ANALYSIS OF ECONOMIC GROWTH AND OTHER MACRO-ECONOMIC VARIABLES OF NEPAL

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By

BINAYA BOGATI

Roll No : 190345

TU Reg No : 6-3-19-1026-2016

Birendra Multiple Campus

Bharatpur, Chitwan, Nepal

April, 2023

LETTER OF DECLARATION

I hereby declare that the Thesis entitled ANALYSIS OF ECONOMIC GROWTH AND OTHER MACRO-ECONOMIC VARIABLES OF NEPAL submitted to the Department of Economics, Birendra Multiple Campus, Bharatpur, Chitwan Nepal is entirely my original work prepared under guidance and supervision of my supervisor. Information collected in my research by means of secondary resources are true and genuine. The core matters of this thesis have not been presented or submitted anywhere else for the award of any degree or for any other purposes. I assure that no part of the content of this thesis has been published in any form before.

.....

Binaya Bogati

Roll No : 190345

TU Reg No : 6-3-19-1026-2016

Birendra Multiple Campus

Bharatpur, Chitwan, Nepal

त्रिभुवन विश्वविद्यालय
TRIBHUVAN UNIVERSITY
वीरेन्द्र बहुमुखी क्याम्पस
BIRENDRA MULTIPLE CAMPUS
भरतपुर, चितवन
Bharatpur, Chitwan
☎:056-520253, 520809, 526159
Fax:056-520253

पत्र संख्याः
च.नं. (Ref.)

मितिः
Date:

Department of Economics

LETTER OF RECOMMENDATION

This thesis entitled ANALYSIS OF ECONOMIC GROWTH AND OTHER MACRO-ECONOMIC VARIABLES OF NEPAL has been prepared by BINAYA BOGATI under my supervision. I hereby recommend this thesis for examination by the Thesis Committee as a partial fulfilment of the requirements for the DEGREE OF MASTER OF ARTS in ECONOMICS.

.....

Surya Narayan Poudel
Associate Professor
Thesis Supervisor
Department of Economics
Birendra Multiple Campus
Bharatpur, Chitwan

Date: 17-April-2023

त्रिभुवन विश्वविद्यालय
TRIBHUVAN UNIVERSITY
वीरेन्द्र बहुमुखी क्याम्पस
BIRENDRA MULTIPLE CAMPUS
भरतपुर, चितवन
Bharatpur, Chitwan
☎:056-520253, 520689, 526159
Fax:056-520253

पत्र संख्याः
च.नं. (Ref.)

मितिः
Date:

Department of Economics

APPROVAL SHEET

This thesis submitted by BINAYA BOGATI entitled ANALYSIS OF ECONOMIC GROWTH AND OTHER MACRO-ECONOMIC VARIABLES OF NEPAL to the Department of Economics, Birendra Multiple Campus, Tribhuvan University in partial fulfilment of the requirements for the DEGREE OF MASTER OF ARTS in ECONOMICS has been found satisfactory in scope and quality. Therefore, we accept this thesis as a part of the Master Degree.

Thesis Committee:

.....

Surya Narayan Paudel
Associate Professor
Thesis Supervisor

.....

External Examiner
Dr. Keshav Bhakta Sapkota, PhD

.....

Deepak Regmi
Associate Professor
Head of the Department
Department of Economics

Date: 30-May-2023

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April 2023

ABSTRACT

The government plays a major role in providing public goods and services, such as infrastructure and education, which can promote economic growth. Additionally, the government can intervene in markets to correct market failures, such as monopolies or externalities. Fiscal and monetary policies are also tools used by governments to stabilize the economy during periods of inflation, recession, or other economic fluctuations.

The core objective of the thesis entitled ANALYSIS OF ECONOMIC GROWTH AND OTHER MACRO-ECONOMIC VARIABLES OF NEPAL is to analyse the relationship between Gross Capital Formation (GCF), Government Revenue (GR), Inflation (CPI), and Gross Domestic Product (GDP) in Nepal. The ARDL and ECM models were used to investigate the short- and long-run relationships between the variables.

This study has been conducted to examine the temporal relationship (long-term and short-term) between the aforementioned macro-economic variables with GDP by analysing the time-series data between 1990-2022. The data were analysed using various analytical techniques such as Unit Root Tests, ARDL Model to Cointegration Tests, ECM Model, Bound Tests and related stability tests.

The ARDL results show that there is a positive relationship between GCF and GDP. Further, results show that GCF has a positive effect on GDP, but the relationship is not very strong and may be influenced by other factors. In addition, the results indicate that changes in inflation do not have a significant effect on GDP.

Similarly, Government Revenue does not have a significant effect on GDP. The short-run relationship between government revenue and GDP is positive, while the long-run relationship between the variables is characterized by the presence of a long-run equilibrium relationship.

Based on the findings, it is recommended that policies that stimulate Gross Capital Formation may be more effective in promoting economic growth than those focused on increasing Government Revenue or controlling inflation.

Keywords: economic growth, gross capital formation, government revenue, inflation

ACRONYMS AND ABBREVIATIONS

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Lag Model
CPI	Consumer Price Index
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Squares of Recursive Residuals
ECM	Error Correction Modelling
GCF	Gross Capital Formation
GDP	Gross Domestic Product
GR	Government Revenue
NRB	Nepal Rastra Bank
R&D	Research and Development
WB	World Bank

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CHAPTER I

INTRODUCTION

1.1. Background of the Study

Nestled between two geopolitical superpowers, Nepal is a landlocked country residing in the heart of South Asia, with an area of 147,516 square kilometres. It is one of the poorest and least developed countries in the world, with a gross domestic product per capita of just $1,372 in 2021/22 (CBS, 2022). The country is home to a population of approximately 30 million people, with a population growth rate of 0.92% per year. Nepal is home to a diverse range of ethnic groups, with the largest being the Chhetri, Brahman, and Newar. Most of the population is engaged in agriculture, with tourism and remittances also playing a significant role in the economy.

Nepal as primarily an agro-based country has national economic growth at 5.84 percent. 17.4 percent population of the country falls below the poverty line (Nepal Planning Commission, 2021). For the holistic development of the country, a careful utilization of natural resources is necessary. Nepalese economy has undergone significant changes over the last few decades, transitioning from an agriculture-based economy to a service-based economy. However, despite these changes, Nepal remains one of the poorest countries in South Asia, with high levels of poverty and unemployment.

Nepal has a large population living in poverty, and economic growth is necessary to reduce poverty levels and improve living standards. By promoting economic growth, Nepal can generate employment opportunities, increase incomes, and improve access to basic services such as education, healthcare, and housing.

In addition to poverty reduction, economic growth can also improve the country's infrastructure and connectivity, which is essential for the development of industries, trade, and tourism. Improved infrastructure can facilitate the movement of goods and services within the country, reducing transportation costs and increasing accessibility to markets. Better infrastructure also has a positive impact on the tourism industry, which is a significant contributor to the Nepalese economy. The development of infrastructure, such as roads, airports, and telecommunications, can help to increase the number of tourists visiting the country, which can generate revenue and provide employment opportunities for the local population. This, in turn, can enhance productivity, increase competitiveness, and promote sustainable development.

The Nealese government has implemented several economic policies to stimulate economic growth, such as promoting foreign investment, increasing infrastructure development, and improving access to credit for small and medium-sized enterprises.

However, despite these efforts, Nepal's economic growth has been relatively slow, with an average annual growth rate of 4.4% over the last decade (World Bank, 2021). Several factors have contributed to this slow growth, including political instability, poor infrastructure, low levels of education and human capital, and a weak regulatory environment.

To address these challenges and promote economic growth, policymakers in Nepal must have a clear understanding of the relationship between economic growth and key economic variables, such as gross capital formation, inflation, and government revenue. Understanding the relationship between these variables can help policymakers design effective economic policies that can stimulate economic growth and development in Nepal.

The relationship between government revenue and economic growth is also complex and debated among economists. On the one hand, government revenue, particularly from taxes, can provide the necessary resources for the government to invest in public goods and services, such as infrastructure and education, which can promote economic growth. On the other hand, high tax rates can discourage private sector investment, reduce incentives for entrepreneurship and innovation, and impede economic growth. The optimal level of government revenue depends on various factors, including the efficiency of government spending, the level of public debt, and the degree of income inequality. In general, a balanced approach to government revenue that supports investment in public goods while maintaining a competitive tax environment can promote sustainable economic growth.

Given the importance of economic growth for poverty reduction and overall improvements in living standards, there is a need for further research to better understand the factors that influence economic growth in Nepal. Specifically, understanding the relationship between economic growth, gross capital formation, inflation, and government revenue can provide policymakers with the necessary insights to design effective economic policies that can promote economic growth and development in Nepal.

1.2. Statement of the Problem

Despite being primarily an agro-based country, the Nepalese economy has undergone significant changes over the last few decades, transitioning from an agriculture-based economy to a service-based economy. However, despite these changes, Nepal remains one of the poorest countries in South Asia, with high levels of poverty and unemployment. The country has a large population living in poverty, and economic growth is necessary to reduce poverty levels and improve living standards. By promoting economic growth, Nepal can generate employment opportunities, increase incomes, and improve access to basic services such as education, healthcare, and housing.

Several studies have investigated the relationship between economic growth and key economic variables, such as gross capital formation, inflation, and government revenue, in Nepal. However, there is still a need for further research to better understand the factors that influence economic growth in Nepal. Specifically, understanding the relationship between economic growth, gross capital formation, inflation, and government revenue can provide policymakers with the necessary insights to design effective economic policies that can promote economic growth and development in Nepal.

The primary aim of this study is to investigate the relationship between economic growth, gross capital formation, inflation, and government revenue in Nepal. The study will use time-series data for the period of 1990-2022 to analyse the impact of these variables on economic growth in Nepal.

Given the lack of empirical research on the associated areas, this study seeks to contribute to the literature by examining the impacts of the mentioned variables on economic growth of Nepal. Specifically, through time-series analysis, the study aims, using a range of econometric models, to assess the extent to which gross capital formation, inflation and government revenue has affected economic growth of Nepal.

Overall, this study will provide important insights into the understanding of economic growth in Nepal, which will be of interest to policymakers, academics, and other stakeholders. The findings of this study will be useful for informing ongoing debates and for shaping future policy decisions in Nepal and other countries.

1.3. Research Questions

The study has been designed to investigate the following:

i. What is the trend of macro-economic indicators (Gross Domestic Product, Gross Capital Formation, Inflation and Government Revenue) in Nepal over the period of 1990-2022?
ii. What is the long-run and short run- relationship between economic growth and other macroeconomic indicators in Nepal?

1.4. Objectives of the Study

Based on the problem statement, the researcher formulated two specific objectives:

i. To analyse the trend of macro-economic indicators in Nepal during the period of 1990-2022.
ii. To explore the long-run and short-run relationship between Nepal's economic growth, gross capital formation, inflation, and government revenue.

1.5. Hypothesis of the Study

The hypothesis of the study is presented below:

i. Null Hypothesis (H0) : There is no significant relationship between economic growth, gross capital formation, inflation and government revenue.
ii. Alternative Hypothesis (H1) : There is a significant relationship between economic growth, gross capital formation, inflation and government revenue.

1.6. Significance of the Study

The findings of previous researches have shown different results while examining the relationship between economic growth and the related macro-economic variables in the context of Nepal. There is a need to analyse the relationship between the variables to further examine the direction of the future policies regarding government revenue, capital spending and inflation control instruments being exercised by the policy makers.

The significance of this thesis lies in its potential to provide policymakers in Nepal with a clear understanding of the relationship between economic growth and key economic variables such as gross capital formation, inflation, and government revenue. By understanding these relationships, policymakers can design effective economic policies that can stimulate economic growth and development in Nepal.

For example, the findings of this thesis can help policymakers determine the optimal level of government revenue that supports investment in public goods while maintaining a competitive tax environment. It can also help policymakers design policies that aim to increase investment in infrastructure and human capital, which can lead to higher levels of economic growth. Additionally, policymakers can use the insights provided by this thesis to design policies aimed at controlling inflation, which can lead to higher levels of economic growth.

Moreover, the findings of this thesis can help attract foreign investment by providing a better understanding of the economic environment in Nepal. It can also help local entrepreneurs by providing insights into the sectors that are likely to experience growth in the future, and the policy changes that may be required to support these sectors.

1.7. Limitations of the Study

The limitations of the above thesis are as follows:

i. Data limitations: The analysis in the thesis relies heavily on secondary data sources, such as Nepal Rastra Bank (NRB) and national statistical agencies. The accuracy and reliability of these data sources may be limited, which could affect the validity of the findings.
ii. Narrow focus: While the thesis provides a comprehensive analysis of the relationship between economic growth and key economic variables in Nepal, it does not consider other factors that may influence economic growth, such as political instability, corruption, or natural disasters. Therefore, the thesis may not provide a complete picture of the challenges and opportunities for economic growth in Nepal.
iii. Causality vs. correlation: While the thesis establishes correlations between economic growth and various economic variables, it does not necessarily establish causality. Other factors that are not considered in the analysis may be driving the relationship between these variables.
iv. Generalisability: The findings of the thesis are specific to Nepal and may not be applicable to other countries or regions. Therefore, the thesis has limited generalisability and its findings may not be relevant to policymakers and scholars outside of Nepal.

v. Lack of primary data collection: The thesis relies solely on existing data sources and does not include any primary data collection. Primary data collection methods, such as surveys or interviews, could provide a more nuanced understanding of the challenges and opportunities for economic growth in Nepal.

1.8. Organisation of the Study

The first chapter of the study will provide an introduction to the topic, including the general background, statement of the problem, objectives, hypothesis, significance, and limitations of the study. The second chapter will review the relevant literature, both theoretical and empirical, from both the international and national contexts. The third chapter will present the research methodology, including the research framework, design, and econometric models and tests. The fourth chapter will present the data and analysis, and the fifth chapter will summarize the findings, conclusions, and recommendations.

CHAPTER II

REVIEW OF LITERATURE

2.1. Theoretical Concept

The relationship between economic growth and macro-economic variables has been a subject of significant interest in economics for several decades. Economic growth is a complex and multifaceted phenomenon, and its determinants are not always straightforward. However, a theoretical understanding of the key drivers of economic growth can provide insights into the relationship between economic growth and other macro-economic variables.

The basic concept of economic growth is based on the idea of capital accumulation. Capital accumulation refers to the process by which an economy increases its stock of capital goods. Capital goods are those goods that are used in the production process to produce other goods and services. Examples of capital goods include machinery, buildings, and equipment. The accumulation of capital goods increases the productive capacity of the economy, which in turn leads to an increase in output and income.

In theory, the accumulation of capital goods can occur in several ways. One way is through investment in physical capital, such as machinery, buildings, and equipment. This type of investment is called gross capital formation, and it is a key driver of economic growth. In addition to physical capital, other types of capital, such as human capital and technological capital, also play a role in economic growth.

Investment in physical capital is important for several reasons. First, it increases the productive capacity of the economy, as it allows firms to produce more goods and services. Second, it contributes to the accumulation of knowledge and technological progress. As firms invest in new machinery and equipment, they learn how to use it more efficiently and effectively, which leads to improvements in productivity and output.

However, investment in physical capital alone is not sufficient to ensure sustained economic growth. Other factors, such as the quality of institutions, the level of education and skills of the workforce, and the availability of natural resources, also play a role in economic growth.

Another important macro-economic variable that is related to economic growth is government revenue. Government revenue is the income that the government collects from various sources, such as taxes, fees, and royalties. The government uses this revenue to finance its activities, such as providing public goods and services, infrastructure development, and social welfare programs.

In theory, an increase in government revenue can have positive effects on economic growth. For example, government spending on infrastructure can improve the productivity of the economy, as it provides the necessary physical and social infrastructure for firms to operate. Similarly, government spending on education and health can improve the skills and productivity of the workforce, which in turn leads to increased output and income.

However, the relationship between government revenue and economic growth is not always straightforward. In some cases, excessive government spending and taxation can lead to inefficiencies and distortions in the economy, which can hinder economic growth. In addition, the effectiveness of government spending depends on the quality of institutions and the efficiency of public services.

The third macro-economic variable that is related to economic growth is inflation. Inflation is the rate at which the general price-level for goods and services rises on a specific period, and it is typically measured by the consumer price index (CPI). Inflation is often viewed as a negative force for economic growth, as it reduces the purchasing power of consumers and erodes the value of savings.

In theory, inflation can have several negative effects on economic growth. First, it can lead to distortions in the economy, such as misallocation of resources and reduced investment, which can hinder economic growth. Second, it can create uncertainty and instability, which can discourage investment and hinder economic growth. Third, it can lead to redistributive effects, as those who are able to adjust their prices and wages quickly are able to protect themselves from the effects of inflation, while those who are unable to do so suffer losses.

However, the relationship between inflation and a country's economic growth is not always straightforward. In some cases, moderate inflation can have positive effects on economic growth. For example, inflation can act as a stimulus for economic activity, as it encourages consumption and investment by reducing the real value of debt. In addition,

moderate inflation can help to reduce unemployment by reducing real wages and making labour more attractive to firms.

To understand the relationship between economic growth and the three macro-economic variables of gross capital formation, government revenue, and inflation, several theoretical frameworks have been developed.

2.1.1. Neo-classical Growth Model

One of the most prominent frameworks is the neoclassical growth model, which emphasizes the importance of capital accumulation in driving economic growth.

The neoclassical growth model is a theoretical framework that emphasizes the importance of capital accumulation in driving economic growth. This model was first developed by economists Robert Solow (Solow, 1956) and Trevor Swan in the 1950s and 1960s. According to the neoclassical growth model, economic growth is driven by the accumulation of physical capital and technological progress.

In the neoclassical growth model, capital accumulation is seen as a key driver of economic growth. As firms invest in new machinery, equipment, and infrastructure, they can increase their production capacity and improve their productivity. This, in turn, leads to increased output and higher levels of economic growth. The model also assumes that technological progress is an important driver of economic growth, as it allows firms to produce more efficiently and develop new products and services.

The neoclassical growth model can be represented mathematically using the following equation:

$Y = F(K,AL)$

Where Y represents output, K represents the stock of physical capital, A represents the level of technological progress, and L represents labour. The function F represents the production function, which describes how inputs of capital, labour, and technology are combined to produce output.

According to the neoclassical growth model, the rate of economic growth is majorly determined by the rate of technological progress and the rate of capital accumulation. In other words, an economy that invests heavily in physical capital and adopts new technologies at a rapid pace will experience faster economic growth than an economy that does not.

Empirical studies have provided support for the neoclassical growth model. For example, a study by Mankiw, Romer, and Weil (1992) found that variations in the rate of capital accumulation and technological progress can explain a significant portion of the variation in economic growth rates across countries. Another study by Barro and Sala-i-Martin (1992) found that the level of investment in physical capital is positively correlated with economic growth.

2.1.2. Endogenous Growth Model

The endogenous growth model is a theoretical framework that emphasizes the role of knowledge and innovation in driving economic growth. This model was first developed by economist Paul Romer in the 1980s and 1990s (Romer P. , 1986). According to the endogenous growth model, economic growth is driven by the accumulation of knowledge and human capital, as well as by technological progress.

In this model, knowledge is seen as a key driver behind economic growth. As firms invest in research and development (R&D) and develop new technologies, they can increase their productivity and output. This, in turn, leads to increased economic growth. The model also assumes that human capital, which refers to the knowledge and skills of workers, is an important driver of economic growth.

The endogenous growth model can be represented mathematically using the following equation:

$Y = F(K, H, A)$

Where Y represents output, K represents physical capital, H represents human capital, and A represents knowledge or technology. The function F represents the production function, which describes how inputs of physical capital, human capital, and technology are combined to produce output.

According to the endogenous growth model, the rate of economic growth is determined by the rate of knowledge accumulation and the rate of investment in human capital. In other words, an economy that invests heavily in R&D and education will experience faster economic growth than an economy that does not.

Empirical studies have provided support for the endogenous growth model. For example, a study by Barro & Lee (2013) found that investment in education and R&D is positively correlated with economic growth. Another study by (Aghion & Howitt, 1998) found that

countries with higher levels of human capital and technological progress tend to experience faster economic growth.

2.1.3. Keynesian Model

According to the Keynesian model, government spending can stimulate economic growth during times of recession by filling the gap between potential output and actual output. As the economy grows, tax revenue will increase, which can help finance additional government spending and lead to further economic growth.

The Keynesian model was first proposed by John Maynard Keynes in the 1930s (Keynes, 1936), during the Great Depression. Keynes argued that during times of recession, there is a deficiency in aggregate demand, which leads to high levels of unemployment and low levels of economic activity. To stimulate economic growth, Keynes proposed that governments should increase spending, even if it meant running budget deficits.

The Keynesian model suggests that government spending can have a multiplier effect on economic activity. This means that for every dollar spent by the government, there can be a greater increase in economic output. For example, if the government spends $1 billion on infrastructure projects, this can create jobs and increase demand for goods and services, which can lead to further economic growth.

Empirical research has provided support for the Keynesian model. For example, a study by Romer and Romer (2010) found that fiscal policy, particularly government spending, had a positive effect on economic growth during the Great Depression. Another study by Blanchard and Leigh (2013) found that fiscal multipliers were larger during times of recession, supporting the idea that government spending can stimulate economic growth during times of economic weakness.

In conclusion, the Keynesian model suggests that there exists a relationship between economic growth and government revenue, which is influenced by government spending during times of recession. While the effectiveness of Keynesian policies has been subject to debate, empirical research provides support for the idea that government spending can stimulate economic growth during times of economic weakness.

2.1.4. Theory of monetarism

Monetarism is an economic theory that emphasizes the role of the money supply in determining inflation and economic growth. According to monetarism, inflation is primarily a monetary phenomenon, caused by an increase in the money supply. Monetarists argue that excessive monetary growth can lead to inflation, which in turn can lead to a decrease in economic growth.

According to monetarism, changes in the money supply are the primary cause of changes in the price level. The quantity theory of money states that the money supply times its velocity equals the nominal value of output. This means that an increase in the money supply will lead to an increase in prices, and a decrease in the money supply will lead to a decrease in prices.

Monetarists argue that excessive monetary growth can lead to inflation, as an increase in the money supply leads to an increase in prices. In turn, inflation can lead to a decrease in economic growth, as it reduces the purchasing power of money and leads to market distortions. For example, inflation can lead to higher interest rates, which can reduce investment and borrowing, and can also lead to lower real wages, which can reduce consumer spending.

Empirical evidence supports the link between monetary growth and inflation. For example, a study by Friedman and Schwartz (1963) found that the Great Depression was caused by a contraction in the money supply, which led to deflation and a decrease in economic growth. Similarly, a study by Sims (1992) found that fluctuations in the money supply were the primary cause of inflation and economic growth in the United States in the post-World War II era.

Despite its empirical support, monetarism has also been subject to criticism. One criticism is that monetarism oversimplifies the relationship between the money supply and the price level, and does not account for the complex interactions between different sectors of the economy. Another criticism is that monetarism assumes a stable relationship between the money supply and the velocity of money, which may not hold true in practice.

When applying these theoretical frameworks to empirical data, it is important to consider the specific context and characteristics of the economy being studied. The relationship between economic growth and macro-economic variables may vary depending on factors such as the quality of institutions, the level of education and skills of the workforce, and

the availability of natural resources. Therefore, a comprehensive analysis of the relationship between economic growth and macro-economic variables requires careful consideration of both theoretical frameworks and empirical evidence.

2.2. International Context

Economic growth is a key indicator of a country's economic performance and is often used to measure its progress and development. The relationship between economic growth and various macroeconomic variables has been a subject of extensive research. According to Barro and Sala-i-Martin (2004), investments in physical and human capital are positively associated with economic growth. Similarly, Kormendi and Meguire (1985) find a positive relationship between investment in physical capital and economic growth.

Over the past few decades, there has been significant research interest in the determinants of economic growth. Empirical studies have identified a range of factors that contribute to economic growth, including human capital, physical capital, technology, institutions, natural resources, and macroeconomic stability (Acemoglu, Johnson, & Robinson, 2016).

One of the key determinants of economic growth is gross capital formation (GCF), which refers to the net increase in a country's capital stock due to investment in physical assets such as buildings, machinery, and infrastructure (World Bank, 2019). GCF is widely considered to be a critical driver of long-term economic growth, as it contributes to increased productivity, improved competitiveness, and higher living standards (Gurley & Shaw, 1967) (Harrod, 1939).

GCF refers to the total investment in fixed assets such as buildings, machinery, and infrastructure. Eita and Jordaan (2007) found a positive relationship between GCF through export-led growth and economic growth in Namibia.

Inflation is another important macroeconomic variable that affects economic growth. High inflation can lead to reduced economic activity by decreasing consumers' and businesses' purchasing powers. Bruno and Easterly (1998) found a negative relationship between inflation and economic growth. Similarly, Edwards (1985) found that high inflation can lead to lower investment and lower economic growth.

Government revenue is an important determinant of economic growth. It provides funds necessary to finance public expenditure and investment in infrastructure and other key sectors of the economy. Afonso and Jalles (2013) found a positive relationship between government revenue and economic growth in European Union countries. However, the

relationship between government revenue and economic growth remains unclear. One of the studies found a negative relationship between government revenue and economic growth in selected Asian countries (Ahmad & Siong, 2023).

Overall, understanding the complex relationship among GCF, inflation, government revenue, and economic growth is crucial for policymakers seeking to promote sustainable economic growth. Given the importance of these variables in determining economic growth, it is essential to understand the nature of the relationship between them. Empirical studies have provided some insights into this relationship, but there is still much to be learned about the dynamics of this relationship. This study aims to contribute to the existing literature on economic growth and inform policymaking in this area.

2.3. Nepalese Context

There have been several studies conducted in Nepal that have examined the impact of gross capital formation, inflation, and government revenue on economic growth.

Gautam (2022) found that government expenditure on education and health has a negative impact on economic growth in Nepal, while social sector and gross capital formation have a positive impact. This suggests that investment in these sectors is important for increasing labour productivity and improving the lives of the poor. However, human capital investment is a long-term process and takes time to show results.

Similarly, Oli and Xie (2021) used time series data from 1975 to 2019 to examine the relationship between domestic savings, investment, and economic growth in Nepal by employing a vector error correction model (VECM). They found that domestic savings and investment growth have a positive contribution to economic growth. This suggests that the government should focus on stimulating capital formation and productive sector investment to achieve sustainable economic growth.

Mandal (2019) used time series data from 1974 to 2017 to explore the relationship between inflation and economic growth in Nepal. They found that inflation is negatively related to economic growth, but there is only one-way causality from inflation to economic growth. This means that inflation does not cause economic growth in Nepal. However, foreign factors, such as Indian prices, play a dominant role in causing inflation in Nepal.

A study conducted by Rana (1988) conducted an analysis of Nepal's fiscal system with the aim of identifying trends in revenue, expenditure, and budget deficits between

1964/65 and 1986/87. The study relied solely on descriptive analysis to reach its objectives. The findings indicate that there has been a consistent increase in revenue and expenditure, with a corresponding increase in regular and development expenditure leading to a continuous deficit. This has resulted in the government's excessive dependence on foreign aid. Lastly, the study shows that the budget deficit has been on the rise over time.

Gyanwaly (2014) examined the relationship between financial development and economic growth in Nepal using time series data from 1975 to 2014. He developed a financial index by taking the weighted average of different indicators of financial development. He used the augmented Dickey-Fuller (ADF) test to check the stationarity of the variables, and the Johansen cointegration technique and error correction model (ECM) to check the long-run relationship between the variables. His findings showed that financial development, real stock of capital, real per capita capital, labour force, real export, and government expenditure have a significantly positive relationship with economic growth. Inflation and trade openness, on the other hand, have a significantly negative relationship with economic growth.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Framework

The research framework is a conceptual model that outlines the theoretical foundation of this study. This study aims to explore the significance of the relationship between economic growth represented by growth in Gross Domestic Product (GDP) and key macroeconomic indicators – Gross Capital Formation (GCF), government revenue (GR), and inflation measured through the Consumer Price Index (CPI).

3.2 Research Design

To conduct the study, descriptive and analytical research designs were adopted to ensure more rigorous, reliable, and valid analyses.

An exploratory study design was chosen to analyse the relationship between economic growth and other macroeconomic variables in Nepal. The design of this study was based on a secondary data review. The researcher has collected data from existing sources such as government reports, statistical databases, and academic journals. The collected data were analysed using statistical techniques.

3.3 Sources of Data

The data collected/used for this study were secondary data collected from various sources. The sources of data include official government publications: Nepal Rastra Bank, Ministry of Finance and Central Bureau of Statistics, reports, statistical data, and other published literature. For the research, dataset from (1990/91 – 2021/22) has been taken as reference. Time-series analysis was adopted to analyse the data.

3.4 Explanation of Variables

In this study, the variables are defined as:

Real Gross Domestic Product (GDP): Real GDP at basic prices refers to the measure of Gross Domestic Product that has been adjusted for inflation. In other words, it is a measure of the value of all goods and services produced within the domestic territory of a country during a specific period, typically a year, after adjusting for the effects of changes in the general price level of goods and services.

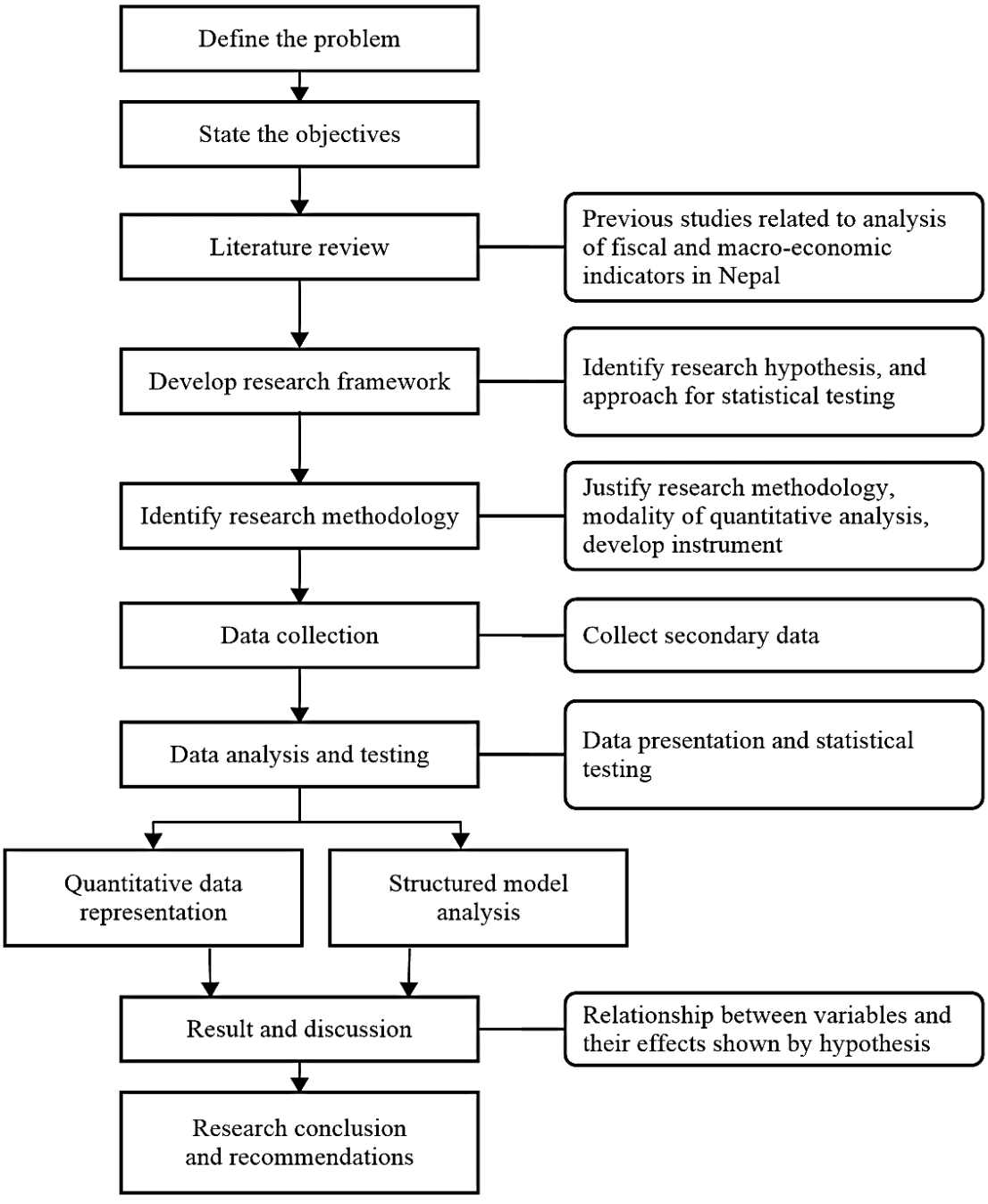
Gross Capital Formation (GCF): GCF is a measure of the total amount of investment made in fixed assets, such as machinery, buildings, and infrastructure. In Nepal, GCF has been a major contributor to economic growth in recent years. Nepal has been investing in various infrastructure projects, such as roads, airports, and hydropower projects, to improve its physical infrastructure and attract foreign investments.

Consumer Price Index (CPI): This is a measure of the average price level of a basket of goods and services consumed by households in Nepal. The CPI is calculated by collecting price data for a specific set of goods and services, such as food, housing, transportation, education, health, and entertainment, and computing their weighted average based on their relative importance in the consumption patterns of households. The consumer price index (CPI) is widely used as a measure of inflation in Nepal.

Government Revenue (GR): Government revenue in Nepal refers to the total amount of money collected by the Nepalese government from various sources such as taxes, fees, fines, grants, and other forms of revenue. Revenue also includes non-tax sources such as fees and charges for government services, fines and penalties, profits from state-owned enterprises, and grants and loans from foreign governments and international organizations.

3.5 Research Process

Figure 3.1 Flowchart of research process



3.6 Tools of Data Analysis

The study relies on a time-series analysis of the available data collected from fiscal years 1990/91 to 2021/22. A time-series analysis can be used to analyze the change in variables over time, including trends, seasonality, and cyclical components.

The data will be checked for linearity, multicollinearity, heteroscedasticity, autocorrelation, and normality. The Autoregressive Lag Model (ARDL), a time-series regression model, was adopted.

3.6.1. Unit Root Test

Unit root tests are required to ensure the stationarity of the time-series data. Stationarity is a crucial assumption in time-series regression analysis, as nonstationary data can lead to spurious regression results and invalid statistical inference. A unit root test can determine whether a variable is stationary or nonstationary, and if nonstationary, appropriate transformations can be made, such as differencing, to make the data stationary. Without conducting unit root tests, the validity and accuracy of the results obtained from the time-series regression model could be questioned, potentially leading to incorrect conclusions and policy recommendations.

There are many ways to test for a unit root in a time series. This study uses the augmented Dickey-Fuller (ADF) test because it is a robust and powerful test that can remove autocorrelation from the model. The ADF test is a parametric test that estimates additional nuisance parameters to account for the autocorrelation of the first differences of a series. (Gujarati and Porter, 2009).

The equations (1) and (2) below model the series of interest, X_t . The symbol Δ indicates the first difference of the series X_t, t in equation (2) is a time trend. "k" is the number of lagged variables that are used to ensure the error term "e" is white noise. The Akaike Information Criterion (AIC) is used to determine the significance of the estimated coefficients of these lagged variables.

$$\Delta X_t = \alpha_1 + \gamma_1 X_{t-1} + \sum_{i=1}^{k} c_{1i}\, \Delta X_{t-i} + e_{1t} \quad \text{..... (1)}$$

$$\Delta X_t = \alpha_2 + \gamma_2 X_{t-1} + \beta t + \sum_{i=1}^{k} c_{2i}\, \Delta X_{t-i} + e_{2t} \quad \text{..... (2)}$$

where k denotes the number of lags.

ADF techniques are employed to test the null hypothesis $\gamma_i = 0$ against the alternative hypothesis $\gamma_i < 0$. Rejection of the null hypothesis is a clear indication that the series X_t is stationary. In equation (1), the alternative hypothesis posits that the series is mean-stationary, and in equation (2), it indicates that the series is a stationary trend.

3.6.2. Autoregressive Lag Model (ARDL) to Cointegration Analysis

Cointegration is a statistical technique that allows researchers to test for the presence of a long-run equilibrium relationship between economic variables. If the variables are integrated of order one (I(1)), meaning that they are non-stationary at levels but stationary after differencing, then they are said to be cointegrated if some linear combination of their levels is stationary.

Formally, given that the series: X_t and Y_t are integrated of order one I(1) or are different stationary processes, both the series are assumed to be cointegrated if there exists a parameter α such that $u_t = y_t - \alpha x_t$ is a stationary process or integrated of order zero I(0).

Tests for cointegration seek to discern whether a long-run relationship exists between such a set of variables. In this study, the ARDL approach of cointegration was applied.

ARDL model to co integration analysis was proposed by Pesaran and Pesaran (1997), Pesaran and Shin (1999). Pesaran et al. (1996) further developed the ARDL model to include co integration analysis. The ARDL co-integration approach has many advantages in comparison to other co-integration methods, such as the Engle and Granger, Johansen, and Juselius techniques.

i. Unlike techniques such as Johansel model, the ARDL procedure does not require unit root pretesting of the variables in the model. It can be employed irrespective of whether the underlying regressors are purely I(0), purely I(1), or mutually co-integrated. However, the limitation of the model is that the procedure collapses in the presence of the I(2) series.
ii. The ARDL procedure allows the variables to have varying optimal lags, which is not possible with conventional cointegration procedures.
iii. Once the order of the lags in the ARDL model is defined, the cointegration relationship can be analysed by employing OLS method.
iv. Despite issues of endogeneity in some regressors, the ARDL technique is useful to provide unbiased estimates of the long-run model and validate the calculations of t-statistics.
v. The short- and long-run parameters of the models can be estimated simultaneously.

3.6.3. Error Correction Modelling (ECM)

It is important to combine Error Correction Modelling (ECM) with the ARDL model as it can address the potential issue of long-run equilibrium relationships and short-run dynamics between the variables.

The ARDL model can handle a mix of stationary and non-stationary variables and can capture both short-run and long-run effects. However, the ARDL model alone may not account for the presence of long-run equilibrium relationships between the given variables, which can result in biased estimates and incorrect inference. This is where the ECM approach comes in, as it can account for long-run equilibrium relationships between the variables and adjust for short-term deviations from the equilibrium.

By combining ARDL and ECM, the analysis can be more robust and informative as you can capture both the long-run equilibrium relationships and the short-run dynamics between the variables. This approach can provide a more accurate representation of the relationships between the macroeconomic variables in Nepal pre and post federalisation and can lead to more reliable policy recommendations.

Despite getting evidence of long-run relationship between Y_t and X_t variables, there is a possibility of disequilibrium in the short run. Thus, an equilibrium error term : $u_t = Y_t - \beta_1 - \beta_2 X_t$ in the presented regression equation $Y_t = \beta_1 + \beta_2 X_t + u_t$ is used to evaluate the short run behaviour of Y in reference to its long run value.

As per Granger representation theorem, if two variables Y_t and X_t are cointegrated, then the relationship between the two can be presented as:

$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 u_{t-1} + \epsilon_t$ ……………………………….. (3)

where,

ϵ_t= A white noise error term.

This equation can be also written as:

$$\Delta Y_t = \beta_1 + \beta_2 \Delta X_t + \delta ECM_{t-1} + \epsilon_t$$

The ECM in equation (3) states that ΔY_t depends on two variables : ΔX_t and equilibrium error term. If the error term has non-zero value, the model is out of equilibrium. Further, the value of α_2 is important to determine the restoration lag-time of equilibrium.

3.6.4. Bound Test (F-Version)

The Bound Test (F-Version) is an important econometric tool to test for the presence of cointegration in a dataset, particularly when using the ARDL approach.

The F-test can be employed to test the hypothesis related to parameters obtained via the usage of K-variable regression model:

$Y_t = \alpha_1 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} \ldots\ldots\ldots + \beta_n X_{kt} + v_i$ ..... (4)

Next, the hypothesis to be tested can be written as:

$H_0 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$

Then, another regression by dropping the variables $X_{3i}, X_{4i}, X_{5i}, X_{6i}$ can be written as:

$Y_t = \alpha_1 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_7 X_{7t} \ldots\ldots\ldots + \beta_n X_{kt} + v_i$..... (5)

And, residual sum of the squares can be calculated from both the models.

The F test statistic is calculated by the formula:

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR} / (n-k)}$$

where,

RSS_R = RSS of restricted regression,

RSS_{UR} = RSS of unrestricted regression,

m = no. of restrictions,

k = no. of parameters in unrestricted regression, and

n = no. of observations

Pesaran (1997) proposed the bounds test to test the long-run relationship between variables. The test is based on the F-statistic of the unrestricted error correction model (ECM). If the F-statistic exceeds the upper critical value, then there is evidence of cointegration between the variables, regardless of their order of integration. If the F-statistic is below the lower critical value, then there is no evidence of cointegration. If the F-statistic lies between the critical values, then the conclusion is inconclusive.

The bounds test is a more powerful test than other cointegration tests, such as the Engle-Granger test, because it does not require the variables to be pre-tested for unit roots. It is also more robust to small sample sizes.

The bounds test has been widely used in empirical research. It is a valuable tool for testing for the presence of long-run relationships between economic variables.

The Bound Test (F-Version) is important for several reasons. First, it can help to identify the appropriate lag structure for an ARDL model, which is crucial for accurate estimation and interpretation of the model coefficients. Second, it can improve the robustness of the model by ensuring that the long-run equilibrium relationship is captured properly. Third, it can help to identify the direction of causality between the variables in the model, which is important for policy makers.

3.6.5. CUSUM Test and CUSUMSQ Test

CUSUM Test

The CUSUM test is a statistical test that can be used to detect changes in the parameters of a model. The test is based on the cumulative sum of the recursive residuals, which are the residuals from the model at each time point, starting from the most recent time point and working backwards. The CUSUM test plots the cumulative sum together with the 5% critical lines. If the cumulative sum goes outside the area between the two critical lines, then the test finds evidence of parameter instability.

The CUSUM test was developed by Brown, Durbin, and Evans (1975). It is a simple and effective test that is widely used in econometrics.The CUSUM test is based on the statistic:

$$W_t = \sum_{r=k+1}^{t} W_r/s$$

For t = k+1 ……. T, where W_t is the recursive residual and s is the standard error of the regression fitted to all sample points T.

If the parameter vector does not change from period to period, the expected value of W_t will be zero. However, if the parameter vector changes, W_t will tend to deviate from the zero-mean value line. The significance of any departure from the zero line is assessed by comparing it to a pair of 5% significance lines, which get further apart as t increases.

The 5% significance lines are drawn by connecting the points:

$\left[k, \pm 0.948(T-k)^{\frac{1}{2}}\right]$ and $\left[T, \pm 3 \times 0.948(T-k)^{\frac{1}{2}}\right]$

Movement lying outside the critical lines is suggestive of coefficient instability.

CUSUMQ Test

The CUSUM of squares test is based on the test statistic:

$$W_t = \frac{\sum_{r=k+1}^{t} w_{r^2}}{\sum_{r=k+1}^{T} w_{r^2}}$$

Under the hypothesis of parameter constancy, the expected value of (S_t) is (t−k)/(T−k), which ranges from zero to unity. The significance of any departure from this expected value is assessed by comparing it to a pair of parallel straight lines around the expected value.

The CUSUM of Squares test plots St against these parallel lines. As with the CUSUM test, movement outside the critical lines is indicative of parameter instability.

3.6.6. LM Test for Serial Correlation, Normality and Heteroscedasticity Test

The normality test is used to assess whether the data is normally distributed. The heteroscedasticity test is used to verify that the error term is homoscedastic. In both tests, the probability values are compared to the critical values. If the p-values are greater than the critical values, then there is no evidence of serial correlation, normality, or homoscedasticity.

3.7 Specification of Model

The specification of the model will rely on the selection of both dependent and independent variables, drawing upon insights from economic literature and relevant econometric tools. The econometric tools will be examined to determine appropriate model selection criteria, while macro-economic variables will be considered in assessing the relationship between economic growth and other variables.

3.7.1. Model Selection Criteria

Model selection criteria are employed to select a model from the multiple alternative models. This research has employed adjusted R^2 criterion.

It is calculated as:

$$R^2 = 1 - \frac{RSS\ /\ (n-k)}{TSS/(n-1)}$$

where,

RSS = Residual sum of squares,

TSS = Total sum of squares,

n = no. of observations, and

k = no. of parameters on the regression model.

Based on this model, a model with highest R^2 is chosen.

3.7.2. Relationship between GDP and other macro-economic variables

The objective of this research is to assess the significance of relationship of economic growth (real GDP) with other macro-economic indicators (gross capital formation, inflation and , government revenue). For this thesis, real GDP is being used as independent variables, and GCF, CPI, and GR are being used as dependent variables. So, the general model that shows the relationship between the macro-economic indicators can be written as:

$GDP = \alpha_0 + \alpha_1 GCF + \alpha_2 GR + \alpha_3 CPI + e_i$…….. (6)

where,

GDP = Real Gross Domestic Product,

GCF = Gross Capital Formation,

GR = Government Revenue,

CPI = Consumer Price Index, and

e_i = Stochastic error term.

Since the unit of the in the equation (6) is not the same, it is necessary to take logarithm of both sides. It can be written as:

$ln\ GDP = \alpha_0 + \alpha_1 lnGCF + \alpha_2 lnGR + \alpha_3 lnCPI + e_i$…….. (7)

3.7.3. Hypothesis

To investigate the significance of relationship among the selected variables of the study, the bound tests approach has been adopted.

Under this study, the null and alternative hypothesis can be stated as follows:

Null Hypothesis (H_0) : $\alpha_1 = \alpha_2 = \alpha_3 = 0$;

Alternative Hypothesis (H_1) : $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq 0$;

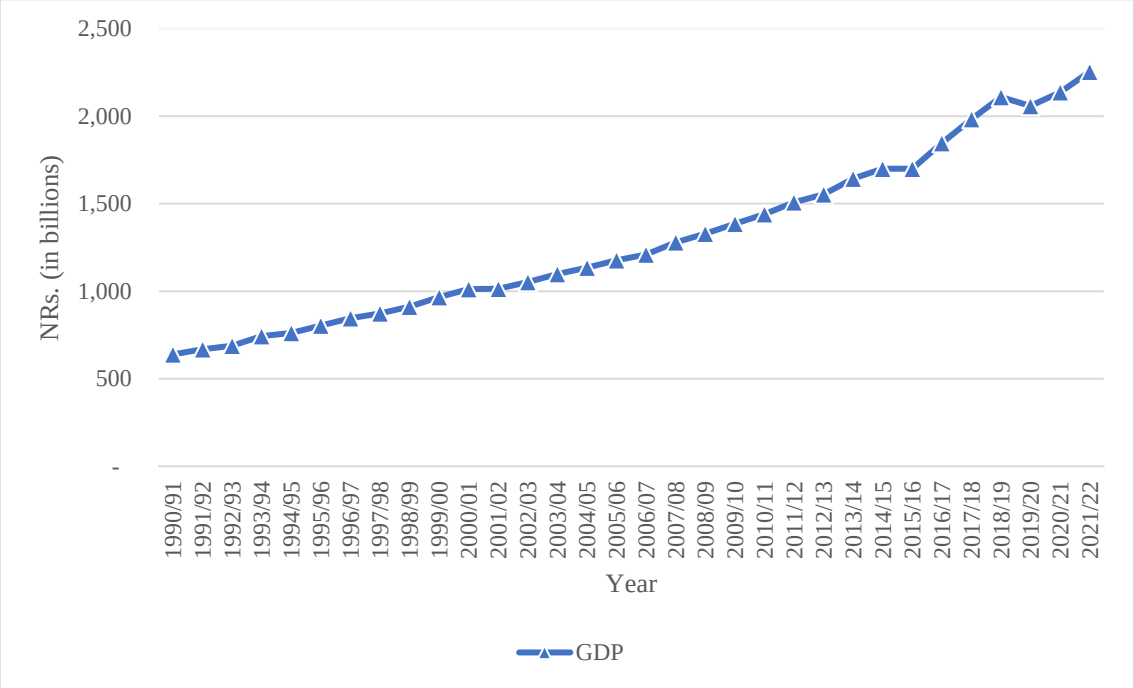
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

4.1. Nature and Trend Analysis of GDP

Graphical presentation is provided for the trend analysis of Gross Domestic Product (GDP) in Nepal. Information has been collected from various economic publications and database of Nepal Rastra Bank.

Figure 4.1: Trend of Gross Domestic Product (in NRs. 1 billion)



The data shows that the GDP of Nepal has been fluctuating over the years, with some periods of growth and others of stagnation. In the early 1990s, Nepal underwent a period of political instability, which contributed to the low levels of GDP growth during that time. However, in the mid-1990s, the country underwent economic liberalization, which resulted in a surge in foreign investment and an increase in GDP.

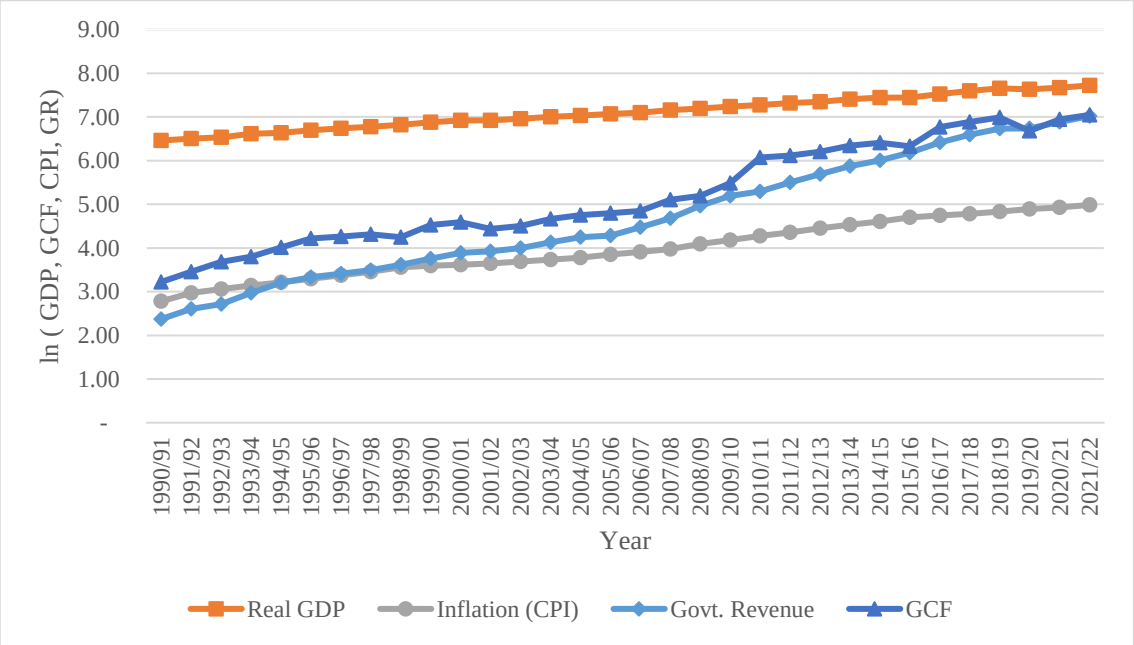
In the late 1990s and early 2000s, Nepal experienced a decline in GDP growth due to a Maoist insurgency, which lasted for over a decade. The insurgency resulted in a decrease in foreign investment, a decline in tourism, and a slowdown in economic activity. The country also faced challenges such as poor infrastructure, inadequate access to finance, and political instability.

In the mid-2000s, Nepal began to recover from the insurgency and embarked on a period of economic reforms, which led to an increase in GDP growth. The country invested in various infrastructure projects, such as hydropower and road construction, to improve the country's physical infrastructure and attract foreign investment. However, Nepal has continued to face challenges such as political instability and poor governance, which have hindered the country's economic growth.

In recent years, Nepal has experienced relatively steady GDP growth, with the country's economy expanding at an average rate of around 6% per year. The government has continued to invest in infrastructure and has taken measures to promote foreign investment. However, Nepal's economy remains vulnerable to external shocks such as natural disasters and global economic downturns, which could affect the country's economic growth in the future.

4.1.1. Trend of GDP and other macro-economic indicators

Figure 4.2: Trend of GDP, GCF, CPI and GR



Based on the analysis, we can observe the following trends:

i. Real GDP: The real GDP of Nepal has been increasing gradually over the years. However, the growth rate of Real GDP was not consistent throughout the years, and there were a few instances where the growth rate decreased. There was a slight dip in the GDP growth rate in 2015/16, which can be attributed to the devastating

earthquake that hit Nepal in April 2015, but it picked up again in the following years.

ii. Gross Capital Formation (GCF): Based on the data provided, the trend of Gross Capital Formation in Nepal appears to be increasing over time. From 1990/91 to 2021/22, there has been a general upward trend in GCF, with some fluctuations in between. During the early 1990s, the GCF in Nepal was below 50 billion Nepalese rupees (NRs). However, by the mid-1990s, it had risen to around 60 billion NRs, and by the end of the decade, it had reached almost NRs. 100 billion In the early 2000s, there was a slight dip in GCF, but it quickly recovered and continued to rise steadily. From 2010/11 onwards, the growth rate of GCF increased significantly, with a five-fold increase in just over a decade. The GCF reached its peak in 2021/22 at 1147.11 billion NRs. Overall, the data suggests that Nepal's economy has been growing steadily over the past few decades, with increasing investment in capital goods and infrastructure.

iii. Consumer Price Index (CPI): The CPI has been increasing over the years, indicating inflationary pressures in the economy. There is a noticeable increase in CPI from 2015/16 to 2016/17, which can be attributed to the impact of federalization. With the transfer of responsibilities to provincial and local governments, there was an increase in demand for goods and services, leading to inflationary pressures.

iv. Government Revenue (GR): The government revenue has also been increasing gradually over the years. There is a noticeable increase in government revenue from 2015/16 to 2016/17, which can be attributed to the impact of federalization. With the transfer of responsibilities to provincial and local governments, there was an increase in revenue collection at the provincial and local levels, leading to an increase in total government revenue. However, the growth rate of GR was not consistent throughout the years, and there were a few instances where the growth rate decreased.

4.2. Relationship between GDP and other macro-economic indicators

Time-series data has been obtained to facilitate the study. The pre-requisite to studying the relationship between GDP, GCF, and GR is to check order of integration of the variables. As exhibited by Figure 4.1 where the natural logarithm of each time-series

variable is presented in graphical form, the variables are non-stationary as each of them has increasing trend over time.

It is necessary to run econometric tools to test the stationarity of the data. This study uses ADF test to test the unit roof of the data for checking the stationarity of the data.

4.2.1. Augmented Dickey-Fuller Test (ADF)

To check the order of integration for each variable, we need to carry out an ADF test after taking the natural logarithm of each variable for the time series.

The result of ADF test for Test can be shown in the Table 4.1. The calculations were carried out by the author through EViews / Excel.

Table 4.1: Results of ADF Test

Variable	Level		First Difference		Order of Integration
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	
ln GDP	-0.21	-3.55	-5.46*	-5.34*	I(1)
ln GCF	-0.70	-2.10	-5.72*	-5.62*	I(1)
ln CPI	-0.14	-7.22*	-3.96*	-4.03*	I(0)
ln GR	0.19	-1.78	-4.01*	-3.95*	I(1)

Note: * denotes rejection of the null hypothesis of unit root at 5% significance level.

I (0) represents variables that are found significant at their level, whereas I (1) represents given variables that are found significant at their first difference.

From the ADF test results, we can see that all variables except ln CPI have a unit root in their levels, as the null hypothesis of a unit root cannot be rejected at 5% significance level. However, after taking the first difference, the null hypothesis of a unit root can be rejected for all variables, indicating that they are integrated of order 1 or in other words, they are stationary after differencing once. All the variables are significant at less than 5% level of significance.

Therefore, for further analysis, we can use the first differences of these variables.

4.2.2. Autoregressive Distributed Lag (ARDL) Model to Cointegration

The ARDL method examines presence of long-term relationship among the variables, and which achieved through the bound testing approach. This approach helps to determine if all the variables used in the study exhibit a long-term correlation or not. To select the maximum number of lags for both the types of variables, the AIC criteria is utilized, and the values of these criteria indicate that the minimum lag for both variables is four. Through the usage of EViews, ARDL (1,0,4,4) was selected.

The result of the bound test is given in Table 4.2

Table 4.2: Estimation of Bound Test for ARDL Cointegration Model

Level of Significance	**F-statistics Value**	**Lower Bound Value**	**Upper Bound Value**
1%	7.392904	3.65	4.66
5%		2.79	3.67
10%		2.37	3.20

The F-statistic in Table 4.2 is 7.39, which is higher than both the lower bound and upper bound values at all levels of significance. This indicates that the null hypothesis of no long-run relationship between the variables is rejected. In other words, there is a long-run relationship between the variables. Therefore, the variables are cointegrated.

To estimate the ARDL equation, the lag length of each variable must be identified. This study uses the Akaike information criterion (AIC) to select the lag length. The AIC criterion selected the lag length (1,0,4,4) and applied it to the ARDL model and ECM model.

AIC criterion has resulted in selection of lag length (1,0,4,4) which explains that LN GCF is regressed with zero lags, LN GDP is regressed with one lag, LNCPI and LN GR are regressed with four lags.

The details of the ARDL model (calculated using EViews) is provided in Table 4.3.

Table 4.3 : Coefficient of long-run relationship in the ARDL (1,0,4,4) Cointegration Model

Dependent variable is D(LN GDP)				
Repressors	Coefficient	Standard Error	t-ratio	p-value
LN GCF	0.406056	0.231464	1.754295	0.0998
LN GR	-0.133710	0.196228	-0.681402	0.506
LN CPI	0.113891	0.420510	0.270840	0.7902
C	5.438498	0.722371	7.528682	0
R-squared	0.999074	Adjusted R-squared	0.998333	

Specifically, while holding all other variables constant, the results suggest:

i. The coefficient of LN GCF is 0.406056, which indicates that a one-unit increase in GCF will lead to an increase of 0.406056 units in D(LN GDP) when other variables are held constant. The t-ratio for LN GCF is 1.754295, and its p-value is 0.0998, which indicates that it is marginally significant at a 10% level of significance.

ii. The coefficient of LN GR is -0.133710, which indicates that a one-unit increase in GR will lead to a decrease of 0.133710 units in D(LN GDP) when other variables are held constant. The t-ratio for LN GR is -0.681402, and its p-value is 0.506, which indicates that it is not significant.

iii. The coefficient of LN CPI is 0.113891, which indicates that a one-unit increase in CPI will lead to an increase of 0.113891 units in D(LN GDP) when other variables are held constant. The t-ratio for LN CPI is 0.270840, and its p-value is 0.7902, which indicates that it is not significant.

iv. The intercept term (C) has a coefficient of 5.438498, indicating that if all other variables were zero, the value of the dependent variable (LN GDP) would be 5.438498. It means that there are underlying variables apart from the ones included that have significant bearing on GDP.

v. The p-value of the F-statistic is 0, indicating that the overall model is statistically significant at any level of significance.

Overall, the ARDL test suggests that gross capital formation and the GDP growth rate have a long-run relationship with the GDP, while the consumer price index does not.

The model has a good overall fit as suggested by the R-squared and adjusted R-squared value, with a significant F-statistic and a low p-value for the constant term.

4.2.3. Error Correction Version of ARDL Model

To assess the short run relationship among the variables Error Correction Model (ECM) model is used.

The details of the ECM model (calculated using EViews) is provided in Table 4.4

Table 4.4: Coefficient of short-run relationship in the ARDL (1,0,4,4) Cointegration Model

Dependent variable is D(LN GDP)				
Repressors	Coefficient	Standard Error	t-ratio	p-value
D(LNGR)	0.123367	0.042868	2.877819	0.0115
D(LNCPI)	-0.055403	0.108447	-0.510871	0.6169
ECT(-1)*	-0.281936	0.041203	-6.84264	0
R-squared	0.789108	Mean dependent var	0.039655	
Adjusted R-squared	0.700311	SD. dependent var	0.021575	

From the above table, the following results can be observed:

i. The coefficient of the lagged difference of Government Revenue (D(LNGR)) is positive (0.123) and statistically significant (p-value=0.0115), indicating that there is a short-run positive relationship between government revenue and the change in GDP. Specifically, a 1% increase in government revenue leads to a 0.123% increase in GDP in the short run.

ii. The coefficient of the lagged difference of CPI (D(LNCPI)) is negative (-0.055) but not statistically significant (p-value=0.6169), suggesting that changes in inflation do not have a significant short-run effect on GDP.

iii. The error correction term (ECT) has a negative coefficient (-0.282) and is statistically significant (p-value=0), indicating that there is a long-run relationship between the variables. Specifically, a 1% deviation from the long-run equilibrium leads to a 0.282% change in GDP towards the equilibrium in the following period.

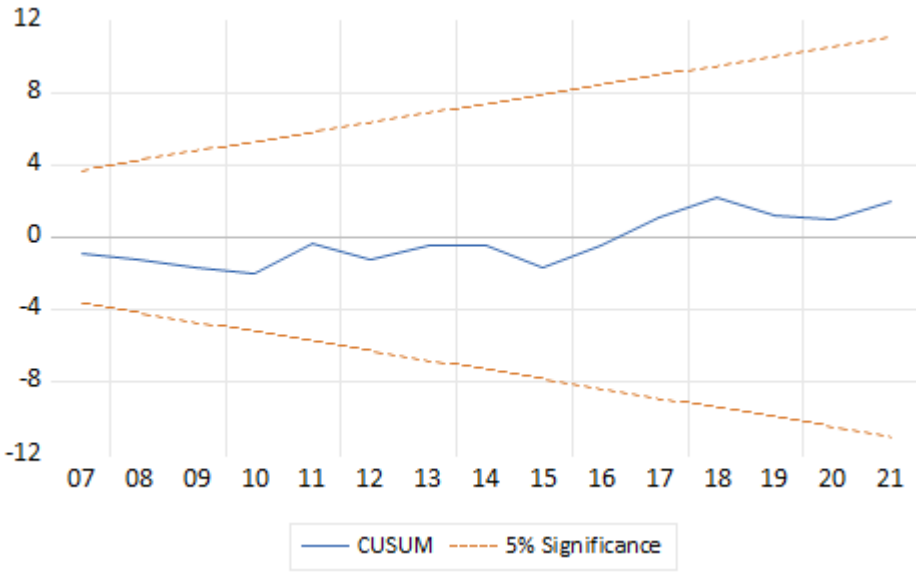
iv. The R-squared value of the model is 0.789, indicating that the model explains a substantial portion of the variation in the dependent variable. The adjusted R-squared value is 0.700, suggesting that the model is a good fit for the data.

4.2.4. Stability Test

To assess the stability of the estimated equations in both the long-run and short-run, the thesis employed Borensztein et al.'s (1998) cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests. These tests were conducted on the residuals of the error correction model (ECM).

The graphical presentation of CUSUM Test is provided in Figure 4.3

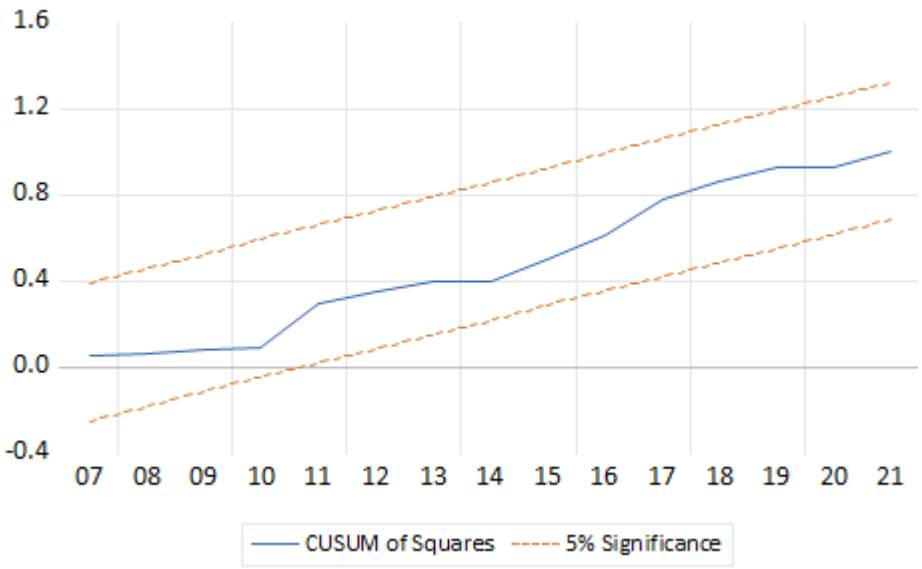
Figure 4.3: CUSUM Test (LN GDP)



Since, the graphical plots of CUSUM statistic for LN GDP are within the critical lines (5% significance level), long run coefficient of the GDP function is considered stable.

The graphical representation of the CUSUMSQ is given in Figure 4.4

Figure 4.4: CUSUM Sum of Squares Test (LN GDP)



Since, the plots of CUSUM and CUSUM of squares statistic for LN GDP are within the critical lines (5% significance level), the long run coefficient of the GDP function is considered as stable.

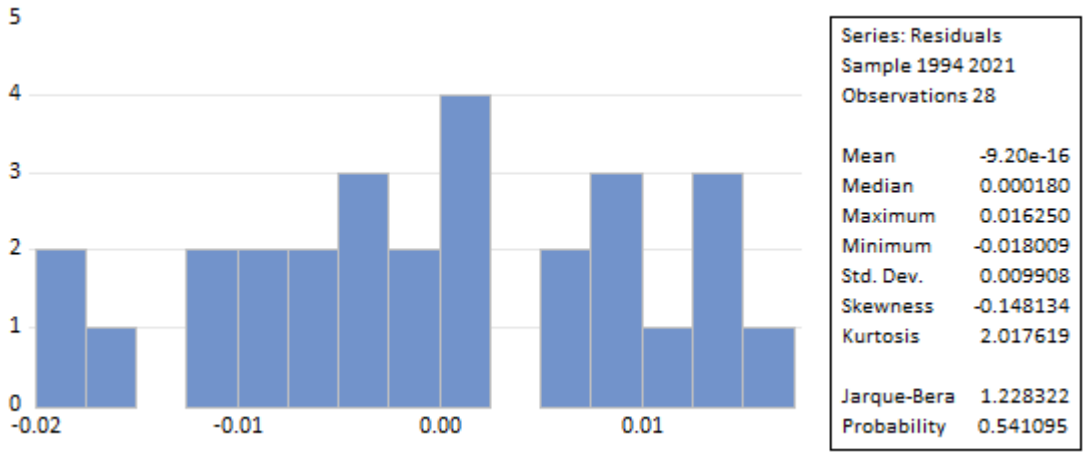
The result for the test of serial correlation (calculated in EViews) is given in Table 4.5.

Table 4.5: Test of Serial Correlation (LN GDP)

Breusch-Godfrey Serial Correlation LM Test Null hypothesis : No serial correlation at up to 4 lags		
Lag length	F-statistics	Chi-square
1	0.891913	0.1953
2	0.425836	0.4228
3	0.345637	0.5266
4	0.326804	0.5622

From the Table 4.5, the p-value is more than 0.05 in each lag length. It shows the rejection of the null hypothesis at 5% level of significance. Thus, there is no evidence of serial correlation in the model.

Figure 4.5: Histogram – Normality Test (LN GDP)



The value of the Jarque – Bera probability test is 1.228 that rejects the null hypothesis for the normality test (i.e; the data is not normally distributed) at significance level of 5%. Hence, the data is normally distributed.

Table 4.5: Test of Heteroscedasticity (LN GDP)

Breusch-Pagan-Godfrey Heteroscedasticity Test Null hypothesis : Homoscedasticity		
F-statistic	Obs*R-squared	Prob. Chi Square
0.499476	0.891913	0.7856

Breusch-Pagan-Godfrey heteroscedasticity test was carried out wherein the null hypothesis for the heteroscedasticity test (i.e.; the data is homoskedastic). In this case, the F-statistic of the test is 0.499476, and the associated probability is 0.7856. Since the probability is greater than the significance level of 0.05, we cannot reject the null hypothesis of homoskedasticity. Therefore, we can say that there is no significant evidence to suggest that the errors of the model have heteroskedasticity.

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CHAPTER V
SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATION

5.1. Summary

Economists believe that Gross Capital Formation (GCF), Government Revenue (GR), and Inflation (CPI) are critical components that impact economic growth. The logic behind this belief is that each of these variables has a direct impact on a country's economy, and their interactions can affect the rate and sustainability of economic growth.

GCF refers to the investment in physical and human capital, which can lead to an increase in productivity and stimulate economic growth. Physical capital includes machinery, buildings, and infrastructure, while human capital refers to education, training, and healthcare. By investing in these resources, a country can increase its productivity, which leads to a more significant output of goods and services, and therefore, economic growth.

GR, on the other hand, provides the government with the necessary resources to finance public goods and services, which can contribute to economic growth. Public goods such as infrastructure, education, and healthcare can increase productivity, and services such as law enforcement and environmental protection can create a stable environment for businesses to operate. By providing these goods and services, the government can create an environment that is conducive to economic growth.

However, inflation can negatively impact economic growth. Inflation refers to the general increase in prices of goods and services over time. If the inflation rate is high, the purchasing power of consumers decreases, which can lead to lower investment and consumption. Moreover, high inflation rates can create uncertainty in the market, leading to lower investment in long-term projects and thus, lower economic growth.

The thesis aims to analyse the relationship between economic growth, measured by Gross Domestic Product (GDP), Gross Capital Formation (GCF), Government Revenue (GR), and Inflation (CPI) in Nepal. Nepal is a developing country with a growing economy, and it is essential to understand the dynamics of these economic variables to plan for sustainable growth.

The study uses time-series data from 1990 to 2022 to estimate the long-run and short-run relationships between the variables. GCF, GR and Inflation (measured by CPI) was used as the independent variable, while GDP was used as the dependent variable.

To assess the long-term and short-term relationship between the variables, the study utilized the ARDL and ECM models after verifying the unit root of the variables. The stability of the long-run coefficient was checked using the CUSUM and CUSUM of square tests, while the LM test was used to evaluate the presence of serial correlation in the model. Additionally, the study conducted the Breusch-Pagan-Godfrey test to assess the existence of heteroscedasticity and carried out a normality test to check the normality of the data.

5.2. Conclusions

The purpose of this study was to analyse the relationship between Gross Capital Formation (GCF), Government Revenue (GR), Inflation (CPI), and Gross Domestic Product (GDP) in Nepal. The ARDL and ECM models were used to investigate the short- and long-run relationships between the variables.

The ARDL results show that there is a positive relationship between GCF and GDP. The coefficient of LN GCF is 0.41, indicating that a one-unit increase in GCF will lead to an increase of 0.41 units in D(LN GDP) when other variables are held constant. However, the t-ratio for LN GCF is 1.75, and its p-value is 0.0998, which suggests that it is only marginally significant at a 10% level of significance. This indicates that while GCF has a positive effect on GDP, the relationship is not very strong and may be influenced by other factors.

In contrast, the coefficient of LN GR is negative, indicating that an increase in GR leads to a decrease in GDP. However, the t-ratio for LN GR is not significant, which suggests that there is no evidence of a significant relationship between GR and GDP in Nepal. Similarly, the coefficient of LN CPI is positive but not significant, indicating that changes in inflation do not have a significant effect on GDP.

The ECM results reveal that in the short run, there is a positive relationship between GR and GDP. Specifically, a 1% increase in government revenue leads to a 0.123% increase in GDP. In contrast, changes in inflation do not have a significant effect on GDP in the short run. Furthermore, the error correction term (ECT) has a negative coefficient, indicating that there is a long-run relationship between the variables. Specifically, a 1%

deviation from the long-run equilibrium leads to a 0.282% change in GDP towards the equilibrium in the following period. This suggests that the variables in the model are cointegrated, and there is a long-run equilibrium relationship between them.

In conclusion, the results of this study suggest that Gross Capital Formation has a positive but marginally significant impact on GDP in Nepal, while Government Revenue and Inflation do not have a significant effect on GDP. The short-run relationship between government revenue and GDP is positive, while the long-run relationship between the variables is characterized by the presence of a long-run equilibrium relationship.

These findings have important implications for policymakers in Nepal, as they suggest that policies that stimulate Gross Capital Formation may be more effective in promoting economic growth than those focused on increasing Government Revenue or controlling inflation. However, it is essential to consider other factors that may influence economic growth in Nepal, such as political instability, lack of infrastructure, and limited access to financing. Future research should explore these factors and their relationship with economic growth in Nepal to provide policymakers with a more comprehensive understanding of the country's economic dynamics.

5.3. Recommendations

Based on the conclusions drawn from the analysis of the relationship between GDP, GCF, CPI, and GR, the following policy recommendations can be made:

i. Encourage investment in infrastructure and technology: The positive coefficient of GCF suggests that Gross Capital Formation has a significant impact on economic growth. Thus, the government should prioritize investment in infrastructure and technology to improve productivity, create employment opportunities, and enhance overall economic growth.
ii. Implement effective taxation policies: The coefficient of GR suggests that government revenue has a negative impact on GDP, although it is not statistically significant. However, the government needs to be careful in implementing taxation policies to avoid discouraging investment and entrepreneurship. Therefore, the government should aim to implement fair and effective taxation policies that generate revenue without hampering economic growth.
iii. Manage inflation effectively: Although the coefficient of CPI is not statistically significant, inflation can have a significant impact on economic growth.

Therefore, the government should implement effective monetary policies to control inflation and maintain price stability, which is essential for economic growth.

iv. Strengthen public-private partnerships: Given the limited resources available to the government, public-private partnerships can provide an effective way to promote economic growth. The government should encourage private sector investment in sectors such as education, health, and infrastructure, which can have a significant impact on the overall development of the country.

In summary, the above policy recommendations aim to promote economic growth in Nepal by encouraging investment, implementing effective taxation policies, managing inflation, promoting international trade, and strengthening public-private partnerships. These recommendations should be implemented with a long-term perspective and in consultation with stakeholders to ensure their effectiveness.

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APPENDIX

APPENDIX A :Variables in Real Form (CPI is in %, and others are multiple of NPR 1 Billion)

Year	GDP	GCF	CPI	GR
1990/91	639.30	25.07	25.07	10.73
1991/92	668.51	31.62	31.62	13.51
1992/93	689.45	39.65	39.65	15.15
1993/94	742.67	44.64	44.64	19.58
1994/95	762.35	55.23	55.23	24.61
1995/96	804.76	68.02	68.02	27.89
1996/97	845.77	71.08	71.08	30.37
1997/98	872.92	74.73	74.73	32.94
1998/99	912.03	70.06	70.06	37.25
1999/00	966.78	92.27	92.27	42.89
2000/01	1,012.95	98.65	98.65	48.89
2001/02	1,014.58	84.81	84.81	50.45
2002/03	1,052.82	90.30	90.30	54.54
2003/04	1,099.26	106.05	106.05	62.33
2004/05	1,134.81	116.08	116.08	70.12
2005/06	1,177.13	121.23	121.23	72.28
2006/07	1,209.51	127.33	127.33	87.71
2007/08	1,279.60	165.04	165.04	107.62
2008/09	1,329.57	179.20	179.20	143.47
2009/10	1,386.18	240.92	240.92	179.94
2010/11	1,439.53	433.62	433.62	199.82
2011/12	1,507.17	453.54	453.54	244.37
2012/13	1,553.50	493.90	493.90	295.94
2013/14	1,642.71	567.57	567.57	356.62
2014/15	1,700.41	607.19	607.19	405.85
2015/16	1,700.45	560.90	560.90	481.98
2016/17	1,846.51	870.36	870.36	609.11
2017/18	1,982.65	976.41	976.41	726.72
2018/19	2,109.26	1,085.03	1,085.03	839.66
2019/20	2,058.15	795.61	795.61	841.31
2020/21	2,136.99	1,037.70	1,037.70	978.75
2021/22	2,254.31	1,147.11	1,147.11	1,116.42

Source: Nepal Rastra Bank, Economics Database

APPENDIX B : Variables in Natural Logarithm

Year	GDP	GCF	CPI	GR
1990/91	639.30	25.07	25.07	10.73
1991/92	668.51	31.62	31.62	13.51
1992/93	689.45	39.65	39.65	15.15
1993/94	742.67	44.64	44.64	19.58
1994/95	762.35	55.23	55.23	24.61
1995/96	804.76	68.02	68.02	27.89
1996/97	845.77	71.08	71.08	30.37
1997/98	872.92	74.73	74.73	32.94
1998/99	912.03	70.06	70.06	37.25
1999/00	966.78	92.27	92.27	42.89
2000/01	1,012.95	98.65	98.65	48.89
2001/02	1,014.58	84.81	84.81	50.45
2002/03	1,052.82	90.30	90.30	54.54
2003/04	1,099.26	106.05	106.05	62.33
2004/05	1,134.81	116.08	116.08	70.12
2005/06	1,177.13	121.23	121.23	72.28
2006/07	1,209.51	127.33	127.33	87.71
2007/08	1,279.60	165.04	165.04	107.62
2008/09	1,329.57	179.20	179.20	143.47
2009/10	1,386.18	240.92	240.92	179.94
2010/11	1,439.53	433.62	433.62	199.82
2011/12	1,507.17	453.54	453.54	244.37
2012/13	1,553.50	493.90	493.90	295.94
2013/14	1,642.71	567.57	567.57	356.62
2014/15	1,700.41	607.19	607.19	405.85
2015/16	1,700.45	560.90	560.90	481.98
2016/17	1,846.51	870.36	870.36	609.11
2017/18	1,982.65	976.41	976.41	726.72
2018/19	2,109.26	1,085.03	1,085.03	839.66
2019/20	2,058.15	795.61	795.61	841.31
2020/21	2,136.99	1,037.70	1,037.70	978.75
2021/22	2,254.31	1,147.11	1,147.11	1,116.42

APPENDIX C : Results of ARDL Test (EViews)

Dependent Variable: LNGDP
Method: ARDL
Date: 04/08/23 Time: 22:46
Sample (adjusted): 1994 2021
Included observations: 28 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LNGCF LNGR LNCPI
Fixed regressors: C
Number of models evaluated: 500
Selected Model: ARDL(1, 0, 4, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNGDP(-1)	0.718064	0.124875	5.750252	0.0000
LNGCF	0.114482	0.030423	3.762976	0.0019
LNGR	0.123367	0.059480	2.074077	0.0557
LNGR(-1)	-0.136651	0.078544	-1.739807	0.1024
LNGR(-2)	-0.060748	0.076433	-0.794794	0.4391
LNGR(-3)	-0.054898	0.073419	-0.747738	0.4662
LNGR(-4)	0.091234	0.062003	1.471433	0.1618
LNCPI	-0.055403	0.146483	-0.378218	0.7106
LNCPI(-1)	-0.024056	0.239806	-0.100314	0.9214
LNCPI(-2)	-0.206207	0.248207	-0.830787	0.4191
LNCPI(-3)	0.035860	0.220859	0.162365	0.8732
LNCPI(-4)	0.281915	0.116395	2.422048	0.0286
C	1.533307	0.627724	2.442646	0.0274

R-squared	0.999074	Mean dependent var	7.182920
Adjusted R-squared	0.998333	S.D. dependent var	0.325539
S.E. of regression	0.013293	Akaike info criterion	-5.498804
Sum squared resid	0.002650	Schwarz criterion	-4.880281
Log likelihood	89.98326	Hannan-Quinn criter.	-5.309715
F-statistic	1348.245	Durbin-Watson stat	2.366308
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX D : Long Run Form and Bound Test (EViews)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNGDP)
Selected Model: ARDL(1, 0, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 04/08/23 Time: 23:49
Sample: 1990 2021
Included observations: 28

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.533307	0.627724	2.442646	0.0274
LNGDP(-1)*	-0.281936	0.124875	-2.257740	0.0393
LNGCF**	0.114482	0.030423	3.762976	0.0019
LNGR(-1)	-0.037698	0.052228	-0.721796	0.4815
LNCPI(-1)	0.032110	0.127112	0.252612	0.8040
D(LNGR)	0.123367	0.059480	2.074077	0.0557
D(LNGR(-1))	0.024413	0.060947	0.400559	0.6944
D(LNGR(-2))	-0.036336	0.048784	-0.744824	0.4679
D(LNGR(-3))	-0.091234	0.062003	-1.471433	0.1618
D(LNCPI)	-0.055403	0.146483	-0.378218	0.7106
D(LNCPI(-1))	-0.111568	0.191478	-0.582669	0.5688
D(LNCPI(-2))	-0.317775	0.188863	-1.682567	0.1132
D(LNCPI(-3))	-0.281915	0.116395	-2.422048	0.0286

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGCF	0.406056	0.231464	1.754295	0.0998
LNGR	-0.133710	0.196228	-0.681402	0.5060
LNCPI	0.113891	0.420510	0.270840	0.7902
C	5.438498	0.722371	7.528682	0.0000

EC = LNGDP - (0.4061*LNGCF -0.1337*LNGR + 0.1139*LNCPI + 5.4385)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	7.392904	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	28		Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816
			Finite Sample: n=30	
		10%	2.676	3.586
		5%	3.272	4.306
		1%	4.614	5.966

APPENDIX E

APPENDIX E : Results of ECM Test (EViews)

ARDL Error Correction Regression
Dependent Variable: D(LNGDP)
Selected Model: ARDL(1, 0, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 04/09/23 Time: 00:09
Sample: 1990 2021
Included observations: 28

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNGR)	0.123367	0.042868	2.877819	0.0115
D(LNGR(-1))	0.024413	0.042161	0.579040	0.5712
D(LNGR(-2))	-0.036336	0.039644	-0.916560	0.3739
D(LNGR(-3))	-0.091234	0.041475	-2.199748	0.0439
D(LNCPI)	-0.055403	0.108447	-0.510871	0.6169
D(LNCPI(-1))	-0.111568	0.134502	-0.829495	0.4198
D(LNCPI(-2))	-0.317775	0.149681	-2.123010	0.0508
D(LNCPI(-3))	-0.281915	0.088059	-3.201440	0.0059
CointEq(-1)*	-0.281936	0.041203	-6.842640	0.0000

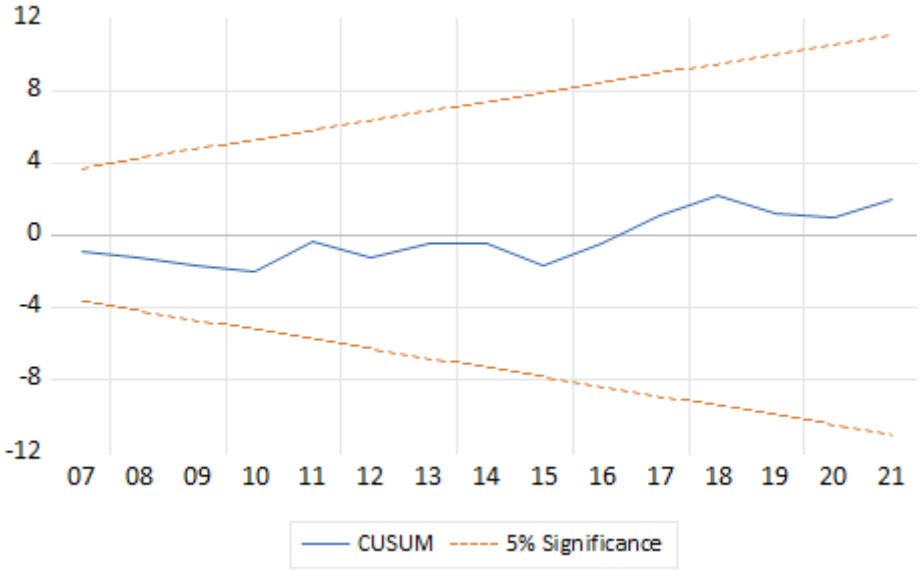
R-squared	0.789108	Mean dependent var	0.039655
Adjusted R-squared	0.700311	S.D. dependent var	0.021575
S.E. of regression	0.011811	Akaike info criterion	-5.784519
Sum squared resid	0.002650	Schwarz criterion	-5.356310
Log likelihood	89.98326	Hannan-Quinn criter.	-5.653611
Durbin-Watson stat	2.366308		

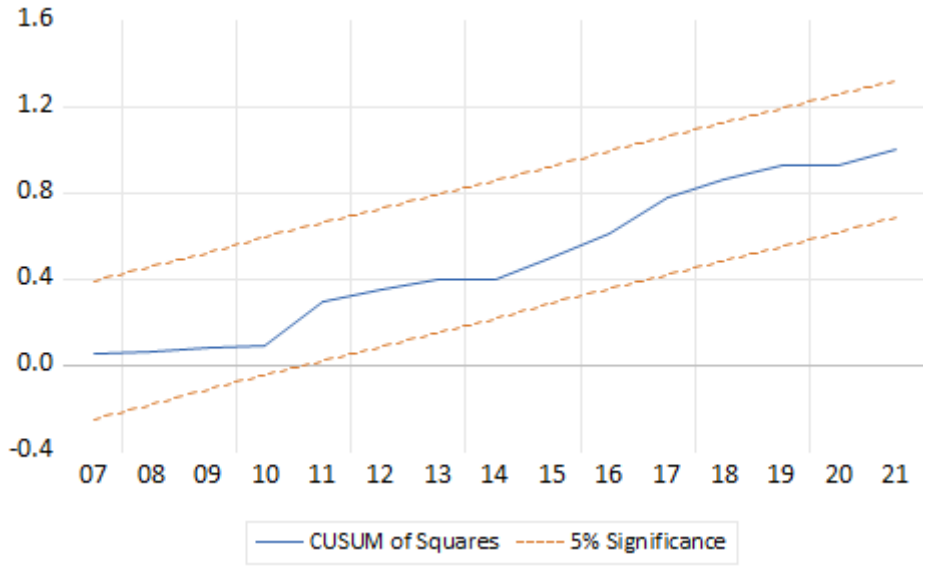
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	7.392904	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

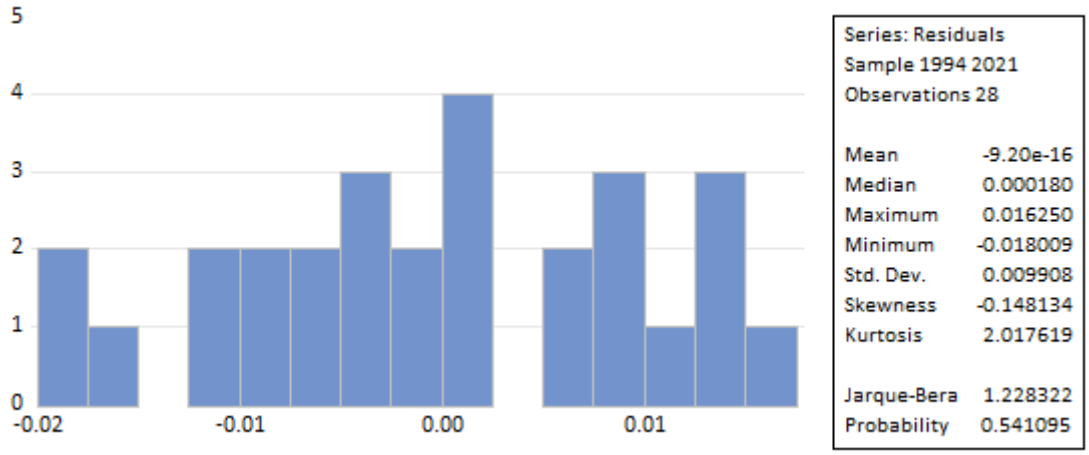
APPENDIX F : CUSUM and CUSUM of Squares (EViews)





APPENDIX G : Test of Serial Correlation and Test of Normality

Breusch-Godfrey Serial Correlation LM Test		
Null hypothesis : No serial correlation at up to 4 lags		
Lag length	**F-statistics**	**Chi-square**
1	0.891913	0.1953
2	0.425836	0.4228
3	0.345637	0.5266
4	0.326804	0.5622



APPENDIX H : Test of Heteroscedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.499476	Prob. F(12,15)	0.8843
Obs*R-squared	7.994011	Prob. Chi-Square(12)	0.7856
Scaled explained SS	1.167311	Prob. Chi-Square(12)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/09/23 Time: 00:44
Sample: 1994 2021
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001037	0.005208	-0.199085	0.8449
LNGDP(-1)	0.000108	0.001036	0.103896	0.9186
LNGCF	0.000294	0.000252	1.162933	0.2630
LNGR	-0.000426	0.000493	-0.863365	0.4015
LNGR(-1)	0.000412	0.000652	0.632549	0.5366
LNGR(-2)	-0.000731	0.000634	-1.153476	0.2668
LNGR(-3)	0.000494	0.000609	0.811387	0.4298
LNGR(-4)	-7.33E-05	0.000514	-0.142584	0.8885
LNCPI	0.002209	0.001215	1.817810	0.0891
LNCPI(-1)	-0.003601	0.001989	-1.810045	0.0904
LNCPI(-2)	0.000471	0.002059	0.228854	0.8221
LNCPI(-3)	0.000615	0.001832	0.335809	0.7417
LNCPI(-4)	0.000417	0.000966	0.432360	0.6716

R-squared	0.285500	Mean dependent var	9.47E-05
Adjusted R-squared	-0.286099	S.D. dependent var	9.72E-05
S.E. of regression	0.000110	Akaike info criterion	-15.08276
Sum squared resid	1.82E-07	Schwarz criterion	-14.46424
Log likelihood	224.1587	Hannan-Quinn criter.	-14.89368
F-statistic	0.499476	Durbin-Watson stat	2.231552
Prob(F-statistic)	0.884286		