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Production VAT elasticity on Nepalese economy without agriculture

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Abstract

This paper aims to investigate the flexibility of production Value Added Tax (PVAT) on Nepalese economy (excluding agriculture) by analyzing its impact on the production sector's Gross Domestic Product (PGDP). The study utilizes an explanatory research design to determine the relationship between PVAT and PGDP, exchange rate, market capitalization, money supply, and government spending as intervening variables. To establish a cointegrated regression model with time series data for the 20-year period from 2003/04 to 2022/23, a model specification is employed. The variables are converted into real prices using the GDP deflator, with the GDP deflator and CPI year 2013/14 considered equivalent to the base year 2013/14 according to the Nepalese fiscal year. Due to the presence of non-normal distribution, autocorrelation, and multicollinearity issues in the model, the data is transformed into first differences, and an error correction model is run. The F-test is significant at a confidence limit of over 99 percent, while the coefficient of determination is 0.245, indicating that 24.5 percent of the variations in the production sector PGDP are explained by the variables included in the regression model.

Keywords: Elasticity, production, GDP, VAT, Economy

1. Introduction

VAT as being the neutral tax can avoid inefficiency of some other indirect tax. This implicates that the VAT is argued to be a powerful method to promote economic growth (GDP). Taxing on intermediate transactions, business tax leads to the loss of the production efficiency. Sales tax also inevitably leads to loss of productivity due to the difficulty in distinguishing the final sales (Ring, 1999). Therefore, in practice, VAT is used to replace the business tax and the single stage sales tax. But some scholars believe that VAT, in simplicity and universality, has the potential advantages compared with the turnover tax, but the comparative advantage is not dramatically remarkable in economic efficiency in the thought of an ordinary person. In terms of VAT, the studies were initially focused on assessing the impact of this tax on international trade (Feldstein and Krugman, 1989) or on identifying the determinants of tax revenue (Bogetic and Hassan, 1993). Later, attention was directed to studying the effectiveness of this kind of tax (Bird and Gendron, 2006). More recently, the relationship between VAT revenue and total tax revenue has been studied, but in terms of the impact which tax system can have on economic growth (Okoli and Afolayan, 2015). The problem was formulated exclusively in terms of economic impact

and less in terms of fiscal sustainability. The European Commission (2015) tends to be more interested in enhancing fiscal.

Income level is an indicator of the purchasing power of the people in the economy, increase in income leads to the higher demand for import of goods and services and also increase in the production level and further increase in the purchasing power of the people of the country. Higher purchasing power forces higher consumption and higher consumption increases VAT revenue collection. The factors such as exchange rate, remittance, market capitalization, money supply and government spending affect the VAT revenue. The theoretical logic behind this argument is that increase in exchange rate, market capitalization, money supply and decrease in government spending and remittance discourage the purchasing power of the people in the country. When purchasing power decreases it leads to decrease in consumption, whereas VAT is consumption-based tax so it also decreases.

2. Review of literature

In some developing countries, VAT is the core content of the modern tax management system as it simplifies the tax management, improve tax compliance. But, VAT has also some potential disadvantages and is not conducive to efficiency. When the transaction chain once broken, VAT leads to the loss of the production efficiency (Desai-Hines, 2005). In addition, because tax system is not perfect, and the statutory tax rebate is too high, it means the VAT does not help the export and trade; hence reduce exports and domestic output. Meanwhile, VAT has a negative impact on informal sector of the economy (Piggott and Whalley, 2001, Emran and Stiglitz, 2005, Keen, 2008). Therefore, since it is not clear whether the performance of VAT is conducive to the improvement of the efficiency, there is only one empirical study, i.e. how to explore the efficiency gain or efficiency loss is a problem in the experience (Keen and Lockwood, 2010). The existing domestic research has not distinguished the composition of productivity, and many research studies only have simple narrative, or just a simple list of data, the lack of empirical econometric analysis is a weak point of these studies.

Recent research focuses on analyzing the relationship between VATrevenues and economic growth, 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 easy, less expensive, and convenient method for a developing economy. Indirect taxes are excise duty, import and export tax or custom duty, Value Added Tax (VAT/GST), sales tax, entertainment tax, road tax, air flight tax, vehicle tax, etc. In any developing economy, indirect taxes occupy the most important means to finance. Among the indirect taxes VAT is the pivotal one (Tait, 1991). Khadka (2008) maintains that in Nepal, the average growth rate of expenditure over revenue during 1996 to 2008 is increasing. Under such a condition, Nepal is facing a serious problem of resource gap and dependency on foreign aid and loan. The widening resource gaps: revenue-expenditure, saving-investment and import-export gaps of the country have further affected the level of macroeconomic stability of the country (Dahal, 1996).

Six of the eight countries that form part of the SAARC comprises of 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, extend right through the retail level (Khadka, 2015).

3. Methodology

To examine the relationship between Production Value added tax (PVAT) and economic growth proxied by PGDP in aggregate level without agriculture, the study employs explanatory research design considering PVAT as independent variable and PGDP as the dependent variable in aggregate level, 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 significant positive impact of PVAT on PGDP. Similarly, it is also hypothesized that the intervening variables government spending and money supply have positive relationship, while exchange rate and market capitalization have negative. In the process of using and testing the relationship between remittance and GDP with other intervening variables, error correction model (ECM) is used. Various other tests such as 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 observation from the fiscal year 2003/04 to fiscal year 2022/23. The values of all variables are converted into real price (constant price) by 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 20 years period. The GDP deflator and CPI year 2013/14 has been assumed equivalent to the base year 2013/14 according to Nepalese fiscal year. The simple linear model has been converted into natural log linear 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 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).

4. Model I: Production sector (PGDP) as dependent and production sector (PVAT) revenue as independent variable and other intervening variables.

The production sector PVAT revenue, remittance and money supply positively affect the production sector national economy (PGDP), while market capitalization and government spending have negative, and exchange rate has mixed effect on production sector national economy (PGDP). In order to examine the effect of each of this independent variable on production sector economic development, a multiple regression model has been used. The relationship between the dependent and independent variable has specified as under.

$PGDP_{ct} = f\ (PVAT_{ct},\ Exr_{ct},\ R_{ct},\ MC_{ct},\ MS_{ct},\ GSP_{ct})$

For the purpose of examining the factors affecting production sector national economy (PGDP), the empirical models have been specified, as in equations I, II and III.,

$\ln PGDP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln MS_{ct} + \beta_6 \ln GSP_{ct} + \ldots + e_i$ I

$\ln PGDP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln MS_{ct} + \ldots + e_i$ II

$\ln PGDP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln GSP_{ct} + \ldots + e_i$ III

where,

$\ln PGDP_{ct}$, Represents log linear Production Gross Domestic Products at constant price at time 't'.

$\ln PVAT_{ct}$= Represents Value Added tax revenue in constant price at time 't' in logarithm.

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

$\ln R_{ct}$ = Represents Remittance at constant price at time 't' in logarithm.

$\ln MC_{ct}$ = 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.

H_{01}: Production PVAT has significant impact on PGDP with other intervening variables.

5. Analysis and Results

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 is 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 to obtain short and long-term effect 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 has a unit root or not. If the absolute test statistics is more than critical value then null hypothesis that the series is non-stationary cannot be accepted. That is the guidelines. However, if the absolute test statistics is less than critical value, null hypothesis can be rejected and the alternative hypothesis will be accepted.

H_1*: The variable log linear at constant price has stationarity or no unit root.*

Table:1

Dickey fuller, Augmented Dickey fuller and Unit root test

Variables	Test	Dickey-fuller	Augmented Dickey-fuller	p-value	Coefficient At lag	Unit root t-stat ( )	p-value
$lnGDPP_{ct}$	At level	-1.9601 (-1.3988)	-3.0299 (-2.8420)	0.0712	-0.1709	1.2632 (855.434)	0.000

	At first difference	-1.9614 (-3.7296)	-3.0403 (-3.6763)	0.0144	-1.0275	1.7143 (35.110)	0.000
$\ln PVAT_{ct}$	At level	-1.1960 (0.0646)	-3.0299 (-0.2518)	0.9155	-0.01285	1.5339 (120.847)	0.000
	At first difference	-1.9614 (-6.3317)	-3.0655 (-4.0664)	0.0076	-2.4594	3.2321 (28.037)	0.000
$\ln Remit_{ct}$	At level	-1.9601 (-1.4005)	-3.0299 (-3.1243)	0.0417	-0.01874	1.2948 (159.197)	0.000
	At first difference	-1.9614 (-3.5551)	-3.0403 (-3.4501)	0.0226	-0.8662	1.8292 (56.0503)	0.000
$\ln MC_{ct}$	At level	-1.9601 (-0.5294)	-3.0299 (-0.9999)	0.7312	0.0746	1.2805 (144.245)	0.000
	At first difference	-1.9644 (-3.7019)	-3.0655 (-3.6319)	0.0174	-1.3269	1.7718 (51.8051)	0.000
$\ln GSP_{ct}$	At level	-1.9601 (0.3886)	-3.0299 (0.2740)	0.9701	0.0140	1.2857 (401.905)	0.000
	At first difference	-1.9614 (-4.1423)	-3.040 (-4.0708)	0.0065	-1.0714	1.7992 (143.491)	0.000

$lnEXR_{ct}$	At level	-1.9601 (-0.5063)	-0.30299 (-0.4639)	0.8783	-0.0614	2.1073 (113.8986)	0.000
	At first difference	-1.9614 (-5.4741)	-3.0403 (-5.3507)	0.0005	-1.2857	-12.910 (-6.2871)	0.000
$lnMS_{ct}$	At level	-1.9601 (-1.5863)	-3.0299 (-1.7535)	0.3903	-0.2887	1.2420 (375.850)	0.000
	At first difference	-1.9614 (-6.8129)	-3.0403 (-6.6097)	0.000	-1.4639	1.6378 (142.2958)	0.000

It is evident from Table: 1 that the variable $lnpGDP_{ct}$ has the p-value that is 0.5581 > 0.05 so it cannot reject the null hypothesis, meaning that the variable $lnpGDP_{ct}$ at level has a unit root. The test statistics guidelines indicate that if test statistics is more than critical value at 5%, it cannot reject null hypothesis but the test statistics -1.404466 and critical value at 1%, 5% and 10% is less than the test statistics. So it cannot reject null hypothesis, meaning that $lnPGDP_{ct}$, has a unit root and all the other variables $lnRmit_{ct}$, $lnMC_{ct}$ lnR_{ct} $lnEXR_{ct}$, $lnGSPDs_{ct}$ and $lnMS_{ct}$, have the P-value >0.05, so it cannot reject 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. -0.047171of all the variables, so the model is viable. ***When the Variables are converted into first difference:*** *A*fter the first differences level of the probability or the p-value that is 0.0081<0.05. So, it can reject the null hypothesis, meaning that $lnGDP_{ct}$ 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 times lag the probability value or p-value < 0.05 indicates the null hypothesis cannot be rejected, which means that the variables have autocorrelation at level. By checking all the variables including variables $lnPGDP_{ct}$,ln $PVAT_{ct}$ ln Remit T_{ct}, $lnEXR_{ct}$ lnR_{ct} $lnMC_{ct}$, and $lnMS_{ct}$. In various times lag the probability value or p-value < 0.05 indicates the null hypothesis cannot

be rejected, meaning that the variables have autocorrelation at level. At 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 times lag, the probability value or p-value > 0.05 indicates the null hypothesis can be rejected which means that the variables have no autocorrelation at first difference level. All the inclusion variables have checked its autocorrelation by using correlogram.

6. Production sector PGDP as dependent and production sector PVAT revenue as independent variable and other intervening variables.

The logical relationship as specified in the research framework hypothesizes that production sector national GDP (PGDP) is positively affected by production sector PVAT revenue, remittance and money supply, while there is a negative effect of market capitalization and government spending. However, there is mixed effect of exchange rate on production sector national economy (GDPP). In order to examine the effect of each of these independent variables on production sector GDP, a multiple regression has been used. For the purpose of examining the factors affecting production sector National economy (GDPP), the empirical models have been specified, as given in equations I , II and III

$$\ln GDPP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln MS_{ct} + \beta_6 \ln GSP_{ct} + . \ e_i . \text{(I)}$$

$$\ln GDPP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln MS_{ct} + \ldots + e_i . \quad \text{(II)}$$

$$\ln GDPP_{ct} = \beta_0 + \beta_1 \ln PVAT_{ct} + \beta_2 \ln EXR_{ct} + \beta_3 \ln R_{ct} + \beta_4 \ln MC_{ct} + \beta_5 \ln GSP_{ct} + \ldots \ldots + e_i \quad \text{(III)}$$

Where,

$\ln GDPP_{ct}$ = Represents Production Gross Domestic Products at constant price at time 't' in logarithm.

$\ln PVAT_{ct}$ = Represents Value Added tax revenue in constant price at time 't' in logarithm.

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

$\ln R_{ct}$ = Represents Remittance at constant price at time 't' in logarithm.

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

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

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

The results of regression equations I , II and III specified for production economic development as dependent variable in aggregate level and the production sector Value Added Tax revenue (PVAT) as independent variable and exchange rate ($\ln EXR_{ct}$) remittance ($\ln R_{ct}$), market capitalization ($\ln MC_{ct}$) money supply ($\ln MS_{ct}$)and Government spending ($\ln GS_{ct}$) as intervening variables. The long-run cointegrating

economy of the country (GDPP) is estimated using ordinary least square (OLS) multiple regression. More specifically, GDPP represents production sector economic development at constant price over a specified period of 20 years. In this study, regression has been used to predict productivity of production VAT revenue collection. Different test statistic has also been employed to identify the violation of multiple regression assumptions. The results of which are presented in Table: II

The results of regression equation I, II and III specified for total production sector economic development (GDPP) as dependent variable and the value of total production sector value added tax revenue (PVAT) as independent variable with other intervening variables are shown table II. The results of the model describe the direction and magnitude of the relationship between dependent variable production economic development (GDPP), independent variable, production sector Value Added Tax (PVAT) revenue and other intervening variable in the prescribed model. The coefficient of the entire model has been as per expectation, meaning that the model has positive impact on production sector economic development (GDPP).

The results of regression equation I, II and III specified for total production sector economic development (GDPP) as dependent variable and the value of total production sector value added tax revenue (PVAT) as independent variable with other intervening variable are shown table I.

Table: II
Regression of Production sector GDP with production sector VAT with other intervening variables

Parameters/variables	Equation: I	Equation: II	Equation: III
Constant (β_0)	3.20218*	3.63252*	3.14192*
	[0.448696]	[0.210764]	[0.44086]
	{6.5760}	{17.23507}	{7.1267}
PVAT revenue (β_1)	0.08276	0.241930**	0.044103
	[0.184164]	[0.086896]	[0.142485]
	{0.44940}	{2.78411}	{0.309531}
Exchange rate (β_2)	−0.16535	−0.165562	−0.15918
	[0.125119]	[0.124947]	[0.119920]
	{-1.32200}	{−1.3250}	{-1.32738}

Remittance (β_3)	0.171703* [0.03629] {4.73037}	0.161999* [0.034855] {4.645821}	0.175724** [0.033326] {5.272228}
Market Capitalization (β_4)	−0.067258 [0.0390745] {-1.72129}	−0.054226 [0.0366946] {−1.47779}	0.064443 [0.037015] {- 1.74098}
Money Supply (β_5)	0.023279 [0.066658] {0.34920}	0.0642625 [0.0518581] {1.239208}	--- --- ---
Government Spending (β_6)	0.247140 [0.252026] {0.9806}		0.302325 [0.190082] {1.590494}
Adjusted R^2	0.994484	0.944997	0.948305
Durbin –Watson	2.675368	2.333520	2.703677
$F_{(1,12)}$	55.24853	66.2877	70.70841
Jarque-Bera statistic	1.026402	1.33362	0.701753
Breusch-Godfrey LM Observed χ^2:	7.684	1.584	7.007
Breusch- pagon observed: χ^2:	10.840	6.098	10.619
Glejser test Observed: χ^2:	11.339	7.153	10.188
RAMSEY TEST: $F_{(1,12)}$:	1.24572	0.004018	1.221318
ARCH Observed: R^2:	0.38224	0.99890	4.287300
Chow test $F_{(7,6)}$:	2.11387	21.86314	20.61706

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*

The results of the model describe the direction and magnitude of the relationship between dependent variable production economic development (GDPP), independent variable, production sector Value Added Tax (PVAT) revenue and other intervening variable in the prescribed model. 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 the sign of exchange rate appeared negative. Moreover, the coefficient of the variable including in the equation II also provides more satisfactory results as compared to the other two equations I and III. It is because the coefficient of all the variables is significant in the model II. 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 99 percent confident limit. Similarly, the coefficient of determination R^2 is 0.944 indicating that 94.4 percent of the variations in production sector GDPP are explained by the variation of the regressors' included in the model.

Normality test: From the table II, it is seen that the JB statistic is 1.33362, and the probability of obtaining such a statistic under the normality assumption is 0.4885 >0.05. Therefore, null hypothesis is not rejected, implying that the error terms are not normally distributed.

Serial correlation test: *Null hypothesis: There is no serial correlation in the residuals.* Since the observed χ^2 is 1.584723 and the p-value is 0.02094 <0.05, null hypothesis is not rejected, meaning that there is no serial correlation in the model.

Durbin Watson test: *Null hypothesis: residual are correlated:* Durbin Watson d statistics of the model 5.8 are 2.675, 2.3335 and 2.7036 shown using VAT and 5 intervening variables with 20 observations with the table values of upper and lower bound at 5% level. The result of DW test has been reported in Table II with its table value of upper and lower bound of d at 5 percent level. From the result, it shows that d-statistics 2.675, 2.3335 and 2.7036 lie between upper bound (d_U) and($4 - d_U$) [i.e. d_U< d < $4 - d_U$], which confirms the absence of auto correlation in the entire model. But the value of DW d statistics lies in indecisive area.

Heteroskedasticity test: *Null hypothesis: there is no heteroskedasticity.* Since The observed $\chi^2$is 6.098 and p-vale 0.0269>0.05, null hypothesis is not rejected, implying 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 χ^2 is 11.3396 and p-value is 0.02081>0.05, null hypothesis is not rejected, indicating that there is no heteroskedasticity in the residuals of this model.

Specification test: *Null hypothesis: dependent variable is not stable.* Since the $F_{(2,12)}$: 0.004.18 and p-value is P > 0.05, null hypothesis is not rejected, which means that the predicted value or value of dependent variable is not stable over the study and prediction period.

Autocorrelation: *Null hypothesis: there is no conditional error variance.* The observed R^2 *is* 0. 998907 and P-value is 0.050= 0.05. Hence, the null hypothesis is not rejected, meaning that the model has no conditional error variances at 5% level.

Multicollinearity test:. *Null hypothesis: explanatory variables are not correlated.*

Multicollinearity test:

Variables	VIF (I)	VIF(II)	VIF (III)
PVATLOGC	149.996	11.155	31.910
EXRLOGC	2.679	2.679	2.625
RLOGC	8.509	7.867	7.653
MCLOGC		14.208	12.565 13.603
MSLOGC	10.669	6.475	-----
GSPDLOGC	73.660	-----	44.704

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. Since the VIF values 149.966, 14.208, 73.660 and 10.669 >10, null hypothesis cannot be rejected, which means that the explanatory variables are collated or the model has multicollinearity problem.

Structural break test: *Null hypothesis: There is no structural break in the time series data.* $F_{(1,12)}$: 2.11387 and p-value is 0.1716 > 0.05. Therefore, null hypothesis is not rejected, implying that there is structural break on time series data used for the model of the study period.

Since it is observed that residuals are not normally distributed in the model, it is necessary to improve the model. 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 5.8.2 is taken as independent variable as shown in equation 5.8.4 as (ECM_{t-1}) *in Table III Therefore, the time series data are transposed into first difference and run the model with error correction model*(ECM_{t-1})*.*

Error correction model (ECM) production sector PGDP.

Following the general to specific modeling methodology, an initially over-parameterized model with one lag on the dependent and independent variables was continually specified and re-parameterized until a parsimonious representation of data generation is meant for obtaining careful and sufficient representation in terms of degree of

freedom. The inclusion of large number of lag length 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 variable.

$$\Delta (\ln PGDP_{ct}) = \beta_0 + \beta_1 \Delta \ln PVAT_{ct} + \beta_2 \Delta \ln EXR_{ct} + \beta_3 \Delta \ln R_{ct} + \beta_4 \Delta \ln MC_{ct}$$

$$+\beta_5 \Delta \ln MS_{ct} + \beta_6 \Delta \ln ECM_{t-1} + \beta_7 \Delta \ln GDPP_{t-1} \text{ - - (IV)}$$

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

The first order condition of statistics of the model as shown by F-statistics, t-statistics, and R^2 are satisfactory. The calculated value of F-statistics of equation IV indicates in table III higher 4.1348957 than table value of F at 0.01 level. It means that the coefficients of production sector VAT, market capitalization, remittance, exchange rate and money supply error and lagged PGDP are simultaneously and jointly equal to zero and the null hypothesis is rejected in favor of the alternative hypothesis. The R^2 shows that the explanatory power of the model is 0.5634, indicating that 56.34 % of the variation of GDP is explained by the variation of the independent variable in the model.

Table: III

Cointegrated Regression Results

$\Delta (\ln GDPP_{ct}) = \beta_0 + \beta_1 \Delta \ln PVAT_i + \beta_2 \ln \Delta EXR_i + \beta_3 \ln \Delta R_i + \beta_4 \ln \Delta MC_i + \beta_5 \ln \Delta MSi + \beta_6 \ln \Delta ECM_{t-1} + \beta_7 \ln \Delta GDPP_{t-1}$

$-0.00232 + 0.24555^{***} \Delta \ln VAT_{ct} - 0.21958 \ln \Delta EXR_{ct} + 0.11431^{***} \Delta \ln R_{ct} + 0.01541 \ln \Delta MC_{ct}$

[0.008933] [0.134706] [0.153846] [0.061877] [0.054496]

{-0.2597} {1.82311} {- 1.42766} {1.847}*** {0.2827}

$+0.0682^{***} \Delta \ln MSi_{ct} + 1.2435^{*} \Delta \ln ECM_{ct-1} - 0.078 \ln \Delta GDP_{ct-1}$

[0.031525] [0.262953] [0.36029]

{2.163} {4.729} {- 0.218}

$F_{(7,10)}$: $(4.1348957)^{**}$ Adjusted R^2 : 0.5634

DW : 1.8387

Jarque-Bera : 1.0789

Breusch-Godfrey LM χ^2 : 2.7889

Breusch- pagon. χ^2	: 11.2854	
Glejser test χ^2	: 2.215	
RAMSEY TEST=F $_{(3,7)}$:	: 0.045428	
ARCH Obs. R^2	: 0.057093	
Chowtest F $_{(6,4)}$	: 0.684005	
Multicollinearity test:	Variables	VIF
	VATLOGC_1	1.501
	EXRLOGC_1	1.440
	RLOGC_1	3.253
	MCLOGC_1	3.521
	MSLOGC_1	1.730
	RES_1	1.251
	PGDPLOGC_2	4.042

Figures in parentheses [ ], { } 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*

It can be seen from Table IV necessary conditions are satisfied indicating the presence of a sound model of production sector PGDP to production sector value added PVAT. The intervening variables at first difference of market capitalization, exchange rate, remittance, money supply and error term have a positive significant impact on production sector PGDP. The production sector PVAT revenue in the production sector PGDP significantly affected. The diagnostic test suggests that the residuals do not violet classical assumptions. The lagged residuals from IV equation of Table III 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 PGDP and PVAT.

The estimated coefficient of VAT in error correction model shows that one percent point rise in PVAT has led to 0.245 percent point increase in real PGDP in short-run, whereas it is found 0.266 percent point in long-run. It means that short run marginal productivity of PVAT is 24.5% percent point, whereas its long run percent point is 26.6.

Durbin Watson test: *Null hypothesis: residuals are correlated:* DW test-statistics is 1.8387 and p-value is 0.0496<0.05 significant at 5% level. It means that null hypothesis is rejected, implying that residuals have no auto correlation after first difference. So, the model is best fit. The result of DW test has been reported in Table III. 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 1.8387 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.

Normality test: *Null hypothesis: residuals are not normally distributed.* Jarque-Bera p-value is 0.003047 <0.05, significant at 1% level. Therefore, the null hypothesis is rejected, meaning that residuals are normally distributed after the first difference level with error correction model.

Serial correlation test: *Null hypothesis: There is no serial correlation in the residuals.* Observed χ^2 is 2.7899 and the p-value is 0.0949 >0.05, so, the null hypothesis cannot be rejected, indicating 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, the null hypothesis cannot be rejected, implying that there is no heteroskedasticity in the residuals of this model.

Glejser test: *Null hypothesis: there is no heteroskedasticity in the residuals. The observed value* χ^2 is 11.2854 and p-value is 0.0.1266 > 0.05, so null hypothesis cannot be rejected, meaning that there is no heteroskedasticity in the residuals of this error correction model.

Specification test: *Null hypothesis: dependent variable is stable.* The $F_{(1,12)}$: 0.45428 and p-value is 0.0096 < 0.10. Therefore, the null hypothesis cannot be rejected, meaning that the predicted value or value of dependent variable is stable over the study and prediction period.

Multicollinearity test: *Null hypothesis: explanatory variables are not correlated.* The VIF < 10, null hypothesis cannot be rejected, indicating that explanatory variables are not collated or the model has no multicollinearity problem. Again, this variance inflation factor indicates 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 best fit model.

Conclusion

Regarding the relationship between dependent variable production economic development (PGDP), independent variable production sector Value Added Tax (PVAT) revenue and other intervening variables in the prescribed model, the constant β_0 of the entire model has been positive, indicating that the model has shown positive impact on production sector economic development (PGDP).

Therefore, in order to improve the non-normal distribution, autocorrelation and multicollinearity problem in the model, the time series data has been transposed into first difference and run the model with error correction model(ECM_{t-1}).

The estimated coefficient of VAT in error correction model shows that one percent point rise in PVAT has led to 0.245 percent point increase in real PGDP in the short-run, whereas it is found 0.266 percent point in the long-run. It means that the short-run marginal productivity of VAT is 24.5% percent point, whereas long-run marginal productivity is 26.6 percent point.

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