Research Article

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Impact of Economic Growth, Inflation, Government Effectiveness, and Corruption Control on Gross Capital Formation of Nepal

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Abstract

This study aims to investigate the impact of inflation rate, economic growth, effectiveness of government, and corruption control on gross capital formation in Nepal. Secondary data, which are collected from the World Bank Report and Nepal's economic surveys, is used in the study. The descriptive and correlational research designs are used to analyze the impact of predictor variables. This study is guided by positivist research philosophy and is mainly quantitative. To investigate the effects and validate the model, econometric tools include descriptive statistics, correlation analysis, dynamic ordinary least squares (DOLS), Phillips-Perron unit root test, and variance inflation factor. Other measures of residual testing include the Hansen parameter instability test, normality test, residual and standardized residual graph, and actual fitted residual graph. The effectiveness of government has a high degree (r=0.722) of positive association with gross capital formation. Economic growth, corruption control, the effectiveness of government, inflation rate, and gross capital formation have long-run cointegration. Economic growth has a positive and significant impact on gross capital formation. One unit increase in economic growth results in a 1.4594 unit increase in gross capital formation in Nepal. The government's effectiveness also positively and significantly impacts gross capital formation in Nepal. One unit increase in the effectiveness of the government results from 0.8125 unit increase in capital formation in Nepal. The inflation rate has no significant impact on gross capital formation in Nepal. But surprisingly, corruption control negatively and significantly impacts capital formation. One unit change in corruption control resulted in a 0.8217 unit decrease in capital formation. About 97.57 percent variation in capital formation is determined by economic growth, effectiveness of government, corruption control, and inflation rate in Nepal. Policymakers should focus on enhancing economic growth through infrastructure, education, and business environment improvements, ensuring effective governance and stable inflation, and fine-tuning anti-corruption strategies to support capital formation in Nepal.

JEL Classification: E_{22}, E_{31}, H_{11}, O_{43}

Keywords: Accumulation, Dynamic OLS, employment, endogenous, sustained

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Introduction

Gross capital formation may be the total investment in physical assets made within an economy, involving additions to fixed assets and net changes in inventories. (Rowthorn, 1995). The World Bank defines GCF as outlays on additions to fixed assets plus net changes in the level of inventories. It includes, among others, expenditure on equipment and machinery, construction of infrastructure such as roads and buildings, and land improvement. Gross Capital Formation (GCF) is thus a key indicator for an economy's investment in productive capacity, denoting its ability to produce goods and services for the future.

The foundation of economic growth is capital formation (Harrod, 1934). It includes building tangible and intangible assets as the foundation of economic expansion (Uneze, 2013). Historically, real estate, equipment, and machinery investments have been linked to capital creation. But digital capital-including material and immaterial elements like software, servers, big data analytics, and brand equity—is essential in the digital age. Economic growth is fueled by robust capital creation. (Tang &Liu, 2022). Businesses may use it to innovate, increase productivity, and generate employment (Yusuf & Mohd, 2022). An efficient capital market allows firms to allocate resources effectively and invest long-term in profitable ventures (Topcu et al., 2020).

Government effectiveness and corruption control are critical factors that influence gross capital formation. Effective governance facilitates an environment conducive to investment by ensuring political stability, efficient public services, and adherence to the rule of law. This promotes investor confidence and increases capital formation (Uddin & Rahman, 2023). Conversely, bureaucratic inefficiencies, corruption, and policy unpredictability hinder capital accumulation, and corruption can deter investment by creating an unpredictable business environment and increasing costs.

Studies have shown that high levels of corruption are associated with lower investment rates and hindered economic growth (Mongi & Saidi, 2023). Corruption corrodes the investment climate. When corruption prevails, resources are diverted away from productive investments. Investors hesitate to commit capital in an environment where bribery, favoritism, and rent-seeking distort fair competition (Kaldor,1961).

Inflation's impact on gross capital formation (GCF) can be complex. Moderate inflation is often seen as a sign of a growing economy, which can encourage investment and capital formation. However, high inflation can create uncertainty about future prices, eroding the actual value of money and savings and discouraging long-term investments. Inflation erodes the purchasing power of savings. High inflation rates discourage saving, affecting the pool of funds available for investment. Stable prices and prudent monetary policies encourage long-term saving and capital accumulation (Blanchard & Wolfers, 2000).

There is a strong positive relationship between GDP growth and gross capital formation. Economic growth increases a country's overall wealth, providing more capital asset investment resources. Moreover, high GDP growth rates signal a healthy economy, encouraging domestic and foreign investments. Studies focusing on various economies, such as South Africa, have shown that robust economic growth positively correlates with increased gross capital formation (Pasara & Garidzirai, 2020).

This study explores the impact of the effectiveness of government, corruption control, inflation, and economic growth on capital formation in Nepal. It searches the individual and joint effects of independent variables (effectiveness of government, corruption, inflation rate, and economic growth) on dependent variables (gross capital formation). This study seeks to answer the following research questions:

- How does the effectiveness of government policies influence gross capital formation in the Nepalese economy?
- To what extent does corruption control affect gross capital formation?
- How does inflation impact gross capital formation in emerging economies like Nepal?
- How does the rate of economic growth influence gross capital formation?
- How do government effectiveness, corruption control, and inflation rates interact to influence gross capital formation?

The paper is divided into six sections. The subsequent sections of this investigation are as follows: The second section contains a comprehensive review of pertinent empirical and theoretical studies. The methodology is delineated in Section Three, which includes the research design, the nature of the data, the data analysis procedure, and the estimating strategies. Data presentation and analysis are found in segment four. Section five delves into the findings, while section six encompasses the study's conclusion, policy implications, and limitations.

Literature Review

There is so much theoretical and empirical literature available. The relevant theoretical and empirical literature are reviewed in this section. The theoretical literature is reviewed at the beginning, and then empirical literature is evaluated under a separate heading that establishes the relationship between dependent and independent variables.

Economic Growth and Capital Formation

The Harrod-Domar model is a classic theory that emphasizes investment policy in economic growth. According to the model, investment is supposed to seed capital accumulation and stimulate economic growth through hiking productive capacity. From the Harrod-Domar theory, it is proposed that the growth rate of an economy is directly proportional to the amount it saves and inversely proportional to the capital-output ratio of that country (Dumo et al., 2023).

As espoused by Paul Romer, endogenous growth theory emphasizes internal economic factors above growth. Human capital, innovation, and knowledge spillovers promote growth. Endogenous growth models suggest that human capital and R&D investment may boost productivity and technology to sustain economic development. According to the Capital Market Development Theory, adequate capital markets channel savings into productive investments. Well-developed Financial Systems encourage capital formation by giving businesses the finance they need to invest in capital goods that boost economic growth. This is shown by research. (Moreano et al., 2024).

Uddin and Rahman (2023) observed the impact of corruption, unemployment, and inflation on economic growth in 79 developing countries from 2002 to 2018. They found the negative effect of corruption, unemployment, and political stability on economic growth. Still, inflation, the effectiveness of government, and the rule of law positively impact GDP per capita. Pasara and Garidzirai (2020) searched the causality effect of gross capital formation unemployment on economic growth in South Africa. They found a positive and long-run relationship between gross capital formation and economic growth, but unemployment has no significant impact on GDP. Uneze (2013) found the positive effect of increased capital formation on economic growth in Sub-Saharan African Countries.

Lymonova (2019) observed the positive impact of economic growth on capital formation in the Euro area. Aslam and Altinoz (2021) observed the effect of natural resources and gross capital formation on economic growth in Europe, Asia, Africa, and America. They found the bidirectional causality between capital formation and economic growth in Europe and Asia. Unidirectional causality between capital formation and economic growth in Africa and America was detected.

Adhikary (2011) found long-term causality between capital formation and economic growth. However, Adhikary (2015) found the negative effect of capital formation on Nepal's economic growth rate. Mahamed (2023) found a strong positive correlation between economic growth and gross capital formation in Somalia. Wisiman and Ndzembanteh (2020) found a bidirectional causality between physical capital formation and growth in Malaysia. Jehangir et al. (2020), Rahman et al. (2020), Maune et al. (2023), and O'noe and Arras (2021) found the positive and significant impact and bidirectional causality between economic growth and capital formation. The study of Makhoba and Kaseeram (2022) and Xia et al. (2022) found the negative impact of capital formation on economic growth.

Effectiveness of Government and Gross Capital Formation

According to the Endogenous Growth Models, government policies that enhance human capital, innovation, and infrastructure are direct sources of long-term economic growth (Romer, 1990 & Arnold, 2000). Better governments can effectively strengthen education and health quality, resulting in a more productive workforce. The Institutional Theory, if emphasized, states that institutions are more critical for economic performance. Proper institutions help lower transaction costs, maintain property rights, and enforce the contracts, promoting investment and financial activities (North, 1990).

Several studies have confirmed the positive impact of government effectiveness on economic growth. For instance, Acemoglu et al. (2001) demonstrated that countries with strong institutions tend to have higher levels of income and growth. Acemoglu and Robinson (2019) argue that the quality of institutions and governance is crucial for economic development. Effective institutions ensure the rule of law, protection of property rights, and enforcement of contracts, which are fundamental for economic activities and investments. Muoneke et al. (2023) observed the interplay between government effectiveness and economic growth. They found the positive and significant impact of government effectiveness and gross capital formation, ultimately promoting economic growth. Hartley and Aldog (2022) examined the effect of the effectiveness of government and economic growth. They found the positive and significant impact of the effectiveness of government and economic growth in Vietnam. North et al. (2019) observed the adverse effects of inefficient government on capital formation.

Corruption Control and Capital Formation

Public Choice Theory suggests that corruption occurs when public officials have the opportunity and motivation to misuse their public position for private benefits. It leads to suboptimal public investment and reduced resource allocation efficiency (Buchanan & Tullock, 1962). Based on the principal-agent perspective for corruption, there arise principal-agent problems, where increased corruption is associated with agents (public officials) achieving maximum personal interest at the expense of the principal (residents), which contributes to agency costs and a decrease in economic efficiency (Jain, 2001).

Empirical studies consistently find that corruption negatively affects economic growth. Mauro (1995) found that corruption lowers investment and economic growth. Similarly, Treisman (2000) and Gerlagh and Pellegrini (2008) showed that corruption is associated with lower levels of economic performance. Toole and Trap (2014) observed the nexus between corruption and the efficiency of capital investment in developing countries. They found the negative impact of corruption on net investment. Belloumi et al. (2021) observed the causal relationship between corruption, investment, and economic growth. They found long-run solid unidirectional causality between domestic investment and domestic investment. Corruption negatively impacts economic growth and development but positively influences domestic investment.

Ghimire (2022) observed the effect of corruption and economic growth. He found that corruption negatively affects public investment, reduces government spending, misuses public resources, and decreases expenditure. Mandal (2017) concluded that low investment is Nepal's leading cause of corruption. Khalid (2024) examined the nexus between FDI and corruption in Asian countries. He found the non-linear corruption-growth and corruption-investment relationship for the sampled 20 most corrupted countries.

Zheng and Xiao (2020) observed the nexus between corruption and investment. They found that infrastructure investment is negative with anti-corruption efforts in China. Al-Mulairi (2023) searched the determinants of economic growth in Kuwait. They found a positive correlation between corruption control and gross capital formation.

Inflation and Gross Capital Formation

Classical and Neoclassical Theories argue that inflation distorts price signals, leading to inefficiencies in resource allocation. High inflation creates uncertainty, discourages investment, and reduces the purchasing power of money (Friedman, 1977). Keynesian theory suggests that moderate inflation can stimulate economic activity by lowering actual interest rates and encouraging consumption and investment. However, excessive inflation harms economic stability (Keynes, 1936).

Empirical studies indicate a nonlinear relationship between inflation and economic growth. Fischer (1993) found that low to moderate inflation rates have little impact on growth, while high inflation rates significantly hinder economic performance. Bruno and Easterly (1998) showed that inflation rates above a certain threshold are associated with lower growth rates. Idolor and Raphae (2022) observed the effect of the inflation rate on investment and economic growth in Nigeria. They found that the investment is negatively impacted by inflation above the threshold at seven percent but positively related to inflation below it.

Kamasa et al. (2022) observed the interplay between inflation and domestic investment in Ghana. They found the solid adverse effect of inflation on domestic investment means gross capital formation. Bambe (2023) found a significant positive impact of inflation on capital formation, which means domestic investment in emerging economies.

Lyke and Ho (2020) observed the relationship between inflation and gross capital formation. They found the negative effect of permanent inflation on domestic investment in the short run but insignificant impact in the long run. Inflation creates uncertainty and hampers capital formation. McCloud (2022) found no short-run and long-run effects of inflation on domestic investment in 21 out of the sampled countries.

Numerous studies have examined capital production and economic growth, but this one specifically examines how economic expansion affects gross capital formation. Similarly, additional studies have explored the efficacy of government and corruption control on economic development. However, this research examines their influence on gross capital production. The link between capital creation and economic development has been studied extensively, but this one examines how economic growth affects gross capital formation. Comparably, other research has looked at how economic development is influenced by government effectiveness and the battle against corruption. Nonetheless, their effect on gross capital output is the main focus of this study. While a profusion of theoretical and empirical research exists concerning the link between capital formation, economic development, and various other critical aspects, studies unique to Nepal are noticeably sparse. Most earlier studies examine these relationships within broader or more specific geographic and economic contexts, often failing to consider Nepal's unique political, institutional, and economic characteristics. Furthermore, an absence of thorough research simultaneously examines the combined effects on gross capital formation of government efficacy, inflation, corruption control, and economic development. By examining these relationships within the Nepalese context, our study fills in these gaps by thoroughly understanding how these factors affect capital creation in a developing nation like Nepal.

The following research hypotheses are developed based on the study's objectives and included variables.

Ho: Economic growth has no significant impact on gross capital formation in Nepal.

Ho: The effectiveness of government has no significant effect on gross capital formation.

Ho: Corruption control has no significant impact on gross capital formation in Nepal.

Ho: The inflation rate does not affect gross capital formation in Nepal.

Research Methodology

Research Design

The descriptive and correlational research design is used to search for the impact of inflation rate, economic growth, effectiveness of government, and corruption control on gross capital formation in Nepal. The correlational research design is used to explore the relation, and the descriptive research design is used to analyze the impact of predictor variables. This study is guided by positivist research philosophy and is mainly quantitative.

Source of Data and Analyzing Technique

This study is based on secondary data collected from reports from the World Bank and various economic surveys of Nepal. It covers 28 data points, spanning from 1998 to 2023. The Jamovi 2.4.11 and EViews12 are used to analyze and explore the impact of inflation, economic growth, effectiveness of government, and corruption control on gross capital formation in Nepal. The econometric tools used in this study include descriptive statistics, correlation analysis, the Phillips-Perron unit root test, Dynamic Ordinary Least Square (DOLS), and various measures of residual testing such as Variance Inflation Factor, Hansen Parameter Instability test, normality test, residual and standardized residual graph, and actual fitted residual graph. These tools investigate the impact and assess the model's validity.

Variable and Model Specification

This study uses five variables: inflation rate, economic growth, effectiveness of government, corruption control, and gross capital formation. The gross capital formation is the dependent variable, and the rest of the variables are the independent variables. It is assumed that gross capital formation depends upon inflation rate, economic growth, effectiveness of government, and corruption control. In this sense,

Gross capital formation = f (Inflation rate, economic growth, effectiveness of government, corruption control) (1)

In symbol

LNGCFM = f (LNGDPGR, INFMR, EFFG. CORRC) (2)

$$LNGCFM = \beta_0 + \beta_1*LNGDPGR+ \beta_2*INFMR + \beta_3*EFFG + \beta_4*CORRC + \mu \quad (3)$$

In equation (3), LNGCFM indicates the natural log of gross capital formation, LNGDPGR shows the natural log of GDP growth rate, INFMR points to the inflation rate, EFFG specifies government effectiveness, CORRC directs corruption control, β_0 is the intercept, β_1, β_2, β_3, and β4 are the coefficients for respective variables, and μ shows error term.

Dynamic Ordinary Least Square (DOLS) Model

The DOLS model is an econometric procedure for assessing the long-run relationship between integrated time series, which are cointegrated (Stock & Watson, 1993). It is an extension of the OLS technique that handles endogeneity and serial correlation issues. This is done by using past and future values of the first differences of explanatory variables. The DOLS method considers the leads and lags of the differenced independent variables, thus accounting for both the simultaneity and slight sample bias in this approach. With this approach, one gets unbiased and efficient estimators, so it is beneficial for cointegrated systems where variables have a long-run relationship but may deviate from each other in the short run (Saikkonen, 1991).

The general form of a dynamic ordinary least square regression model is specified as given below:

$$Y_t = \beta_0 + \beta_1 X_t + \sum_{K=-p}^{P} \partial_k \Delta X_{t+k} + \mu t \quad (4)$$

In equation (4), Y_t is the dependent variable at time t, and X_t is the independent variable at time t. ΔX_{t+k} represents the first differences of the independent variable, included to correct for endogeneity. k ranges from −p to p, representing the leads and lags of the first differences. β0 is the intercept. β1 is the coefficient for the independent variable. δ_k are the coefficients for the leads and lags of the first differences, and μt is the error term.

By using study variables, the DOLS model is specified as follows:

$$LNGCFM_t=\beta_0+\beta_1 LNGDPGR_t+\beta_2 INFMR_t+\beta_3 EFFG_t+\beta_4 CORRC_t+\sum_{k=-p}^{P} \partial_{1k} \Delta LNGDPGR_{t+k}+ \sum_{k=-p}^{P} \partial_{2k} \Delta INFMR_{t+k}+ \sum_{k=-p}^{p} \partial_{3k} \Delta EFFG_{t+k}+ \sum_{k=-p}^{P} \partial_{4k} \Delta CORRC_{t+k} + \mu_t \quad (5)$$

In equation (5), $LNGCFM_t$ is the natural log of gross capital formation at time t. $LNGDPGR_t$ is the natural log of GDP growth rate at time t. $INFMR_t$ is the inflation rate at time t. $EFFG_t$ is the government's effectiveness at time t. $CORRC_t$ is the corruption control at time t. $\Delta LNGDPGR_{t+k,}$ $\Delta INFMR_{t+k}$, $\Delta EFFG_{t+k}$, and $\Delta CORRC_{t+k}$ are the leads and lags of the first differences of the respective independent variables. K ranges from −p to p, representing the number of leads and lags included in the model. β_0 is the intercept term. β_1, β_2, β_3, and β_4 are the coefficients for the independent variables. δ_{1k}, δ_{2k}, δ_{3k}, and δ_{4k} are the coefficients for the leads and lags of the first differences of the independent variables. μt is the error term.

The error term is estimated as given below:

$$\mu_t=LNGCFM_t-(\beta_0+\beta_1 LNGDPGR_t+\beta_2 INFMR_t+\beta_3 EFFG_t+\beta_4 CORRC_t+\sum_{k=-p}^{P} \partial_{1k} \Delta LNGDPGR_{t+k}+ \sum_{k=-p}^{P} \partial_{2k} \Delta INFMR_{t+k}+ \sum_{k=-p}^{p} \partial_{3k} \Delta EFFG_{t+k}+ \sum_{k=-p}^{P} \partial_{4k} \Delta CORRC_{t+k}) \quad (6)$$

In practice, residual refers to the error term's realized values, which are the differences between observed values and predicted values from the model.

Presentation and Analysis

Descriptive Statistics

Descriptive statistics provide a brief summary and overview of a data set's main characteristics and patterns. The results of descriptive statistics are listed in Table 1.

The descriptive statistics table contains a summary of key statistical measures for five variables: GDP growth, gross capital formation, inflation rate, corruption control, and effectiveness of government, with 28 observations. The mean and median values for LNGDPGR, LNGCFM, INFMR, CORRC, and EFFG are all close. Hence, the distribution of these variables is relatively symmetric. Standard deviations express the variability in the data. The highest variability is for INFMR, with 2.80, while the lowest is for EFFG, with 0.233. Skewness values indicate that CORRC, with 3.82, and EFFG, with 1.09, are highly positively skewed, showing a longer tail on the right side; all the other variables have skewness close to zero, indicating near-normal distribution. Kurtosis values indicate the tailedness of the distribution.

Table 1
Key Information About the Study Variable

Base	LNGDPGR	LNGCFM	INFMR	CORRC	EFFG
N	28	28	28	28	28
Mean	23.4	22.1	6.63	-0.637	-0.812
Median	23.4	22.3	7.19	-0.670	-0.910
Standard deviation	0.771	0.936	2.80	0.259	0.233
Minimum	22.2	20.8	2.27	-0.950	-1.14
Maximum	24.4	23.5	11.2	0.560	-0.340
Skewness	-0.081	-0.083	-0.121	3.82	1.09
Std. error skewness	0.441	0.441	0.441	0.441	0.441
Kurtosis	-1.58	-1.55	-1.29	18.0	0.0264
Std. error kurtosis	0.858	0.858	0.858	0.858	0.858
Shapiro-Wilk W	0.900	0.894	0.934	0.591	0.825
Shapiro-Wilk p	0.012	0.008	0.079	< .001	< .001

Where LNGDPGR indicates the Gross Domestic Product growth or economic growth rate, LNGCFM indicates the gross capital formation, INFMR, EFFG, and CORRC indicate the annual inflation rate, effectiveness of government, and corruption control, respectively.

For CORRC, Kurtosis is very high, 18.0, indicating that the distribution is leptokurtic with heavy tails. For LNGDPGR, LNGCFM, and INFMR, the kurtosis is negative. Thus, their distributions are platykurtic with lighter tails. The Shapiro-Wilk W test can be used to check if the data is normally distributed. A lower W statistic and a significant P-value less than 0.05 indicate non-normality. The P-values for CORRC and EFFG variables are very low (<0.001), showing strong evidence against normality. Moreover, the assumptions were also violated by LNGDPGR and LNGCFM with P = 0.012 and 0.008, while INFMR was on the borderline with the P-value of 0.079, indicating a possible but not definite deviation from normality.

Correlation Analysis

A correlation matrix is a table showing the correlation coefficients between variables. Each cell in the matrix represents the correlation between two variables, indicating the strength and direction of their relationship. This matrix is often used in statistics and data analysis to understand the relationships between multiple variables simultaneously. The results of Karl Pearson's correlation matrix are presented in Table 2.

The correlation matrix table shows the relationships between various economic variables, measured using Pearson's correlation coefficient (r) and their significance levels (P-values). The LNGDPGR (GDP growth) is highly positively correlated with gross capital formation (LNGCFM) (0.993, P < 0.001) and negatively correlated with EFFG (-0.784, P < 0.001), indicating strong relationships. LNGCFM also strongly correlates with EFFG (0.772, P < 0.001). The correlations between CORRC, IMFMR, and other variables are weak and not statistically significant, suggesting limited or no linear relationships among these variables. The significant correlations indicate that GDP growth and government efficiency are strongly interconnected with investment levels.

Table 2
Results of Karl Pearson Correlation Matrix

Variable	Base	LNGDPGR	LNGCFM	CORRC	INFMR	EFFG
LNGDPR	Pearsons' r	-				
	P-Value	-				
LNGCFM	Pearsons' r	0.993***	-			
	P-Value	<0.001	-			
CORRC	Pearsons' r	0.151	0.139	-		
	P-Value	0.442	0.479	-		
IMFMR	Pearsons' r	0.132	0.142	-0.184	-	
	P-Value	0.505	0.471	0.349	-	
EFFG	Pearsons' r	-0.784***	0.772***	0.057	-0.071	-
	P-Value	<0.001	<0.001	0.772	0.718	-

Note. * p < .05, ** p < .01, *** p < .001

Phillips-Perron Unit Root Testing

The Phillips-Perron (PP) unit root test is a statistical test used to determine whether a time series is stationary or contains a unit root, implying non-stationarity. Unlike the Augmented Dickey-Fuller (ADF) test, the PP test accounts for heteroscedasticity and serial correlation in the error terms without adding lagged difference terms. The PP test provides more robust results in the presence of autocorrelation and conditional heteroscedasticity in the time series data. The results of the Phillips-Perron stationarity test are displayed in Table 3.

Table 3
Results of Phillips-Perron Unit Root Test

Variable	Base	Level		First Difference		Decision
		Intercept	Trend and intercept	Intercept	Trend and intercept	
INGCFM	PP-test	-0.427	-2.453	-5.351	-5.185	Stationary after the first difference
	P-value	0.891	0.346	0.0002	0.0015	
	t-value	-2.796	-3.587	-2.981	-3.595	
LNGDPGR	PP-test	-0.404	-1.599	-4.151	-4.039	Stationary after the first difference
	P-value	0.895	0.766	0.004	0.019	
	t-value	-2.976	-3.587	-2.981	-3.595	
INFMR	PP-test	-3.645	-3.627	-13.251	-12.790	Stationary at level
	P-value	0.012	0.046	0.000	0.000	
	t-value	-2.976	-3.587	-2.981	-3.595	
EFFG	PP-test	-2.040	-2.882	-8.729	-21.619	Stationary after the first difference
	P-value	0.269	0.183	0.000	0.000	
	t-value	-2.976	-3.587	-2.981	-3.595	
CORRC	PP-test	-4.069	-4.131	-14.199	-14.102	Stationary at level
	P-value	0.004	0.016	0.000	0.000	
	t-value	-2.976	-3.587	-2.981	-3.595	

Where LNGDPGR indicates the Gross Domestic Product growth or economic growth rate, LNGCFM indicates the gross capital formation, INFMR, EFFG, and CORRC indicate the annual inflation rate, effectiveness of government, and corruption control, respectively.

The Table shows the results of the stationarity test using the Phillips-Perron test for the following five variables: Gross capital formation, economic growth, inflation rate, Effectiveness of government, and control of corruption. The level and the first difference are tested with intercept and trend. Gross capital formation (LNGCFM) and economic growth (LNGDPGR) are non-stationary at levels since the p-values in each case are very high at 0.891 and 0.895, respectively. On first differencing, however, both become stationary, with p-values dropping to 0.0002 and 0.004, respectively. The inflation rate (INFMR) is level stationary; the P-values are significant at 0.012 and 0.046, so it does not require differencing. The efficiency of government (EFFG) is non-stationary at the level—p-value 0.269—but at first differencing, it is stationary with a p-value of 0.000. Corruption control (CORRC) is level stationary; the P-values are 0.004 and 0.016, indicating that it is intrinsically stationary.

Trace and Max-Eigen Unrestricted Co-integration Rank Test

The Trace and Max-Eigenvalue tests are part of the Johansen co-integration approach used to determine the number of co-integrating relationships in a multivariate time series system. The Trace test examines the null hypothesis of at most r co-integrating vectors against the alternative of more than r. In contrast, the Max-Eigenvalue test evaluates the null hypothesis of r co-integrating vectors against the alternative of r+1. In the context of the Johansen co-integration approach, r represents the number of co-integrating vectors or relationships among the variables in the multivariate time series system. These tests help identify long-term equilibrium relationships among multiple non-stationary time series variables. The Results of the Johnsen co-integration test are presented in Table 4.

The Trace and Maximum Eigenvalue tests check the number of cointegrating equations within a dataset, showing the long-run equilibrium relationships between variables. It is essential to know that the Table contains eigenvalues, test statistics, critical values, and p-values associated with the hypothesized number of cointegrating equations. For the hypothesis "None" (no co-integration), the Trace statistic was 79.34. In contrast, the critical value of 69.82 was associated with a p-value of 0.007, while the Max-Eigen statistic was 34.11, with a critical value of 33.87 and a p-value of 0.046. With these two tests at the 5 percent significance level, one rejects the null hypothesis of no co-integration. Hence, at least one cointegrating equation exists. It indicates a stable long-run relationship among the variables under study.

Table 4
Outcomes of Long-Run Co-Integration Test

Hypothesized No. of CE(s)	Eigen Value	Trace unrestricted cointegration test			Max-Eigen unrestricted Co-integration test		
		Trace stat.	0.05 critical value	Prob.	Max-eigen stat	0.05 critical value	Prob
None*	0.731	79.34	69.82	0.007	34.11	33.87	0.046
At most 1	0.577	45.23	47.86	0.086	22.38	27.58	0.201
At most 2	0.376	22.84	29.79	0.254	12.26	21.13	0.521
At most 3	0.242	10.57	15.49	0.238	7.21	14.26	0.464
At most 4	0.121	3.36	3.84	0.067	3.36	3.84	0.0678

Note: Both trace and Max-Eigen value tests indicate one cointegrating equation at the 5 percent significance level.
*Denotes rejection of the hypothesis at the 0.05 level.

Dynamic Ordinary Least Square (DOLS) Regression Analysis

Dynamic least squares regression is an econometric technique to confirm an estimated long-run relationship between variables in a cointegrated system. It extends OLS by adding leads and lags of the first differences of explanatory variables, thereby overcoming the deficiencies associated with endogeneity and serial correlation. It then ensures that the estimates of parameters obtained are unbiased and efficient, even in dynamic interactions among variables. The Dynamic Ordinary Least Square (DOLS) outcomes are displayed in Table 5.

Table 5
*Outcomes of Dynamic Ordinary Least Square (DOLS) Regressio*n

Dependent Variable: LNGCFM
Method: Dynamic Least Squares (DOLS)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth =3.00

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDPGR	1.4594	0.0777	18.782	0.000
INFMR	-0.0171	0.0116	-1.4724	0.179
EFFG	0.8125	0.2626	3.0931	0.014
CORRC	-0.8217	0.2602	-3.1580	0.013
C	-11.841	1.6569	-7.1467	0.0001

R-squared	0.9757	Mean dependent var	22.156
Adjusted R-squared	0.9672	S.D. dependent var	0.9007
S.E. of regression	0.1019	Sum squared resid	0.0831
Long-run variance	0.0071		

Where LNGDPGR indicates the Gross Domestic Product growth or economic growth rate, LNGCFM indicates the gross capital formation, INFMR, EFFG, and CORRC indicate the annual inflation rate, effectiveness of government, and corruption control, respectively.

The DOLS regression analysis will estimate the long-term relationship between the dependent variable, gross capital accumulation, and other independent variables, such as economic growth, inflation rate, effectiveness of government, and corruption control. This approach controls for possible endogeneity and serial correlation by adding leads and lags of first differenced independent variables. The results indicate an estimated regression equation as follows:

LNGCFM = 1.4594*LNGDPGR−0.0171*INFMR+0.8125*EFFG−0.8217*CORRC−11.841 (7)

The coefficient of each independent variable is the estimated long-term effect on LNGCFM, assuming that other factors are held constant. The coefficient for LNGDPGR comes out to be 1.4594, which is highly significant; hence, the GDP growth strongly impacts the LNGCFM. Gross capital formation will increase by roughly 1.4594 percent as the GDP increases by one percent.

The coefficient for the inflation rate is -0.0171; its P-value of 0.179 shows that this effect does not reach statistical significance at the 5 percent level. Hence, inflation is not statistically significant to gross capital formation in Nepal. The coefficient estimation for the effectiveness of government indicators is 0.8125, which is positive and statistically significant (P-value = 0.014). It suggests that more efficient government is associated with increased capital formation. Each unit increase in the effectiveness of the government induces a rise of 0.8125 units of capital formation in Nepal.

The coefficient for CORRC, which measures corruption, is -0.8217 and is highly significant, with a p-value of 0.013. This means that higher levels of corruption are related to decreased capital formation within Nepal. Capital accumulation decreased by about 0.8217 units for every unit increase in corruption.

The R-squared value of 0.9757 indicates that the model accounts for about 97.57 percent of the variation in Gross Capital Formation, which fits very well. The adjusted R-squared adjusts this value slightly to consider the number of predictors in the model. The standard error of the regression, 0.1019, shows the average distance that the observed values fall from the regression line. The estimated long-run relationship using this model is that all selected independent variables strongly influence gross capital formation, except for corruption, which hurts capital accumulation. Inflation, according to this analysis, does not have any significant effect.

Residual Diagnostic of the Model

Residual diagnostics involve evaluating a statistical model's residuals (errors) to check its adequacy and assumptions. Analyzing the residuals can detect patterns indicating potential issues such as non-linearity, heteroscedasticity, or autocorrelation. Proper residual diagnostics ensure the model's validity and reliability for making predictions or inferences. In the residual diagnostic variance inflation factor, the Hansen parameter instability test, normality test, residual graph, standardized residual graph, and actual fitted residual graph are analyzed. Table 6 displays the results of the variance inflation factors (VIF) and co-integration test- Hansen parameter instability test.

The Table presents the variance inflation factors (VIF) and the Hansen parameter instability co-integration Test results. The centered VIF values are considerably lower, suggesting that while multicollinearity exists, it might be more manageable when the variables are centered. The VIF value is less than 10. So, there is no severe problem of multicollinearity in the study variables. The Hansen parameter instability co-integration test assesses whether the series in the model are cointegrated, meaning they share a long-term equilibrium relationship. The null hypothesis is that the series are cointegrated. The Lc statistic value is 0.077, and the corresponding p-value is more significant than 0.2, indicating that the null hypothesis cannot be rejected. This suggests that the variables in the model are cointegrated, implying a stable long-term relationship among them despite potential short-term fluctuations. This stability is crucial for the reliability of the model's long-term forecasts and inferences.

Table 6
Variance inflation factors and Co-integration Test - Hansen Parameter Instability

Variance inflation factor			Co-integration Test - Hansen Parameter Instability Null: Series are cointegrated.				
Variables	**Coefficient of variance**	**Centered VIF**	**Lc statistic**	**m**	**k**	**P^2**	**Prob***
LNGDPGR	0.006	6.17	0.077	4	0	0	>0.2
INFMR	0.0001	1.38					
EFFG	0.069	6.028					
CORRC	0.0677	1.260					
C	2.745	-					

Where, m= Stochastic trends, k= Deterministic trends, P^2= Excluded trend
*Hansen (1992b) Lc (m2=4, k=0) p-values, where m2=m-p2 is the number of stochastic trends in the asymptotic distribution.

Normality Test

A normality test assesses whether a data set is well-modeled by a normal distribution. Using statistical measures and graphical methods, it evaluates the hypothesis that the sample comes from a normally distributed population. Ensuring normality is crucial because many statistical tests assume that the data follows a normal distribution, affecting the validity of their results. The Histogram of the normality test is presented in Figure 1.

The residuals appear to be approximately normally distributed, as indicated by the histogram and supported by the Jarque-Bera test statistic of 1.196930 with a p-value of 0.549803, higher than the standard significance levels (e.g., 0.05). This suggests that the null hypothesis of normality cannot be rejected. The mean of the residuals is nearly zero (-4.23e-15), and the standard deviation is 0.058834, indicating that the residuals are centered around zero with a moderate spread. The residuals' normality and randomness suggest a well-fitting regression model with no significant deviations from the assumptions.

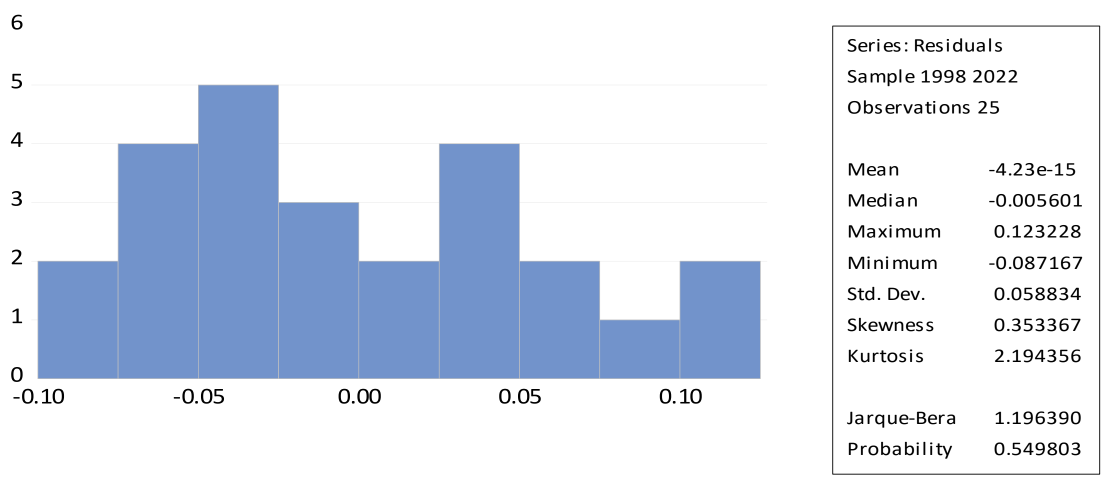

Figure 1
Histogram- Normality Test

Residual and Standardized Residual Graph

Residual and standardized residual graphs are tools used to evaluate the fit of a statistical model. Residual graphs plot the differences between observed and predicted values, helping identify patterns suggesting model inadequacies. Standardized residual graphs, which scale residuals to have constant variance, make detecting outliers and heteroscedasticity in the data more accessible. The derivation of Residual and Standardized Residual Graph are presented in Figure 2.

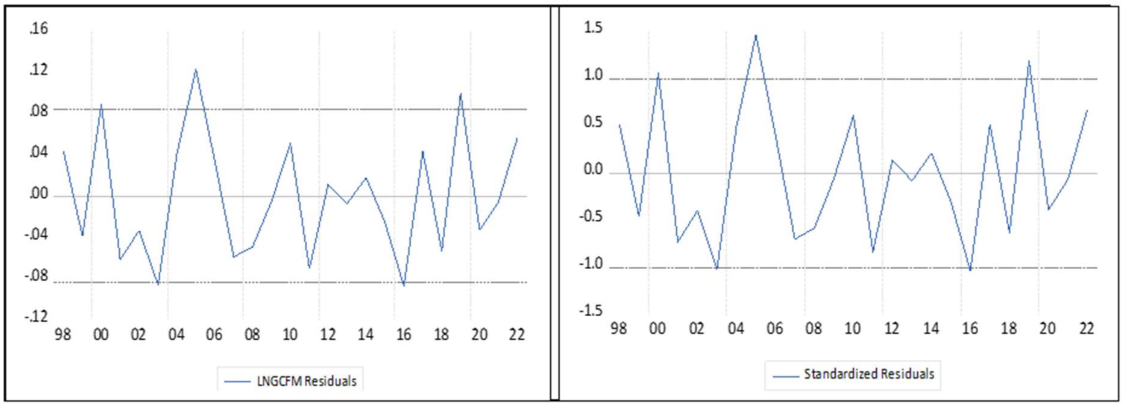

Figure 2
Residual and Standardized Residual Graph

The residual and standardized residual graphs typically provide insights into a regression model's fit and assumptions. The graph shows the standardized residuals of a model over time, spanning from 1998 to 2022. Standardized residuals measure how far each data point is from the predicted value, scaled by the standard deviation of the residuals. The Y-axis ranges from -1.5 to 1.5, with the residuals fluctuating around zero. The residuals seem to have higher and lower variability periods, indicating some cyclical or systematic pattern in the model's errors. Values above zero indicate the model underestimated the actual values, while values below zero indicate overestimation. The residuals generally within ±1.5 suggests that the model's predictions are reasonably accurate. The graph depicts the residuals of a model for the variable 'LNSCFM Residuals' over time from 1998 to 2022. The y-axis ranges from -0.12 to 0.12, with residuals fluctuating around zero. There is some fluctuation in the residuals, but no severe problem exists.

Actual Fitted Residual Graph

An Actual vs. Fitted vs. Residual graph is a diagnostic tool used to assess the performance of a regression model. It plots the actual observed values against the fitted (predicted) values and the residuals (differences between actual and predicted values). This graph helps identify how well the model captures the data trends and highlights any systematic patterns in the residuals that may indicate model misspecification.

The Actual Fitted Residual (AFR) graph in regression analysis depicts the model's residuals. According to a regression model, residuals are the differences between observed and fitted values. Trending time series information in the graph is available from 1998 to 2022. The top section contains two lines: "Actual," which stay very close to each other, thus showing that the model fits the actual data well. The right Y-axis likely corresponds to these values, ranging from approximately 20.5 to 23.5. The residuals—differences between the actual and fitted values—are in blue, down in the lower part of the plot. Those residuals would oscillate around zero, showing the deviations of the actual data from the fitted model—residual values on the left Y-axis range from -0.10 to 0.15. Overall, the model fits the data reasonably well, as can be seen by those tiny, generally centered residuals.

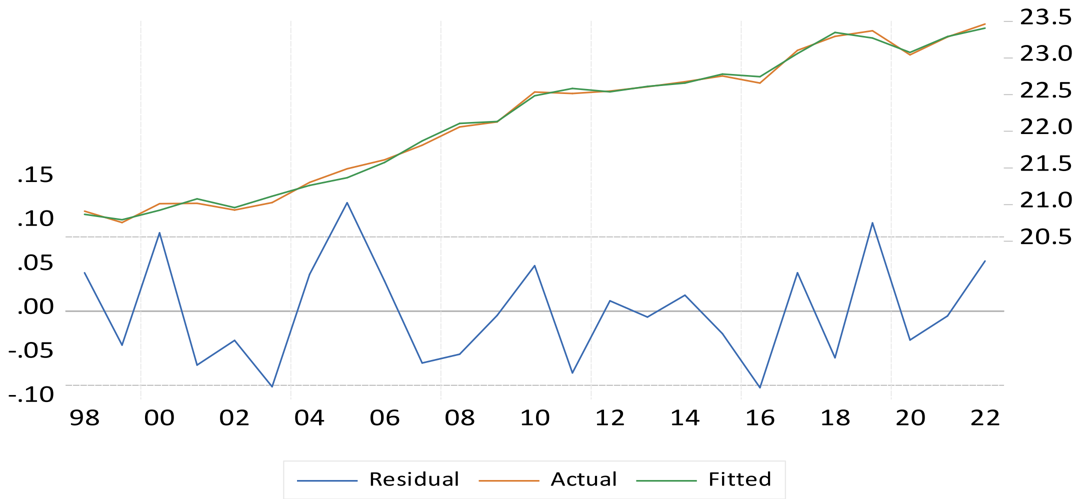

Figure 3
Actual Fitted Residual Graph of the Model

Result and Discussions

The effectiveness of government has a high degree (r=0.722) of positive association with gross capital formation. Economic growth, corruption control, the effectiveness of government, inflation rate, and gross capital formation have long-run cointegration. Economic growth has a positive and significant impact on gross capital formation. One unit increase in economic growth results in a 1.4594 unit increase in gross capital formation in Nepal. The findings of Pasara and Garidzirai (2020), Unez (2013), Lymonova (1019), Altinoz (2021), and Mahamed (2023) also found a strong positive correlation between economic growth and gross capital formation. However, the findings of Adhikary (2015), Makhoba and Kaseeram (2022), and Xia et al. (2022) do not align with this research findings. This is often because growth positively affects gross capital formation, as the higher economic activity and profits translate into increased funds available for reinvestment in capital goods. On the other hand, some negative impacts could occur in as many ways as growth, which can lead to an increase in the cost of capital goods due to inflation, thus lowering the actual value of investments. More rapid economic growth may immediately result in overexploitation of resources or environmental degradation, which will retard sustainable investment in capital formation over the longer run.

The government's effectiveness also positively and significantly impacts gross capital formation in Nepal. One unit increase in the effectiveness of the government results from 0.8125 unit increase in capital formation in Nepal. The findings of Acemoglu et al. (2001), Muoneke et al. (2023), and Aldog (2022) align with this finding. No research findings were found to be against this research finding. The effectiveness of government thus positively impacts gross capital formation, considering that a stable and predictable economic environment ensures an increase in private investment and reduces uncertainties. Efficient governance provides the essential public goods and infrastructure required, gives better regulatory quality, and enforces property rights—all of which are important in creating a suitable environment for capital accumulation.

The inflation rate has no significant impact on gross capital formation in Nepal. Idolor and Raphae (2022), Kamasam et al. (2022) Lyke and Ho (2022) found the adverse effects of inflation on domestic investment. These studies' findings violate the findings of the present study. However, McCloud (2022) found no causal impact of inflation on domestic investment. But surprisingly, corruption control negatively and significantly impacts capital formation. One unit change in corruption control resulted in a 0.8217 unit decrease in capital formation. The findings of Ghimire (2022) are aligned with this finding. However, the findings of Khalid (2024), Al-mulairi (2023), and Zheng and Xiao (2020) do not align with this finding. About 97.57 percent variation in capital formation is determined by economic growth, effectiveness of government, corruption control, and inflation rate in Nepal. The high variability of capital formation determined by economic growth, effectiveness of government, corruption control, and inflation rate in Nepal can be attributed to the fact that these variables considerably influence the climate for investment, efficiency in resource allocation, and stability of the economy as a whole; all these being sensitive parameters for accumulation of capital.

Conclusion, Policy Implications and Limitations

This study has searched the impact of economic growth, effectiveness of government, corruption control, and inflation on gross capital formation in Nepal. The effectiveness of government and economic growth have a high degree of positive correlation. The effectiveness of government has a high degree (r=0.722) of positive association with gross capital formation. Economic growth, corruption control, the effectiveness of government, inflation rate, and gross capital formation have long-run cointegration. Economic growth has a positive and significant impact on gross capital formation. One unit increase in economic growth results in a 1.4594 unit increase in gross capital formation in Nepal. The government's effectiveness also positively and significantly impacts gross capital formation in Nepal. One unit increase in the effectiveness of the government results from 0.8125 unit increase in capital formation in Nepal. The inflation rate has no significant impact on gross capital formation in Nepal. But surprisingly, corruption control negatively and significantly impacts capital formation. One unit change in corruption control resulted in a 0.8217 unit decrease in capital formation. About 97.57 percent variation in capital formation is determined by economic growth, effectiveness of government, corruption control, and inflation rate in Nepal.

Policymakers should prioritize boosting economic growth through infrastructure, education, and a better business environment to enhance gross capital formation. Improving government effectiveness and focusing on institutions, public service delivery, and efficient governance are crucial. While inflation doesn't significantly impact capital formation, maintaining stable inflation is essential for overall economic stability. The unexpected negative impact of corruption control on capital formation suggests that anti-corruption measures may need adjustment to avoid disrupting economic activities. Policymakers should fine-tune these strategies to support, rather than hinder, capital formation.

This study includes only five variables: economic growth, effectiveness of government, corruption control, inflation rate, and gross capital formation. It examined the impact of corruption control, effectiveness of government, inflation, and economic growth on gross capital formation in Nepal. It uses secondary data from 1998 to 2023, or 28 data points. The econometric tools like descriptive statistics, correlation analysis, Phillips- Perron unit root test, Dynamic Ordinary Least Square (DOLS), and various measures of residual testing like Variance inflation factor, Hansen Parameter Instability test, normality test, residual and standardized residual graph, and actual fitted residual graph are included to explore the impact and check the validity of the model. The Jamovi 2.4.11 and EViews12 explore the impact between response and predictor variables. Therefore, further study is necessary using more variables, data points, countries, tools, and techniques.

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