Original Research Article

Analysis of Government Expenditure on Private Sector Investment in Nepal: A Time Series Approach

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Abstract

This study examines the role of government expenditure on private sector investment in Nepal, utilizing a time-series approach. The research employs a quantitative methodology, analyzing 49 years of time-series data (1974/75-2022/23). The study uses the Autoregressive Distributed Lag (ARDL) model to explore both the long-run and short-run relationships between government expenditure and private investment. The dependent variable is private sector investment, while the independent variables include real GDP, government expenditure, foreign exchange rates, and the consumer price index (CPI). Unit root tests, the ARDL bounds test, and Granger causality tests were applied to analyze the data. The results indicate a significant positive long-run relationship between real GDP and private sector investment, while government expenditure shows mixed effects. Infrastructure-related government spending positively influences private investment, whereas non-infrastructure expenditure has a crowding-out effect. Inflation, represented by the CPI, has a negative impact on private sector investment, creating uncertainty and raising costs. The foreign exchange rate demonstrates a marginally

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significant positive effect on private investment. The findings align with previous research in developing countries where researchers observed the crowding-in effect of government spending on private investment. The role of inflation and foreign exchange stability was also highlighted as crucial for fostering a favorable investment environment.

Keywords: *Government expenditure, Private sector investment, ARDL model, Infrastructure spending, Inflation, Foreign exchange rate*

JEL Classification: C32, E31, F31, O53

Introduction

In the economic world, there are two contrasting views related to the impact of government expenditure and private sector investment on the economic growth of a nation. Neo-classical theorists argue that the decreased role of the private sector helps reduce inflation. In contrast, Keynesian theorists argue that there will be a multiplier effect in the economy when increased government expenditure increases the demand and thus increases economic growth (Kunwar, 2019). In a country like Nepal, where the government spending is mostly on non-infrastructure-related expenditure, it might have detrimental effects on the private sector's motivation to invest and generate economic activities.

Government expenditure refers to the spending by different levels of government in a nation to provide public services to the public and for the security, welfare, and overall benefits of the public. Government spending is one of the tools used by various nations to stimulate the economic activities in a nation thus increasing employment opportunities, improving the living standard of the people, etc. (Lahirushan and Gunasekara, 2015). A few years ago, during the COVID-19 pandemic as well, various nations increased their public spending manifold to stimulate the economy. The United States of America is among the nations that have higher government expenditure through various fiscal policy measures to stimulate the economy and increase private investment (Soyres, et al., 2024).

Government expenditure plays a crucial role in the economy of both developed and developing nations, and it has been used widely as one of the tools to overcome economic barriers. As compared to other fiscal policies, it has a direct impact on the economy by helping the government to overcome the cyclicality of the economy. However, the risks always lie that overspending by the government might lead to a high inflation rate, and both crowding in as well as crowding out effects might be

there depending upon the scenario (Nguyen, 2023). The crowding in and out of private investment differs as per the economic development of a country and the different components of the government spending.

In any nation, the level of income of the population is not the direct impact of the increased government expenditure but of the increased private investment (Mallick, 2016). When the government spends on different sectors for different purposes, it has both positive as well as negative impacts on private investment. Government expenditure on infrastructure-related activities might have a positive impact since it stimulates other auxiliary economic activities. On the contrary, expenditure by the government on non-infrastructure activities and welfare might hurt private investment.

The central question guiding this study is: does government expenditure affect private sector investment in Nepal? Different studies were conducted in Nepal revolving around the similar areas and questions; and this study aims to fill the gap in the research by analyzing larger data sets in a time series analysis and using different quantitative analysis models.

The overall objective of this study is to analyze the impact of government expenditure on private-sector investment in Nepal by studying the data of 49 years in a time-series analysis. Moreover, the study is also aimed at providing valuable insights into how Nepal's private investment reacts as compared to the level and composition of the government expenditure.

Literature Review

Nguyen (2023) found that the increased public expenditure has a dual effect on private investment i.e., it crowds out the private investment in developed countries. Whereas in the developing countries, increased government expenditure crowds in the private investment. The researcher observed data from 2002 to 2019 from 36 developed countries and 98 developing countries. Before generalizing the result in the Nepalese context, it is important to test the findings in the Nepalese context and adapt the findings accordingly.

In another study, researchers observed that a high level of government spending decreased the private sector investment in the economy. for example, when the government starts hiring more people, there are fewer people left with the private sector to start a business with and invest in. The private sector decreases its investment

in R&D, manufacturing, and other activities when government spending increases. The level of effect, of course, depends upon the type of government spending and the private firm; however, it hurts the private sector investment in the long run (Kim and Nguyen, 2020).

In the Indian context, (Mallick, 2016) published a working paper where it has been observed that government expenditure has both crowding-in and crowding-out relationship with private investment. When the government spends on non-infrastructure expenditures, the crowding-out relationship can be seen, and vice-versa. The ratio of infrastructure and non-infrastructure expenditure of the government in Nepal is on the higher side, and this finding might be relevant in the Nepalese context as well. However, a study for this effect to validate the findings is necessary before generally accepting the findings of the Indian economy.

Carvelli (2023) found that government expenditure has a crowding-out effect both in the short run and long run based on the time series data analysis of 28 OECD countries from 1990-2019 irrespective of the sources of financing of the government expenditure. Similarly, the expenditure by the government on the productive sector has a positive long-term impact on private investment, and vice-versa. Now, the findings, before adapting to the Nepalese context, need to be thoroughly tested and modified, and hence the present research is necessary to validate these findings in Nepal.

A study conducted in the Nigerian economy using the ARDL approach from 1981 to 2015 observed that there were both positive as well as negative effects of government spending on private investment. The effect depends upon the types and components of the government spending and concluded that the increase in the private sector investment in Nigeria depends upon the pattern and components of the government expenditure (Omitogun, 2018). It is therefore important to conduct a similar study in Nepal using a larger time series dataset is necessary to help the stakeholders make an informed decision and adapt the international findings in the Nepalese context.

Shrestha (2009) found that in Nepal the government expenditure on the physical infrastructure plays a very important role in enhancing economic growth by stimulating increased private sector investment. The role of government expenditure on physical infrastructure is productive in Nepal, which facilitates enhancing private sector engagement in other supporting economic activities as well as generating employment. The study was conducted by analyzing the data from 1981 to 2007 using

the OLS model. To further stretch and confirm the results is necessary by employing the larger data sets and different measurement models in the analysis process.

Methods and Materials

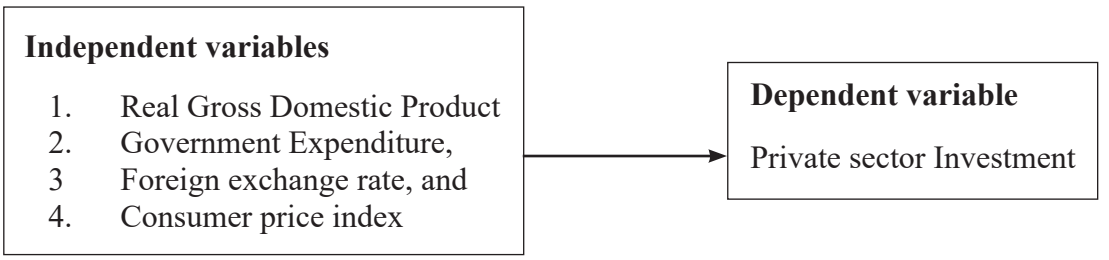
This quantitative study employs analytical and descriptive research designs. Secondary data were used to evaluate the impact of independent variables on the dependent variable. The data were analyzed and interpreted using EViews version 12. The investigation relies on secondary and time series data.

The study utilized 49 sets of time series data spanning from 1974/75 to 2022/23 to analyze the relationship between the dependent and independent variables. The dependent variable is Private Sector Investment, while the independent variables consist of the Real Gross Domestic Product, Government expenditure, Foreign exchange rate Nrs. to USD and Consumer price index.

Conceptual Framework, Model formulation and Study Variables

Figure 1

Relationship between Dependent and Independent Variables



The relationship between private sector investment (PSI) and its determinants can be expressed as:

$CPI_t = f(RGDP_t, GE_t, FER_t, CPI_t)$

The linear relationship between the variables is established by applying logarithms to both sides of the equation. This transformation enables the calculation of the elasticities of PSI relative to the explanatory variables.

$$\ln PSI_t = \beta_0 + \beta_1 \mathbf{t} + \boldsymbol{\beta}_2 \ln RGDP_t + \beta_3 \ln GE_t + \beta_4 \ln FER_t + \beta_5 \ln CPI_t + e_t$$

Where,

PSI = Private sector Investment

RGDP = Real Gross Domestic Product

GE = Government Expenditure

FER = Foreign exchange rate

CPI = Consumer price index (2014/15 = 100)

e_t = error term

β_i = constant coefficient

Sources of Data

This research used both descriptive and analytical methods and only used secondary data.

Table 1

Variables, Abbreviations, Units and Data Sources Used in Research

Variable names	Symbols	Units	Sources
Private sector Investment	PSI	% of GDP	QEB, 2024 Jan, NRB
Real Gross Domestic Product	RGDP	Nrs. in 10 Million	Economic Survey (Various issues)
Government Expenditure	GE	Nrs. in 10 Million	Economic Survey (Various issues)
Foreign exchange rate	FER	Nrs. to USD	QEB, 2024 Jan, NRB
Consumer Price Index	CPI	Base Year 2014/15=100	QEB, 2024 Jan, NRB

Econometric Method

For the time series method studies, the following procedures were used to test for the economic development:

Stationery Test

The majority of time series econometric techniques were built upon the assumption that the time series variables were stationary. Therefore, standard estimations and test procedures were applied in the dynamic time series model. As the first step, it was necessary to examine the stationary property of each series. The unit root test allowed us to determine the order of integration for each time series. To

proceed with the ARDL model, the time series needed to be integrated at either I(0) or I(1). Therefore, the ADF and P-P tests were used in this study to identify the order of integration.

ARDL Model

In the literature, the Engle-Granger (1987) and Johansen (1988) models are widely used for co-integration tests (Poudel, 2024). These models require variables to be stationary at I(1) and non-stationary at I(0) (Peseran et al., 2001). However, the Autoregressive Distributed Lag (ARDL) boundary test, as proposed by Pesaran and Shin (1995) and further developed by Pesaran et al. (2001), accommodates non-stationary series at the same level, making it possible to test for co-integration without determining the degree of integration. The ARDL approach offers several key advantages:

i. **Simplicity:** It allows for co-integration verification after determining the appropriate lag length, unlike the Johansen and Juselius (1990) methods.
ii. **Flexibility:** It does not require preliminary unit root testing, making it suitable for variables that are I(0) or I(1), but not I(2).
iii. **Efficiency:** It is effective even with small or limited sample sizes.

ARDL Bounds Test

The ARDL bounds test is used to identify long-run relationships between independent and dependent variables, offering several advantages over traditional cointegration tests (Johansen, 1991). This method involves determining whether the data are integrated at order zero, I(0), or order one, I(1). Once this is established, an error correction model (ECM) is employed for further analysis.

Error Correction Model (ECM)

The error correction representation of the Autoregressive Distributed Lag (ARDL) model captures the cointegration among variables and is analyzed through the ECM. The coefficients of the lagged values are utilized to examine short-run dynamics.

Granger Causality Test

The relationship between the variables was assessed using the Pairwise Granger Causality Test. In this test, if past values of variable x could predict future values of variable y, considering the past values of y, then x was said to Granger-cause y. A common method for testing Granger causality involved regressing y on its own

lagged values as well as the lagged values of x. The null hypothesis in this context was that the coefficients of the lagged values of x were all jointly zero. Rejecting this null hypothesis indicated that x does indeed Granger-cause y.

Results

Descriptive Statistics

The descriptive statistics reveal key insights into Nepal's economic environment over time. Table 2 shows descriptive statistics of variables used in research article.

Table 2

Descriptive Statistics

	LNPSI	LNRGDP	LNGE	LNFER	LNCPI
Mean	2.660677	6.776728	8.630998	3.803856	3.339630
Median	2.714961	6.815672	8.692473	4.170043	3.559224
Maximum	3.238678	7.746041	11.71679	4.870952	5.060314
Minimum	2.167406	5.833766	5.019727	2.351375	1.421761
Std. Dev.	0.291921	0.600619	1.980110	0.815322	1.128352
Skewness	-0.029441	-0.058498	-0.068752	-0.553942	-0.213850
Kurtosis	1.866550	1.768916	1.965983	1.819013	1.848156
Observations	49	49	49	49	49

Source: Author's calculations performed using E-Views

Private sector investment (LNPSI) shows moderate variability with near-symmetrical distribution, indicating stable investment patterns influenced by broader macroeconomic conditions. Real GDP (LNRGDP) reflects steady economic growth with some fluctuations, suggesting periods of expansion and contraction driven by both external shocks and domestic policies. Government expenditure (LNGE) exhibits high variability, signaling an active fiscal policy with increased spending during economic downturns or developmental phases. The foreign exchange rate (LNFER) shows significant fluctuations and negative skew, highlighting currency depreciation over time due to trade imbalances and external economic factors. Finally, the Consumer Price Index (LNCPI) reveals moderate inflation volatility, reflecting periods of both low and high inflation, likely influenced by domestic supply constraints and external price shocks. Together, these variables depict an economy that is responsive to both

internal and external factors, with fiscal policy and currency movements playing significant roles in shaping private sector investment and overall economic stability.

Table 3

Correlation Analysis

Correlation t-Statistic	LNPSI	LNRGDP	LNGE	LNFER	LNCPI
LNPSI	1.000000				
LNRGDP	0.923981	1.000000			
	16.56341				
LNGE	0.909243	0.995373	1.000000		
	14.97473	71.01500			
LNFER	0.901748	0.967375	0.961107	1.000000	
	14.30172	26.17744	23.85817		
LNCPI	0.913271	0.996808	0.995996	0.977765	1.000000
	15.37013	85.59801	76.38136	31.96488	

Source: Author's calculations performed using E-Views

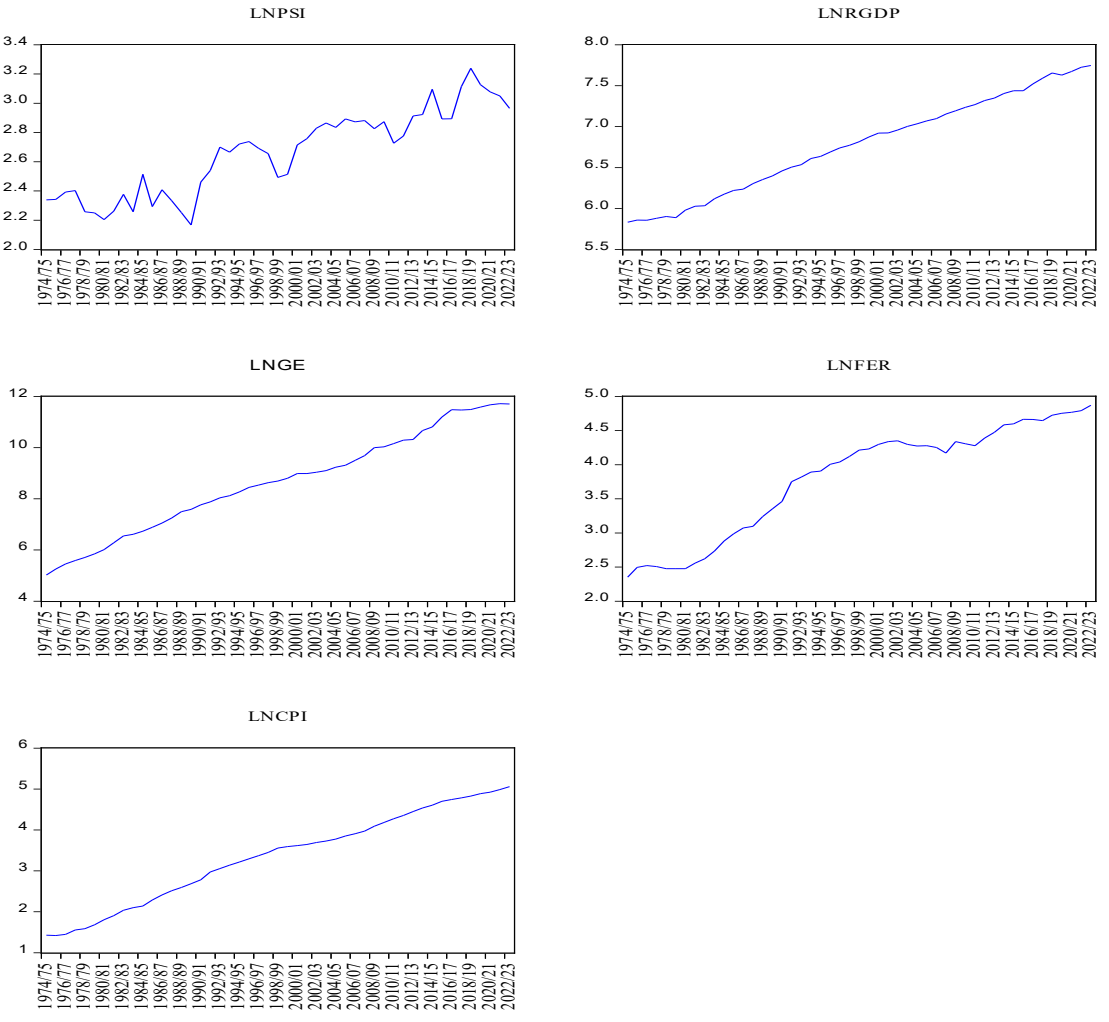
The correlation analysis reveals a strong interconnectedness between private sector investment (LNPSI) and key macroeconomic variables in Nepal. LNPSI shows a high positive correlation with real GDP (LNRGDP) at 0.92 (t-statistic = 16.56), indicating that economic growth significantly drives private sector investment. Similarly, government expenditure (LNGE) is highly correlated with LNPSI at 0.91 (t-statistic = 14.97), suggesting that fiscal policy plays a crucial role in stimulating investment. The foreign exchange rate (LNFER) also exhibits a strong positive correlation of 0.90 with LNPSI (t-statistic = 14.30), implying that currency movements impact investment, potentially through export competitiveness. Additionally, the correlation between inflation (LNCPI) and LNPSI is 0.91 (t-statistic = 15.37), indicating that moderate inflation may signal economic activity that encourages investment. The near-perfect correlations among LNRGDP, LNGE, and LNCPI (all above 0.96) highlight their interdependence, showing how fiscal policy and macroeconomic stability jointly influence investment behavior. The statistically significant t-values across these relationships further confirm the robustness of these associations.

Time Series Plots

The time series plots offer significant insights into the dynamics of Nepal's economic development. Figure 2 shows the time series plots of concern variables.

Figure 2

The time series plots



Source: Author's calculations performed using E-Views

Private sector investment (LNPSI) exhibits an upward trend, though marked by periods of volatility, potentially attributable to political instability and external shocks.

In contrast, real GDP (LNRGDP) displays a stable and consistent growth trajectory, reflecting sustained economic expansion over the period. Government expenditure (LNGE) aligns with this trend, indicating a proactive fiscal policy aimed at enhancing public infrastructure and social services. Foreign exchange rate (LNFER) show a steady accumulation, driven by rising remittances and export earnings, although intermittent declines suggest vulnerability to external imbalances. Lastly, the consumer price index (LNCPI) follows a persistent upward path, signaling ongoing inflationary pressures. These patterns highlight a growing economy tempered by fluctuations in private investment and inflation, underscoring the importance of prudent economic policies to foster long-term growth and macroeconomic stability.

Unit Root Testing

As shown in Table 2, the unit root test results from both the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) tests indicate that most variables are non-stationary at their level forms but become stationary at their first differences.

Table 4

Unit Root Test Results

UNIT ROOT TEST TABLE (PP)

At Level		LNPSI	LNRGDP	LNGE	LNFER	LNCPI
With Const.	t-Statistic	-1.1492	0.1508	-1.6290	-1.3959	-1.1551
	Prob.	***0.6886***	***0.9664***	***0.4602***	***0.5766***	***0.6862***
		no	no	no	no	no
With Const. & Trend	t-Statistic	-3.6737	-3.1063	-2.0971	-1.1322	-1.0419
	Prob.	***0.0340***	***0.1165***	***0.5342***	***0.9126***	***0.9281***
		**	no	no	no	no
At First Difference		d(LNPSI)	d(LNRGDP)	d(LNGE)	d(LNFER)	d(LNCPI)
With Const.	t-Statistic	-10.3159	-7.7849	-5.5252	-5.6162	-5.0907
	Prob.	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0001***
		***	***	***	***	***
With Const. & Trend	t-Statistic	-10.1422	-7.6931	-5.6545	-5.6345	-5.4133
	Prob.	***0.0000***	***0.0000***	***0.0001***	***0.0001***	***0.0003***

UNIT ROOT TEST TABLE (PP)

At Level		LNPSI	LNRGDP	LNGE	LNFER	LNCPI
		***	***	***	***	***

UNIT ROOT TEST TABLE (ADF)

At Level		LNPSI	LNRGDP	LNGE	LNFER	LNCPI
With Const.	t-Statistic	-1.3735	0.1185	-1.7162	-1.6272	-1.3986
	Prob.	***0.5874***	***0.9640***	***0.4169***	***0.4612***	***0.5753***
		no	no	no	no	no
With Const. & Trend	t-Statistic	-3.7916	-2.9860	-1.9689	-0.7608	-1.2898
	Prob.	***0.0256***	***0.1467***	***0.6030***	***0.9621***	***0.8784***
		**	no	no	no	no
At First Difference		d(LNPSI)	d(LNRGDP)	d(LNGE)	d(LNFER)	d(LNCPI)
With Const.	t-Statistic	-8.2121	-7.7542	-5.5252	-5.3842	-5.0744
	Prob.	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0001***
		***	***	***	***	***
With Const.& Trend	t-Statistic	-8.1170	-6.4932	-5.6545	-5.4052	-5.4334
	Prob.	***0.0000***	***0.0000***	***0.0001***	***0.0003***	***0.0003***
		***	***	***	***	***

Source: Author's calculations performed using E-Views

The unit root tests (Phillips-Perron and Augmented Dickey-Fuller) indicate that all variables—LNPSI, LNRGDP, LNGE, LNFER, and LNCPI—are non-stationary at level but become stationary after first differencing, implying that these variables are integrated of order one (I(1)). For instance, the PP test for LNPSI at the first difference yields a t-statistic of -10.3159 with a p-value of 0.0000, confirming stationarity. Similar patterns are observed for the other variables across both tests. These results suggest that while the variables exhibit stochastic trends in levels, they revert to stationarity in their first differences, making them suitable for cointegration analysis. This justifies the use of the ARDL model, which can handle variables integrated of different orders (I(0) and I(1)) and allows for the analysis of both short-term dynamics and long-term relationships. The ARDL bounds testing approach is particularly suitable here, as the model does not require variables to be integrated of the same order, making it an

appropriate method for investigating the long-run interactions among these economic variables.

VAR Lag Order Selection Criteria

Table 5 presents the VAR Lag Order Selection Criteria, showing different lag lengths and their corresponding criteria for model selection: LogL (log-likelihood), LR (Likelihood Ratio), FPE (Final Prediction Error), AIC (Akaike Information Criterion), SC (Schwarz Criterion), and HQ (Hannan-Quinn Criterion).

Table 5

VAR Lag Order Selection Criteria Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	108.4746	NA	6.92e-09	-4.598870	-4.398129	-4.524036
1	377.3011	465.9661*	1.37e-13*	-15.43561*	-14.23116*	-14.98660*
2	398.3328	31.78124	1.71e-13	-15.25924	-13.05109	-14.43606
3	420.6392	28.75035	2.15e-13	-15.13952	-11.92767	-13.94217
4	434.4061	14.68475	4.46e-13	-14.64027	-10.42473	-13.06876

Source: Author's calculations performed using E-Views

The model with lag 1 is selected based on all criteria, as it minimizes the AIC (-15.44), SC (-14.23), and HQ (-14.99), and also has the smallest FPE (1.37e-13). The Likelihood Ratio (LR) test confirms that lag 1 is statistically significant compared to the others, with a high value of 465.97, further justifying the choice. This indicates that a one-period lag provides the best fit for explaining the dynamic interactions among the variables in the system. Choosing the optimal lag length is critical in VAR models, as too few lags can lead to omitted variable bias, while too many lags may introduce overfitting. The selection criteria suggest that past values of economic variables from one period have a strong influence on current outcomes.

ARDL Long Run Form and Bounds Test

Within the ARDL framework, the co-integrating equation outlines the long-term relationship among the variables being studied. This equation is established when co-integration is detected, signifying that the variables share a common stochastic trend (Poudel, 2023). The hypotheses for the co-integration test are as follows: H0,

stating that there is no co-integrating equation, and H1, asserting the existence of a co-integrating equation. To further investigate these long-term relationships, the ARDL Long Run Form and Bounds Test are performed in Table 6.

Table 6

ARDL Long Run Form and Bounds Test

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
		Asymptotic: n=1000		
F-statistic	4.045270	10%	2.2	3.09
k	4	5%	2.56	3.49
		Actual Sample Size 48	Finite Sample: n=50	
		10%	2.372	3.32
		5%	2.823	3.872
			Finite Sample: n=45	
		10%	2.402	3.345
		5%	2.85	3.905

Source: Author's calculations performed using E-Views

The F-Bounds test is used to examine the existence of a long-run relationship between private sector investment (LNPSI) and its independent variables (LNRGDP, LNGE, LNFER, LNCPI). The null hypothesis states that there is no levels relationship among these variables.

The calculated F-statistic is 4.045, which is higher than the critical bounds at the 5% significance level for both the I(0) and I(1) bounds (2.56 and 3.49, respectively). This suggests that there is a cointegrating relationship among the variables, rejecting the null hypothesis of no long-run relationship. The inclusion of 48 observations ensures a robust sample size, which strengthens the reliability of this result.

Economically, this means that the independent variables like Real GDP, government expenditure, foreign exchange rates, and inflation are indeed interrelated with private sector investment in the long run, reflecting how macroeconomic policies and external conditions affect investment decisions in Nepal.

Table 7

Long run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNRGDP	1.461743	0.571151	2.559293	0.0142
LNGE	0.124230	0.203520	0.610407	0.5449
LNFER	0.401373	0.211547	1.897325	0.0647
LNCPI	-1.036291	0.539426	-1.921100	0.0615
C	-6.376546	2.929863	-2.176398	0.0352

Source: Author's calculations performed using E-Views

The long-run coefficients of the ARDL model reveal important insights into the determinants of private sector investment (LNPSI). The positive and statistically significant coefficient for real GDP (LNRGDP) suggests that economic growth is a key driver of private sector investment, with a 1% increase in GDP leading to a 1.46% rise in investment, underscoring the pro-growth nature of the relationship. In contrast, government expenditure (LNGE) is found to be insignificant, indicating that public spending does not substantially influence private investment in the long run. The foreign exchange rate (LNFER) has a marginally significant positive effect, implying that exchange rate stability modestly supports investment, possibly through its impact on export competitiveness. Inflation, represented by the consumer price index (LNCPI), exhibits a negative and nearly significant coefficient, indicating that higher inflation tends to discourage private investment by raising uncertainty and costs. The negative and significant constant term suggests underlying structural barriers that may inherently suppress investment, independent of the macroeconomic variables considered.

Short run Coefficients

The short-run coefficients from the ECM (Error Correction Model) regression provide insights into how deviations from the long-run equilibrium are corrected in the short term and the immediate impact of changes in explanatory variables on the dependent variable.

Table 8

Short run Coefficients

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)*	-0.591453	0.113487	-5.211631	0.0000
R-squared	0.357708	Mean dependent var		0.013054
Adjusted R-squared	0.357708	S.D. dependent var		0.113665
S.E. of regression	0.091095	Akaike info criterion		-1.933222
Sum squared resid	0.390017	Schwarz criterion		-1.894238
Log likelihood	47.39732	Hannan-Quinn criter.		-1.918490
Durbin-Watson stat	1.964233			

Source: Author's calculations performed using E-Views

The short-run coefficients in the ARDL model are captured by the error correction term (CointEq(-1)), which is negative (-0.5915) and highly significant (p = 0.0000). This indicates a strong adjustment mechanism, with approximately 59.15% of the deviation from the long-run equilibrium being corrected each period. The R-squared value of 0.3577 shows that around 35.77% of the variation in private sector investment is explained by the model in the short run. The model's Durbin-Watson statistic of 1.964 suggests no significant autocorrelation in the residuals. Overall, the short-run dynamics reveal a stable adjustment process towards long-run equilibrium.

Granger Causality Test

In the ARDL framework, the Granger Causality Test is a common method used to assess causal relationships among the model's variables. A significant result from this test suggests that historical values of the proposed predictor variable provide useful information for forecasting the dependent variable (Poudel et al., 2023).

Table 9

Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
LNRGDP does not Granger Cause LNPSI	48	14.7040	0.0004
LNPSI does not Granger Cause LNRGDP		3.44844	0.0699
LNGE does not Granger Cause LNPSI	48	12.0751	0.0011
LNPSI does not Granger Cause LNGE		0.07782	0.7816
LNFER does not Granger Cause LNPSI	48	13.0014	0.0008
LNPSI does not Granger Cause LNFER		2.05234	0.1589
LNCPI does not Granger Cause LNPSI	48	13.2063	0.0007
LNPSI does not Granger Cause LNCPI		0.89957	0.3480
LNGE does not Granger Cause LNRGDP	48	15.3832	0.0003
LNRGDP does not Granger Cause LNGE		0.82963	0.3672
LNFER does not Granger Cause LNRGDP	48	0.39018	0.5354
LNRGDP does not Granger Cause LNFER		0.32713	0.5702
LNCPI does not Granger Cause LNRGDP	48	16.9568	0.0002
LNRGDP does not Granger Cause LNCPI		0.90424	0.3467
LNFER does not Granger Cause LNGE	48	0.65007	0.4243
LNGE does not Granger Cause LNFER		1.04551	0.3120
LNCPI does not Granger Cause LNGE	48	1.70589	0.1982
LNGE does not Granger Cause LNCPI		2.28133	0.1379
LNCPI does not Granger Cause LNFER	48	1.52616	0.2231
LNFER does not Granger Cause LNCPI		1.61642	0.2101

Source: Author's calculations performed using E-Views

The Granger causality results reveal the dynamic interactions between private sector investment (LNPSI) and key macroeconomic variables. Real GDP (LNRGDP) strongly Granger-causes LNPSI ($p = 0.0004$), indicating that economic growth is a significant predictor of private sector investment. However, the reverse is not as

strong (p = 0.0699), suggesting that while GDP drives investment, investment does not necessarily predict GDP growth in the short run.

Government expenditure (LNGE) also Granger-causes LNPSI (p = 0.0011), implying that fiscal policies significantly influence private investment. However, LNPSI does not Granger-cause LNGE (p = 0.7816), meaning that changes in private sector investment do not seem to drive government spending.

Similarly, the foreign exchange rate (LNFER) and inflation (LNCPI) Granger-cause LNPSI with significant p-values (0.0008 and 0.0007, respectively), indicating that currency stability and inflation strongly affect investment decisions. However, LNPSI does not Granger-cause either of these variables, suggesting a unidirectional influence where macroeconomic factors affect investment more than investment affects those factors. These results highlight that in Nepal's economic context, macroeconomic policies play a critical role in shaping private investment, but investment's role in influencing macroeconomic variables is limited.

Table 10

Wald Test

Test Statistic	**Value**	**df**	**Probability**
F-statistic	5.203631	(4, 42)	0.0017
Chi-square	20.81453	4	0.0003
Null Hypothesis: C(2)=C(3) =C(4) = C(5)=0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(2)=LNRGDP		0.864552	0.366585
C(3)= LNGE		0.073476	0.119208
C(4)= LNFER		0.237393	0.121397
C(5)= LNCPI		-0.612918	0.315752

Source: Author's calculations performed using E-Views

The Wald test evaluates the joint significance of the coefficients for the independent variables in the ARDL model. The test results reject this null hypothesis, as both the F-statistic (5.2036, p = 0.0017) and Chi-square (20.8145, p = 0.0003) are highly significant. This indicates that, collectively, the independent variables have a statistically significant impact on private sector investment. The normalized restrictions

show that while some coefficients like LNRGDP (C(2) = 0.8646) and LNFER (C(4) = 0.2374) are positive, LNCPI (C(5) = -0.6129) has a negative impact, suggesting mixed effects of inflation on investment. Overall, the Wald test confirms the relevance of these macroeconomic variables in influencing private sector investment.

Diagnostics and Stability Tests

Diagnostics and stability tests are essential for validating model assumptions, detecting issues, assessing parameter stability, ensuring robustness, improving model specification, and avoiding invalid inferences. They are integral to credible and accurate econometric analysis, ensuring that findings and recommendations are based on sound and reliable models.

Table 11

Diagnostics and Stability Tests

Diagnostics	Statistics	p-value
Normality(J-B)	0.334368	0.846044
Serial Correlation $\chi^2(1)$	0.000160	0.9899
B-P-G Test(Scaled explained SS)	5.929304	0.3132
Ramsey RESET(F_{STAT})	0.271982	0.6048
CUSUM Test	Stable	
CUSUM of Square Test	Stable	

Source: Author's calculations performed using E-Views

Table 11 presents the results of diagnostic and stability tests for the ARDL model, confirming the model's robustness. The Jarque-Bera (J-B) normality test yields a high p-value (0.8460), indicating that the residuals are normally distributed, a critical assumption for reliable hypothesis testing (see Figure 3). The serial correlation test (χ^2 = 0.000160, p = 0.9899) reveals no autocorrelation in the residuals, ensuring that the model captures the full dynamics of the data (see Table 12).

The Breusch-Pagan-Godfrey (B-P-G) test for heteroscedasticity also shows an insignificant result (p = 0.3132), suggesting homoscedasticity, meaning that the variance of the errors is constant over time (see Table 13). The Ramsey RESET test (p = 0.6048) indicates no model specification errors, confirming the model's functional form is correctly specified (see Table 14).

Finally, the CUSUM and CUSUM of Squares tests show stability, implying that the model's coefficients remain consistent over time (see Figure 4 & 5).. These diagnostics confirm that the ARDL model is well-specified, stable, and reliable for analyzing the long-run and short-run relationships between private sector investment and its determinants.

Discussion

The findings from the research on government expenditure and private sector investment in Nepal exhibit both similarities and differences when compared to past studies. The current research emphasizes that government expenditure in Nepal, particularly in infrastructure, tends to have a positive effect on private sector investment, aligning with Keynesian economic theory, which suggests that increased government spending stimulates economic activity (Kunwar, 2019). This complements the findings of Mallick (2016), who observed a similar crowding-in effect in India, where infrastructure spending boosts private investment. However, the current study also highlights that non-infrastructure government spending may not always support private sector investment, mirroring Carvelli's (2023) observation in OECD countries, where excessive non-productive government expenditure can crowd out private investment.

The study's identification of inflation as a negative factor impacting private investment is consistent with Poudel et al. (2024), who found that inflationary pressures in Nepal create uncertainty, thereby discouraging private sector investment. This finding contrasts with Nguyen (2023), who noted that in some developed economies, inflation did not significantly deter private sector activities, likely due to better economic stabilization mechanisms.

Additionally, the research confirms the role of foreign exchange rate fluctuations as a determinant of private investment, supporting Omitogun's (2018) findings in Nigeria, where currency instability discouraged private sector growth. Similarly, the positive relationship between real GDP and private investment noted in the research is in line with Shrestha (2009), who found that economic growth significantly drives private investment in Nepal, though the reverse relationship—where private investment influences GDP—was found to be less prominent.

The use of the ARDL model in this research to assess long-run and short-run dynamics reflects an established approach in econometric studies, as seen in Nguyen's

(2023) analysis of both developed and developing countries. The research further supports the idea that fiscal policy's impact on private investment varies depending on the nature of expenditure and the country's level of development, underscoring the nuanced role of government intervention across different economic contexts.

Conclusion

This study reveals that real GDP is a significant driver of private sector investment in Nepal, reflecting the critical role of economic growth in promoting private sector activities. Government expenditure and foreign exchange rates show a limited or marginal influence, while inflation negatively impacts investment, suggesting that macroeconomic stability is crucial for fostering private sector growth. The ARDL model confirms a long-run relationship between private sector investment and its determinants, with strong adjustment mechanisms evident in the short run. The findings indicate that policy efforts should prioritize economic growth and macroeconomic stability to stimulate private investment. The insignificant role of government expenditure suggests a need for more targeted fiscal policies that directly support private sector development. Furthermore, managing inflation and stabilizing exchange rates are essential to create a conducive environment for investment. These insights can guide policymakers in designing effective strategies for private sector expansion.

This study contributes to the literature by applying the ARDL model to assess the long-term and short-term impacts of key macroeconomic variables on private sector investment in Nepal. Unlike previous studies, it incorporates an in-depth analysis of inflation and exchange rate dynamics, providing a comprehensive understanding of their effects on investment. The use of recent time-series data from 1974/75 to 2022/23 enhances the relevance of the results in the current economic context. Future studies may be conducted to analyze the impact of government expenditure in the different sectors like education, health, infrastructure, etc. aiming to dive deeper and identifying the relationship of government expenditure with private sector investment in different sectors and sub-sectors which can help devise fiscal policy accordingly based on the results.

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Appendix-1

Fiscal Year	Gross Fixed Capital Formation (% of GDP)	Government Expenditure (ten million)	Real GDP	NCPI	FER
1974/75	10.37	151.37	341.64	4.17	10.50
1975/76	10.41	191.33	350.62	4.14	12.13
1976/77	10.94	233.04	349.46	4.26	12.45
1977/78	11.05	267.49	358.00	4.73	12.27
1978/79	9.57	302.05	366.18	4.89	11.90
1979/80	9.49	347.07	361.33	5.37	11.90
1980/81	9.07	409.23	395.55	6.09	11.90
1981/82	9.61	536.13	415.02	6.73	12.90
1982/83	10.77	697.92	417.12	7.68	13.78
1983/84	9.57	743.73	454.73	8.16	15.40
1984/85	12.36	839.48	480.28	8.50	17.83
1985/86	9.91	979.71	502.86	9.84	19.85
1986/87	11.11	1151.32	511.01	11.15	21.59
1987/88	10.31	1410.50	546.66	12.35	22.11
1988/89	9.51	1800.50	575.00	13.38	25.53
1989/90	8.74	1966.93	600.70	14.68	28.54
1990/91	11.71	2354.98	639.30	16.12	31.85
1991/92	12.67	2641.82	668.51	19.51	42.59
1992/93	14.88	3089.77	689.45	21.24	45.49
1993/94	14.38	3359.74	742.67	23.14	49.01
1994/95	15.19	3906.00	762.35	24.92	49.70
1995/96	15.45	4654.24	804.76	26.94	54.96
1996/97	14.76	5072.37	845.77	29.12	56.75
1997/98	14.23	5611.83	872.92	31.55	61.66
1998/99	12.10	5957.90	912.03	35.14	67.63
1999/00	12.36	6627.25	966.78	36.33	68.74
2000/01	15.10	7983.51	1012.95	37.21	73.48
2001/02	15.77	8007.22	1014.58	38.29	76.53
2002/03	16.93	8400.61	1052.82	40.11	77.49
2003/04	17.55	8944.26	1099.26	41.70	73.49
2004/05	17.02	10256.04	1134.81	43.59	71.76
2005/06	18.04	11088.92	1177.13	47.06	72.03
2006/07	17.68	13360.46	1209.51	49.84	70.20

Fiscal Year	Gross Fixed Capital Formation (% of GDP)	Government Expenditure (ten million)	Real GDP	NCPI	FER
2007/08	17.83	16134.99	1279.60	53.18	64.72
2008/09	16.87	21966.19	1329.57	59.87	76.58
2009/10	17.71	22710.73	1386.18	65.60	74.24
2010/11	15.28	25749.54	1436.10	71.87	72.07
2011/12	16.04	29485.07	1507.17	77.85	80.72
2012/13	18.41	30205.39	1553.50	85.51	87.66
2013/14	18.58	42825.11	1642.71	93.27	97.95
2014/15	22.11	49454.85	1700.41	100.00	99.19
2015/16	18.05	72736.45	1700.45	109.94	106.05
2016/17	18.06	96763.32	1846.51	114.83	105.91
2017/18	22.50	95798.01	1982.65	119.60	104.07
2018/19	25.50	97323.36	2109.26	125.14	112.58
2019/20	22.80	107505.34	2058.15	132.84	116.01
2020/21	21.70	117052.98	2150.50	137.62	117.57
2021/22	21.10	122613.15	2263.60	146.32	120.54
2022/23	19.40	120724.24	2312.40	157.64	130.45

Appendix-2

Fiscal Year	LNPSI	LNGE	LNRGDP	LNCPI	LNFER
1974/75	2.34	5.02	5.83	1.43	2.35
1975/76	2.34	5.25	5.86	1.42	2.50
1976/77	2.39	5.45	5.86	1.45	2.52
1977/78	2.40	5.59	5.88	1.55	2.51
1978/79	2.26	5.71	5.90	1.59	2.48
1979/80	2.25	5.85	5.89	1.68	2.48
1980/81	2.20	6.01	5.98	1.81	2.48
1981/82	2.26	6.28	6.03	1.91	2.56
1982/83	2.38	6.55	6.03	2.04	2.62
1983/84	2.26	6.61	6.12	2.10	2.73
1984/85	2.51	6.73	6.17	2.14	2.88
1985/86	2.29	6.89	6.22	2.29	2.99
1986/87	2.41	7.05	6.24	2.41	3.07
1987/88	2.33	7.25	6.30	2.51	3.10
1988/89	2.25	7.50	6.35	2.59	3.24

Fiscal Year	LNPSI	LNGE	LNRGDP	LNCPI	LNFER
1989/90	2.17	7.58	6.40	2.69	3.35
1990/91	2.46	7.76	6.46	2.78	3.46
1991/92	2.54	7.88	6.51	2.97	3.75
1992/93	2.70	8.04	6.54	3.06	3.82
1993/94	2.67	8.12	6.61	3.14	3.89
1994/95	2.72	8.27	6.64	3.22	3.91
1995/96	2.74	8.45	6.69	3.29	4.01
1996/97	2.69	8.53	6.74	3.37	4.04
1997/98	2.66	8.63	6.77	3.45	4.12
1998/99	2.49	8.69	6.82	3.56	4.21
1999/00	2.51	8.80	6.87	3.59	4.23
2000/01	2.71	8.99	6.92	3.62	4.30
2001/02	2.76	8.99	6.92	3.65	4.34
2002/03	2.83	9.04	6.96	3.69	4.35
2003/04	2.87	9.10	7.00	3.73	4.30
2004/05	2.83	9.24	7.03	3.77	4.27
2005/06	2.89	9.31	7.07	3.85	4.28
2006/07	2.87	9.50	7.10	3.91	4.25
2007/08	2.88	9.69	7.15	3.97	4.17
2008/09	2.83	10.00	7.19	4.09	4.34
2009/10	2.87	10.03	7.23	4.18	4.31
2010/11	2.73	10.16	7.27	4.27	4.28
2011/12	2.78	10.29	7.32	4.35	4.39
2012/13	2.91	10.32	7.35	4.45	4.47
2013/14	2.92	10.66	7.40	4.54	4.58
2014/15	3.10	10.81	7.44	4.61	4.60
2015/16	2.89	11.19	7.44	4.70	4.66
2016/17	2.89	11.48	7.52	4.74	4.66
2017/18	3.11	11.47	7.59	4.78	4.65
2018/19	3.24	11.49	7.65	4.83	4.72
2019/20	3.13	11.59	7.63	4.89	4.75
2020/21	3.08	11.67	7.67	4.92	4.77
2021/22	3.05	11.72	7.72	4.99	4.79
2022/23	2.97	11.70	7.75	5.06	4.87

Annexes

Figure 3

Normality Test Result

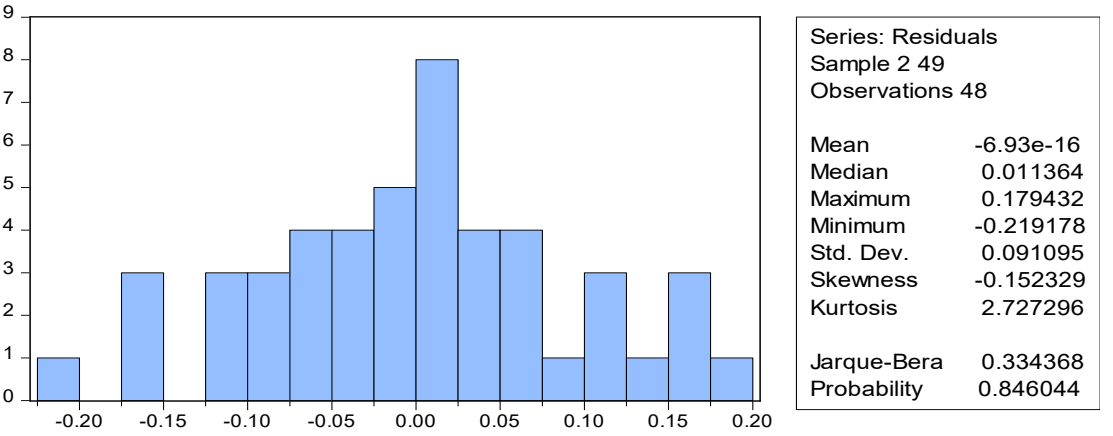

Table 12

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.000137	Prob. F(1,41)	0.9907
Obs*R-squared	0.000160	Prob. Chi-Square(1)	0.9899

Table 13

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.929741	Prob. F(5,42)	0.1096
Obs*R-squared	8.967076	Prob. Chi-Square(5)	0.1104
Scaled explained SS	5.929304	Prob. Chi-Square(5)	0.3132

Table 14

Ramsey RESET Test

Specification: LNPSI LNPSI(-1) LNRGDP LNGE LNFER LNCPI C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.521519	41	0.6048
F-statistic	0.271982	(1, 41)	0.6048

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.002570	1	0.002570
Restricted SSR	0.390017	42	0.009286
Unrestricted SSR	0.387447	41	0.009450

Figure 4

CUCUM Test

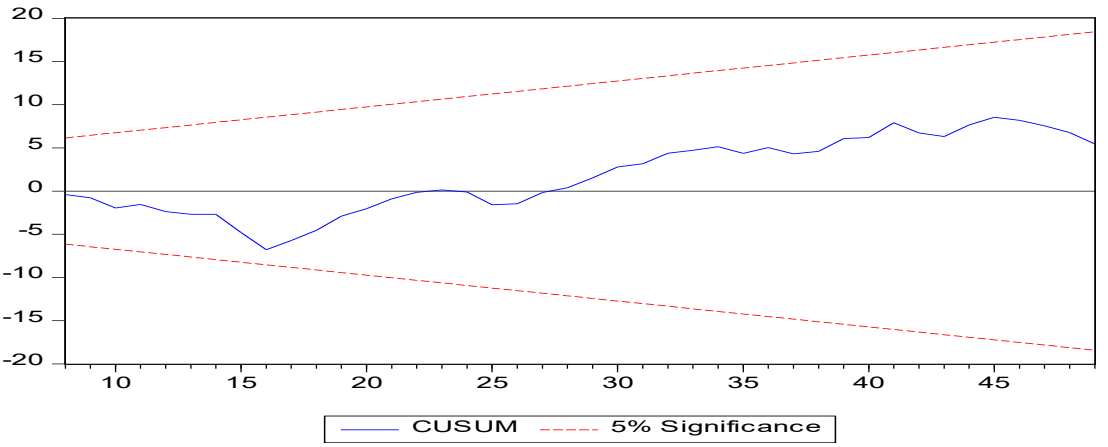

Figure 5

CUCUM of Square Test