-normal distribution, autocorrelation and multicollinearity problem in the model. Therefore, the data are transposed into first difference and run the model with error correction model*(ECM_{t-1})*.*

Error correction model (ECM)without Agriculture GDP

With the identification of cointegration of a set of variables, the dynamics of economic development proxied by GDP are explored. Following the general-to-specific

modeling methodology, an initially over-parameterized model with one lag on the dependent and independent variables has been continually specified and re-parameterized until a parsimonious representation of data generation is meant for obtaining careful and sufficient representation in terms of degrees of freedom. The inclusion of a large number of lag lengths reduces the degree of freedom. However, because of the small sample size (need to preserve the degree of freedom), the initial model includes only one lag on the dependent and independent variables.

$$\Delta(\ln GDPWA_{ct}) = \beta_0 + \beta_1 \Delta\ln VAT_{ct} + \beta_2 \Delta\ln EXR_{ct} + \beta_3 \Delta\ln R_{ct} + \beta_4 \Delta\ln MC_{ct} + \beta_5 \Delta\ln MS_{ct} + \beta_6 \Delta\ln ECM_{t-1} + \beta_7 \Delta\ln GDPWA_{t-1} \quad \text{(IV)}$$

Where Δ is the first difference operator, ECM_{t-1} is the lagged error correction term from equation II of Table 1. The use of first difference lagged GDPWA facilitates to obtain long-run and short-run impact of the variable included in the model.

Table 2 shows that the necessary econometric conditions are satisfied in the model. This indicates the presence of a sound model of the GDPWA and VAT relationship and the prediction of VAT productivity. The first difference of intervening variables—market capitalization, exchange rate, remittance, money supply, and error term—keeping constant, there is a positive significant impact of VAT on the economic development of Nepal.

The first order conditions of statistics as shown by F-statistics, t-statistics, and R^2 in the table are satisfactory. The calculated value of F-statistics is higher 3.727307 than the table 1 value at 0.01 levels. The coefficient of VAT, market capitalization, remittance, exchange rate and money supply error and lagged GDP are simultaneously and jointly equal zero that rejects the null hypothesis in favor of the alternative hypothesis. The R^2 shows that the explanatory power of the model is 0.528 indicating that 52.89 % of the variation of GDP is explained to the extent of 52.8 by percent variation of the independent variable in the model.

The diagnostic test suggests that the residuals do not violet classical assumptions. The lagged residuals from II equation of Table 2 ECM_{t-1} are statistically significant indicating the acceptable ground to take variable as cointegrated set. The result allows long-run and short-run dynamics of all the relationship between GDPWA and VAT. The estimated coefficient of VAT in error correction model shows that one percent point rise in VAT has led to 0.438 percent point increase in real GDPWA in short-run, whereas it is found 0.558 percent point in long-run. It means that short-run marginal productivity of VAT is 0.438 percent point, whereas its long-run percent point is 0.558.

Normality test: ***Null hypothesis: residuals are not normally distributed.*** Since Jarque-Bera p-value is 0.000028 <0.05 at 5% significant level, null hypothesis is rejected and alternative hypothesis accepted, meaning that residuals are normally distributed after the first difference level with error correction model.

Table 2. Cointegrated Regression Results

$$\Delta(lnGDPWA_{ct}) = \beta_0 + \beta_1 \Delta lnVAT_{ct} + \beta_2 \Delta lnEXR_{ct} + \beta_3 \Delta lnR_{ct} + \beta_4 ln\Delta lnMC_{ct} + \beta_5 ln\Delta lnMS_{ct} + \beta_6 \Delta lnECM_{t-1} + \beta_7 \Delta lnGDPWA_{t-1}$$

$$0.00689 + 0.43859^{*}\Delta lnVt_i + 0.07838\Delta lnEXR_i + 0.043779\,\Delta lnR_i - 0.03012\Delta lnMC_i$$

[0.00732] [0.10781] [0.11612] [0.04249] [0.03339]
{0.9419} {4.06801} {0.6750} {1.02998} {- 0.9019}

$$+0.020\Delta lnMSi + 0.846^{**}\,\Delta lnECM_{t-1} - 0.214\Delta lnGDP\beta_{t-1}$$

[0.02247] [0.36556] [0.19951]
{0.8900} {2.3153} {- 1.070}

$F_{(7,10)}$: $(3.727307)^{**}$ Adjusted R^2 : 0.528984

DW: 1.9239

Jarque-Bera	J-B stat	: 21.129
Breusch-Godfrey LM	χ^2	: 0.4297
Breusch- pagon	χ^2	: 2.04211
Glejser test	χ^2	: 3.8793
RAMSEY TEST -$F_{(2,7)}$		: 3.9004
ARCH Obs. R^2		: 0.188760
Chow-test	$F_{(7,3)}$	: 1.69792

Multicollinearity test:

Variables	VIF
VATLOGC_1	1.157
EXRLOGC_1	1.361
RLOGC_1	2.546
MCLOGC_1	2.194
MSLOGC_1	1.458
RES_1	2.511
GDPWALOGC_2	1.531

Figures in parenthese [ ], { } and ( ) indicates standard error, t-statistics of the concerned variables and p-values.
(*) *Significant at (0.01) 1% level*
(**) *Significant at (0.05) 5% level*
(***) *Significant at (0.10) 10% level*

Durbin Watson test: ***Null hypothesis: residual are correlated:*** DW test-statistics is 1.9239 and p-value is 0.039<0.05 that is significant at 5% level, which means that null hypothesis is rejected and alternative hypothesis accepted. This implies that residuals nave no auto correlated after first difference. The econometric theory points out that the d-statistics has to lie between (d_U) and$(4 - d_U)$ to confirm autocorrelation in the model. From the result, it shows that d-statistics 1.9239 lies between upper bound (d_U) and$(4 - d_U)$ [i.e. d_U< d < $4 - d_U$]. Thus, it confirms the absence of auto correlation in the error correction model.

Serial correlation test: ***Null hypothesis: There is no serial correlation in the residuals.*** Since observed χ^2 is 0.4297 and the p-value is 0.5269>0.05, null hypothesis cannot be rejected implying that there is no serial correlation in the model.

Heteroskedasticity test: ***Null hypothesis: there is no heteroskedasticity.*** Since the observed χ^2 is 2.04211 and p-vale is 0.9575 >0.05, null hypothesis cannot be rejected, indicating that there is no heteroskedasticity in the residuals of this model.

Glejser test: ***Null hypothesis: there is no heteroskedasticity in the residuals.*** Since the observed value $\chi^2$is 3.8793 and p-value 0.7936 > 0.05, null hypothesis is not rejected, meaning that there is no heteroskedasticity in the residuals of this error correction model.

Specification test ***Null hypothesis: dependent variable is stable.*** Sincec the $F-statistics_{(1,12)}$: 3.9004 and p-value is 0.0657 < 0.10, the null hypothesis is not rejected implying that the predicted value or value of dependent variable is stable over the study and prediction period.

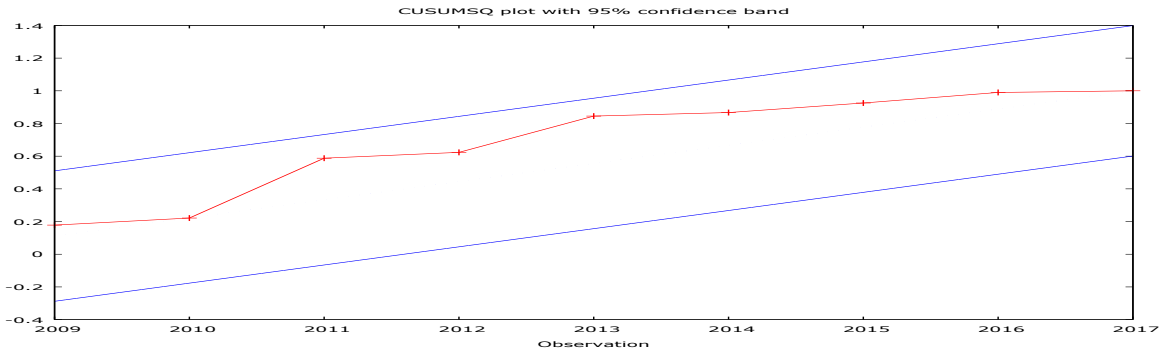

Figure 1.

Figure: 1. shows the predicted value within the upper bound lower bound and the predicted value. It can be well observed from the figure that the predicted value is perfectly stable between the upper bound and lower bound.

Multicollinearity test: ***Null hypothesis: explanatory variables are not correlated.*** The VIF < 10. Hence, null hypothesis is not rejected indicating that explanatory variables are not collated or the model has no multicollinearity problem. Again, this variance inflation factor implies that the variance of the weight coefficient is not inflated by a factor. The estimated value of Y has normally moving around the actual value of Y. The model is the best fit.

CONCLUSION

It is found that the relationship between VAT and the national economy's GDPWA has a positive relationship in the long and short run. The result allows long-run and short-run dynamics of all the relationships between GDPWA and VAT. The estimated coefficient of VAT in the error correction model shows that a one percentage point rise in VAT has led to a 0.438 percentage point increase in real GDPWA in the short run, whereas it is found 0.558 percentage points in the long run. It means that the short-run marginal productivity of VAT is 0.438 percentage points, whereas its long-run percentage point is 0.558. Therefore, OLS estimates of the coefficients for the sample are pretend.

All factors for the interaction term are as per expectation, though marginal and statistically significant, implying a gradual improvement in VAT administration. Further, it found estimates to be biased if the DGPWA is not habituated by income tax exclusion. Empirical results show that the long-run impact of VAT coefficients for VAT is the lowest, indicating the areas of reform to be focused on in VAT revenue administration and stakeholders of VAT.

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