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Research Article

Impact of Value Added Tax on Indirect Tax and Total Tax Revenue: An Empirical Study from Nepal

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Abstract

This study examines the impact of value-added tax on indirect tax and total tax revenue collection in Nepal. The secondary data that covers 48 annual data points collected from the various economic surveys are used in this study. Descriptive and exploratory research designs are used. Some statistical and econometric tools like graphs, scatter plots, regression analysis, variance analysis, multicollinearity test, normality test (Shapiro-Wilk), and heteroscedasticity test are used. VAT revenue is statistically significant in determining Indirect tax and total tax revenue in Nepal. One percent increase in value-added tax results in 0.919 and 0.944 percent increase in indirect tax and total tax revenue in Nepal. A variation of 98.9 percent in indirect tax and 97.8 percent in total tax revenue depends upon VAT in the Nepalese economy. Policymakers in Nepal might use these findings to make informed decisions regarding VAT rates and policies, recognizing the substantial influence of VAT on overall tax revenue.

JEL Classification: H_{00}, H_{20}, H_{21}

Keywords: Sales tax; generation: significant: multicollinearity: variations.

Introduction

Value Added Tax (VAT) is a consumption tax levied at each stage of the production and distribution chain. It is considered an indirect tax because it is ultimately passed on to the final consumer (Bird and Gendron, 2007). VAT typically contributes significantly to indirect tax revenue. Its efficiency lies in capturing value addition at each stage of production, leading to a broad tax base (Keen and Lockwood, 2010). VAT is often praised for its economic efficiency as it minimizes tax cascading, encourages compliance, and allows for a more neutral impact on consumer behavior (Acosta-Ormaechea and Morozumi, 2021).

The concept of tax was introduced in 1919 by Germany as a new concept of the indirect tax system in the world (Dahal,

2020). VAT was introduced in 1998 as an alternative to sales tax in Nepal (Khadka, 2001). VAT can impact businesses by influencing pricing strategies, production processes, and compliance costs. The effects vary based on the design of the VAT system. The effectiveness of VAT in generating revenue depends on the efficiency of enforcement and compliance measures. Weak administration may lead to revenue leakage (Tanzi and Zee, 2001). Nepal has implemented a VAT system to collect indirect taxes on the sale of goods and services. Nepal typically has multiple VAT rates for different categories of goods and services. Rates may vary, and there could be exemptions or reduced rates for certain essential items.

VAT plays a pivotal role in generating indirect tax revenue by levying a consumption-based tax at each stage of the production and distribution chain. Its efficiency lies in capturing value addition, ensuring a broad tax base, and reducing tax cascading. VAT fosters economic efficiency, encourages compliance, and provides a stable revenue source for governments. In summary, the role of VAT in generating indirect tax revenue is significant due to its broad base, multiple-stage taxation, efficiency, and compliance mechanisms. Governments often rely on VAT as a critical component of their revenue-generating strategies (Jalata, 2014).

The VAT enhances total tax revenue through its broad-based consumption tax structure, multiple-stage taxation, efficiency, and compliance mechanisms. By capturing value at each stage of the production and distribution chain, VAT contributes to a steady and reliable revenue stream, making it a significant component of a government's total tax revenue.

This study tries to find the impact of VAT on indirect tax and total tax revenue in Nepal. It also examined the relationship between VAT and indirect tax and tax revenue in the Nepalese economy.

This study is divided into six parts. Part two presents the theoretical and empirical literature. The third section describes the study materials and procedures. In the fourth section, the data are provided and discussed. The results are discussed in Part Five and parallels the previous research endeavors of other experts. Section six discusses the study's limitations, policy implications, and conclusion.

Literature Review

The economic theories related to VAT and tax revenue are diverse, encompassing microeconomic and macroeconomic perspectives. The tax incidence theory, tax efficiency and neutrality, fiscal policy, and countercyclical theory are fundamental economic theories related to VAT and tax revenue. The tax incidence theory examines how a tax burden is distributed among producers and consumers. VAT is often considered a consumption tax, but the actual incidence can vary depending on the elasticity of supply and demand (Herberger, 1962).

The economic efficiency of a tax system is a crucial consideration. VAT is often praised for its neutrality and efficiency as it avoids distorting production and consumption decisions (Auerbach, 2006). Some economic theories posit that VAT can be an effective fiscal policy tool, allowing governments to adjust tax rates to stabilize the economy during economic downturns or overheating periods (Kopits and Symansky,1998). VAT systems often face challenges related to tax evasion. Economic theories about tax evasion and enforcement strategies are crucial for understanding the effectiveness of VAT in generating revenue (Slemrod, 2007).

VAT can have implications for international trade, affecting competitiveness and trade balances. Economic theories related to global trade and VAT focus on how VAT influences cross-border transactions (Keen and Ligthart, 2002). The Laffer Curve theory suggests that there is an optimal tax rate that maximizes revenue. VAT rates need to be set, considering revenue elasticity and balancing the need for revenue with the potential adverse effects on economic activity (Auerbach and Hassett, 2002).

Dahal (2020) observed the role of VAT in total tax revenue in Nepal. He found the positive and significant effect of VAT on tax revenue in Nepal. It was found that 99 percent of the variation was due to VAT in total revenue. Kunwar (2023) observed the impact of VAT on revenue generation. He found the positive impact of VAT on the generation of total tax revenue. VAT's multiplier effect is observed in Nepal's total tax revenue. Mu *et al*. (2022) found the impact of VAT on tax revenue in Ethiopia. They found a significant positive role of VAT in the tax revenue.

Most studies relate to VAT's role in the country's economic development. These studies are related to the survey about the role of VAT on tax revenue generation. Still, this study tries to find the impact of VAT on Indirect tax revenue and total tax revenue in Nepal.

Material and Methods

This study is based on descriptive and exploratory research designs**.** The impact of VAT on indirect tax and total tax revenue is explored using Jamovi 2.4.11 software, and the results are used to derive conclusions. Secondary data is used in this study, which covers 48 annual data from fiscal year 1974/75 to 2021/22. The secondary data are collected from various economic surveys of Nepal and publications of Nepal Rastra Bank. Three variables, VAT, indirect tax, and total tax revenue, are used in the study. VAT is the independent variable, and indirect tax and total tax revenue are the dependent variables. Some statistical and econometric tools like graphs, descriptive statistics, simple regression analysis, ANOVA, normality test,

multicollinearity analysis, and heteroscedasticity test are used.

Models are developed based on two assumptions: first, indirect tax depends upon VAT revenue, and second, total tax revenue depends upon VAT revenue. Based on these assumptions, two regression models can be developed as given below:

Indirect Tax = f (VAT) (1)

In symbol, INTX = f (VAT) (2)

In logarithmic form, LNINTX = f (LNVATT) (3)

A simple regression model can be specified as given below:

$Y = \beta_0 + \beta_1 X + \mu$ (4)

In equation 4, Y is the dependent variable, X denotes the independent variable, β_1 is the coefficient of the independent variable, and β_0 and μ are intercepts of the regression line and error term, respectively. After introducing the study variables, the equation concerted as given below:

$LNINTX = \beta_0 + \beta_1 * LNVATT + \mu$ (5)

$LNTTXR = \beta_0 + \beta_1 * LNVATT + \mu$ (6)

LNINTX indicates total indirect tax revenue after converting logarithms, and LNTTXR and LNVATT represent total tax revenue and value-added tax after converting logarithms. Simple regression is a statistical method that models the relationship between two variables, typically denoted as the dependent and independent variables, using a linear equation (Dahal *et al*. 2024). The goal is to find the line that best fits the data, allowing predictions of the dependent variable based on the values of the independent variable (Wallisch *et al*., 2022).

Presentation and Analysis

General Interpretation of Variables

The condition of variables is presented through graphical form and descriptive statistics. According to Fig. 1, the value-added tax, total tax revenue, and indirect tax are increasing gradually with slight variation in some fiscal years. The variation is observed in the fiscal years 2019/20, 2020/21, and 2021/22. The VAT, indirect, and total tax revenue fluctuate in the affected fiscal years.

Table 1 shows the descriptive statistics for the study variables that provide valuable insights into the distribution and variability of these financial measures in ten million rupees. The mean values indicate that, on average, indirect tax revenue is 107324.9, total tax revenue is 149902.7, and value-added tax revenue is 47756.74. The median values are considerably lower than the means, suggesting a positively skewed distribution. The wide range between the minimum and maximum values highlights substantial variability in tax revenues. The standard deviations are significant, further confirming the dispersion of the data. Skewness values above 1 indicate a right-skewed distribution, while positive kurtosis values signify heavy tails and potential outliers. The coefficients of variance demonstrate high relative variability in all three revenue types.

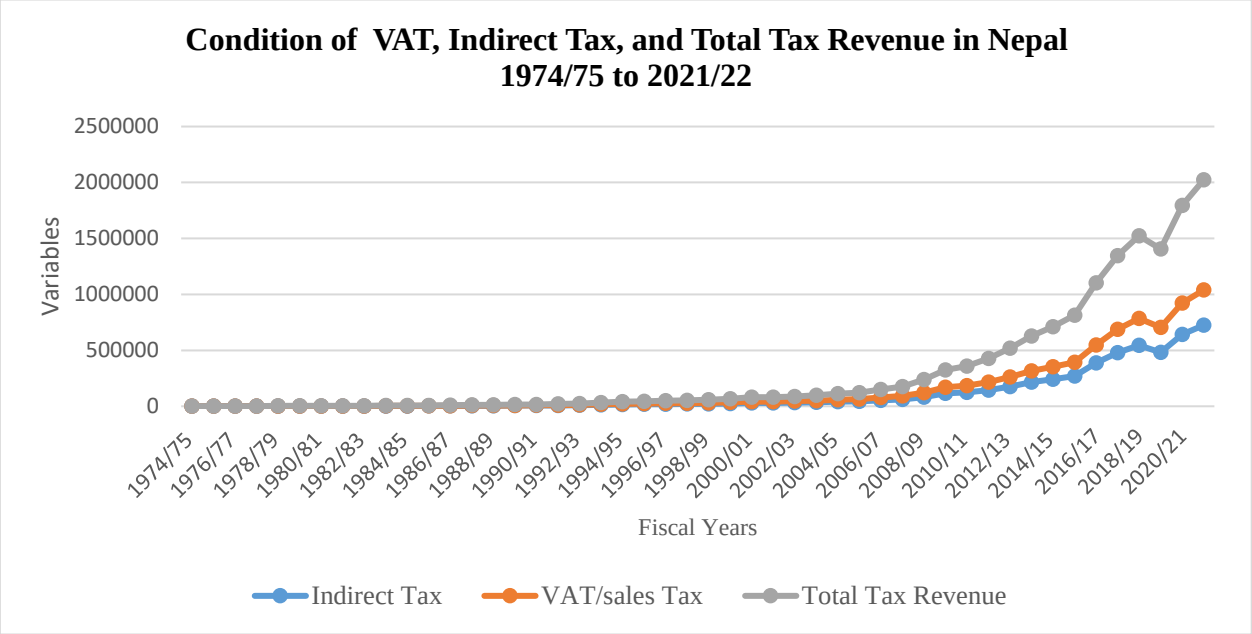

Fig. 1: Conditions of VAT, indirect tax, and total tax revenue

Table 1: *Descriptive Statistics of Variables*

Variables	INTX	TTXR	VATT
Mean	107324.9	149902.7	47756.74
Median	20683.75	27339.80	7504.550
Maximum	724337.2	984332.0	314229.1
Minimum	667.8000	841.3000	161.6000
Std. Dev.	183100.2	254189.3	80822.68
Skewness	2.020547	1.934125	1.959320
Kurtosis	6.034415	5.615278	5.789414
Coefficient of variance	170.603%	169.570%	169.238%
Observations	48	48	48

Note: INTX, TTXR, and VATT indicate indirect tax, total tax, and value-added tax revenue, respectively; All data are in ten million rupees

Table 2: *Effect of VAT on indirect tax collection in Nepal.* (Regression Analysis with Model Summary)

Predictor	estimate	SE	t	P	Stand. Estimate	Model Fit Measures					
						R^2	Adj R^2	Overall Model Fit			
								F	Df_1	Df_2	P
Intercept	1.708	0.0601	28.4	0.001							
LNVATT	0.919	0.0065	140.9	0.001	0.999	0.989	0.987	19862	1	46	0.001

Dependent variable: Indirect tax revenue (LNINTX)

Source: Authors calculation by using Jamovi 2.4.11

Impact Analysis of VAT on Indirect Tax and Total Tax Revenue

Nexus between VAT and Indirect Tax

VAT is the primary source of total indirect tax collection. Excise duty, customs duties, service tax, and local development tax are some examples of indirect taxes in Nepal other than VAT. In Table 2, the effect of VAT on indirect tax is analyzed. The intercept (1.708) represents the estimated indirect tax revenue when the value-added tax revenue is zero, and the coefficient for LNVATT (0.919) indicates the estimated change in indirect tax revenue for a one-unit increase in value-added tax revenue. Both coefficients are statistically significant, with p-values less than 0.001, suggesting a strong relationship between the variables. The regression equation is estimated as given below:

$$LNINTX = 1.708 + 0.919 * LNVATT \quad (7)$$

The model fit measures indicate the overall goodness of fit. The R-squared value of 0.989 implies that approximately 98.9 of the variability in indirect tax revenue can be explained by the natural logarithm of value-added tax revenue. The adjusted R-squared, accounting for the number of predictors, remains high at 0.987. These values signify a remarkably well-fitted model. The F-statistic of 19862 with a corresponding P-value less than 0.001 further supports the overall significance of the model. The model fit measures collectively affirm the robustness of the regression equation in explaining the variation in indirect tax revenue based on the predictor variable, value-added tax.

The ANOVA of the model is presented in Table 3. The omnibus ANOVA test for the variable value added Tax (LNVATT) produced a highly significant result ($F = 19862$, $P < .001$), showing that there are statistically significant variations among the groups. The total amount of squares for LNVATT is 202.232, while the average square is 202.2316. The little residual sum of squares (0.468) indicates that the majority of the variance is explained by the variable LNVATT rather than being due to random error.

Assumption Check of the Model

Some diagnostic checking measures are presented in Table 4. The collinearity statistics, precisely the variance inflation factor (VIF) and tolerance, evaluate multicollinearity among the predictor variables. In this case, the VIF for LNVATT is 1.00, and the tolerance is 0.965. Generally, a VIF below ten and a tolerance above 0.10 are acceptable, indicating no significant multicollinearity concerns. Thus, the model does not seem to suffer from high collinearity issues among the predictor variables. The normality test using the Shapiro-Wilk statistic assesses the normality of the residuals. The p-value of 0.158 is more significant than the typical significance level of 0.05, suggesting that the residuals may not significantly deviate from a normal distribution. Statistically speaking, the data set does not have an apparent problem with normality.

Table 3: *Omnibus ANOVA Test*

Variables	Sum of Squares	df	Mean Square	F	P
LNVATT	202.232	1	202.2316	19862	0 .001
Residuals	0.468	46	0.0102		

Source: Authors calculation by using Jamovi 2.4.11

Table 4: *Test of collinearity and normality of the model*

Collinearity Statistics			Normality Test (Shapiro-Wilk)	
Variable	VIF	Tolerance	Statistics	P-value
LNVATT	1.00	1.00	0.965	0.158

Source: Authors calculation by using Jamovi 2.4.11

Table 5: Effect of VAT on indirect tax collection in Nepal (Regression Analysis with Model Summary)
Dependent variable: Total tax revenue (LNTTXR)

Predictor	estimate	SE	t	P	Stand. Estimate	Model Fit Measures					
						R^2	Adj R^2	Overall Model Fit			
								F	df_1	df_2	P
Intercept	1.748	0.0631	27.7	<.001							
LNVATT	0.944	0.0069	137.9	<.001	0.999	0.978	0.977	19005	1	46	<.001

Source: Authors calculation by using Jamovi 2.4.11

Table 6: *Omnibus ANOVA Test*

Sum of Squares	df	Mean Square	F	p
213.505	1	213.5051	19005	< .001
0.517	46	0.0112		

Source: Authors calculation by using Jamovi 2.4.11

Influence of VAT on Total Tax Revenue

Nexus between VAT and Total Tax Revenue

Table 5 explores the impact of VAT on total tax revenue. The intercept (1.748) represents the estimated total tax revenue when the value-added tax revenue is zero, and the coefficient for LNVATT is 0.944, indicating that one unit change in VAT revenue results in 0.944 unit change in total revenue. Both coefficients are statistically significant, with p-values less than 0.001, suggesting a robust relationship between the variables. The regression equation is estimated as given below:

LNTTXR = 1.748 + 0.944 * LNVATT. (8)

The R-squared value of 0.979 implies that the value-added tax revenue can explain approximately 97.9% of the total tax revenue variability. The adjusted R-squared, accounting for the number of predictors, remains high at 0.977. These values signify a remarkably well-fitted model. The F-statistic of 19005 with a corresponding p-value less than 0.001 further supports the overall significance of the model. The model fit measures collectively affirm the solid explanatory power of the regression equation in capturing the variation in total tax revenue due to change in VAT.

Table 6 analyzes the variance of the model. The ANOVA test evaluates the overall significance of the regression model by comparing the variance explained by the predictor variable (LNVATT) to the variance remaining in the residuals. In this analysis, the sum of squares for LNVATT is 213.505, with 1 degree of freedom, resulting in a mean square of 213.5051. The F-statistic of 19005 is highly

significant ($p < 0.001$), indicating that value-added tax revenue (LNVATT) significantly explains the variation in the dependent variable (LNINTX). The small sum of squares for residuals (0.517) and the absence of significance in the residual mean square highlight the model's effectiveness in capturing the relationship between the variables.

Assumption Check of the Model

The collinearity statistics, including the variance inflation factor (VIF) and tolerance, evaluate multicollinearity among the predictor variables. In this instance, the VIF for LNVATT is 1.00, and the tolerance is 0.975. Both values are within acceptable ranges, suggesting no significant multicollinearity concerns. Therefore, the model appears free from high collinearity issues among the predictor variables. The normality test using the Shapiro-Wilk statistic assesses the normality of the residuals. The p-value of 0.381 is more significant than the typical significance level of 0.05, indicating that the residuals may not significantly deviate from a normal distribution.

Fig. 2 shows the heteroscedasticity test of the two models' residuals. The scatter plot graph of the heteroscedasticity shows that the points are spread randomly. This indicates that heteroscedasticity is absent in the regression models. Therefore, the regression models appropriately predict the dependent variables according to pre-assumptions.

Discussion of Results

The value-added tax is significant in determining the indirect tax revenue in Nepal. One percent increase in VAT results in a 0.919 percent increase in indirect tax in Nepal. A variation of 98.9 percent in indirect tax revenue depends upon value-added tax. Increasing the VAT raises the overall burden on consumers by imposing a higher percentage on the value added at each stage of the production and distribution chain, thereby escalating indirect tax costs.

VAT has a positive and significant impact on determining total tax revenue. One percent increase in VAT results in a 0.944 unit increase in total tax revenue. A variation of 97.8 percent in total tax revenue depends upon VAT. Dahal (2020) also found that 99 percent of the variation in total tax revenue depends upon VAT. The findings of Kunwar (2023) and Mu *et al.* (2022) also align with the present study's findings.

VAT significantly increases total tax revenue by applying a percentage to the value added at each stage of production and distribution. As goods or services move through the supply chain, the tax is levied on the incremental value, contributing to higher overall revenue. VAT is an indirect tax, meaning it is ultimately borne by the consumer, leading to a broad tax base. Its efficiency in capturing economic activity at various stages results in substantial revenue generation, making it a pivotal contributor to indirect tax collections.

Table 7: Diagnostic checking of the model

Collinearity Statistics			Normality Test (Shapiro-Wilk)	
Variable	VIF	Tolerance	Statistics	P-value
LNVATT	1.00	1.00	0.975	0.381

Source: Authors calculation by using Jamovi 2.4.11

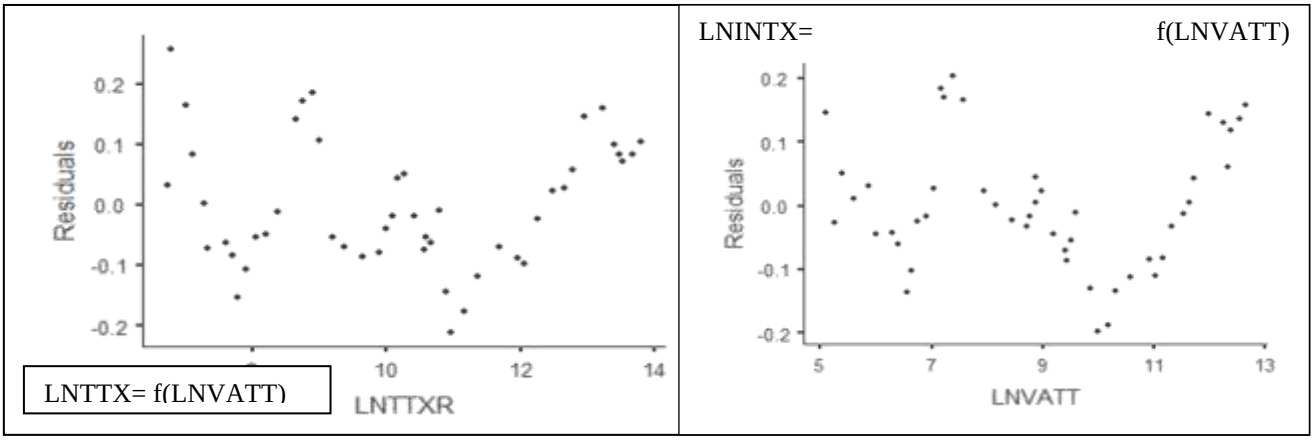

Fig. 2: Heteroscedasticity test of the models

Conclusion, Policy Implications, and Limitations

This article has examined the impact of value added on indirect tax and total tax revenue. The value-added tax is more consistent than other variables. The value-added tax (VAT) is statistically significant in explaining indirect tax revenue in Nepal. One percent increase in VAT revenue results in a 0.919 percent increase in indirect tax in Nepal. A variation of 98.9 percent in indirect tax in Nepal depends upon VAT revenue. Likewise, the VAT revenue is statistically significant in determining total tax revenue. One unit increase in VAT results in a 0.944 unit increase in total tax revenue in Nepal. A variation of 97.8 percent in total tax revenue depends upon value-added tax in Nepal.

Targeted VAT collection measures can raise indirect tax collections and improve fiscal sustainability without burdening taxpayers. Policies should prioritize VAT structure assessments, including rate and exemption adjustments, to maximize revenue while preserving justice and economic efficiency. Policymakers should actively explore innovative approaches like digital taxation and cross-border collaboration to adapt to changing financial landscapes and secure a resilient fiscal foundation for public services and development initiatives, given the importance of VAT in total tax revenue.

This study is based on secondary data covering 1974/75 to 2021/22 or 48 annual data points. It searches the impact of VAT on indirect and total tax revenue separately. Some statistical tools like regression analysis, ANOVA test, multicollinearity test, heteroscedasticity test, and normality test are used. Therefore, further study is necessary by using more variables, data points, tools, methods, and designs.

Conflict of Interest

Authors declare no any conflict of interest with the present study.

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