**BINDURA UNIVERSITY OF SCIENCE EDUCATION**

**FACULTY OF COMMERCE**

**DEPARTMENT OF ECONOMICS**

# THE IMPACT OF INFLATION ON ECONOMIC GROWTH IN ZIMBABWE.


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| **PREPARED BY:** | **CHANTELLE CHITORERA** |
| **REGISTRATION NUMBER:** | **B193098B** |
| **RESEARCH SUPERVISOR:** | **DR DAMIYANO** |
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| **NAME OF AUTHOR** | CHANTELLE CHITORERA |
| **TITLE OF PROJECT** | THE IMPACT OF INFLATION ON ECONOMIC GROWTH IN ZIMBABWE. |
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| **PERMANENT ADDRESS** | N.E126 VENGERE, RUSAPE |
| **PHONE NUMBER** | 078 059 7695 |
| **SIGNED** | **……** |
| **DATE** | **……** |

## APPROVAL FORM

The undersigned certify that they have supervised, read and recommend to the Bindura University of Science Education for acceptance a research project entitled: **The impact Of inflation on Economic growth in Zimbabwe,** submitted by Chantelle Chitorera in Partial fulfillment of the requirements for the **Bachelor of Science (Honors) Degree in Economics.**

**……** **……/……/……**

**(Signature of Student)** **Date**

**……** **……../……/……**

**(Signature of Supervisor)** **Date**

**……..** **……/……/……**

**(Signature of Chairperson)** **Date**

**……** **……/……/……**

**(Signature of the Examiner(s))** **Date**

## DECLARATION

I, Chantelle Chitorera, hereby declare that this research project is my own work and has not been copied or lifted from any source without the acknowledgement of the source.

**……** **……../……../……**

**Student Signature** **Date**

## DEDICATION

This study is dedicated to my parents who have been my inspiration and the shadow of my strength through their support all around. I would also like to thank my close friend Takudzwa, my sisters, and all family members for being my pillar of strength. Not forgetting to thank God for making everything possible.

## ABSTRACT

This research study aimed to examine the impact of inflation on economic growth in Zimbabwe from 2005 to 2020, using Ordinary least squares (OLS) regression analysis. The study also considered other variables such as government expenditure, debt service, and unemployment. The research sample consisted of macroeconomic data World development indicators. The results of the study indicated that inflation had a significant negative impact on economic growth in Zimbabwe. Specifically, it was found that increasing inflation rates had a detrimental effect on the country's economic growth. The study also revealed that inflation coefficient is negative and statistically significant, this implies that inflation has a negative impact on economic growth in Zimbabwe. Based on these findings, several recommendations were made to mitigate the negative impact of inflation on economic growth in Zimbabwe. Firstly, inflation control measures should be implemented to stabilize the economy. Secondly, fiscal policy management should be improved to ensure more effective management of government expenditure and debt service. Thirdly, economic diversification should be promoted to reduce the country's reliance on a few sectors and increase overall economic resilience. Finally, institutional strengthening should be prioritized to enhance the capacity of institutions to effectively manage the country's economic affairs. This study provides evidence of the negative impact of inflation on economic growth in Zimbabwe, highlighting the need for policy measures to address the issue. It also emphasizes the importance of considering multiple factors that influence economic growth, such as government expenditure, debt service, and unemployment. The findings of this study have important implications for policymakers and researchers interested in the economic development of Zimbabwe and other developing countries facing similar challenges.

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| | |
|---|---|
| VIF | Variance Inflation Factor |
| ADF | Augmented Dickey Fuller |
| OLS | Ordinary Least Square |
| R squared | Coefficient Of Determinant |
| DW | Durbin Watson |
| J-B | Jarque Bera |
| IMF | International Monetary Fund |

# CHAPTER I

# INTRODUCTION

## 1.0 Introduction

Inflation and economic growth are two critical factors that affect the well-being of any economy. Inflation is the increase in the prices of goods and services over time, while economic growth refers to the increase in the production and consumption of goods and services in an economy. These two factors are closely related, and their relationship has been the subject of intense research in the field of economics. In Zimbabwe, the relationship between inflation and economic growth has been of great concern to policymakers and stakeholders, given the country's history of high inflation rates. According to the International Monetary Fund (IMF), Zimbabwe has experienced hyperinflation, with the inflation rate reaching 837.5% in July 2020. Such high levels of inflation can have a significant impact on economic growth, and this has led to calls for more research on the topic. Several studies have examined the relationship between inflation and economic growth in other countries, and the findings have been mixed. Some studies suggest that inflation has a negative impact on economic growth, while others argue that there is no clear relationship between the two variables. For example, a study by Agyapong and Adam (2015) found a negative relationship between inflation and economic growth in Ghana, while a study by Kim et al. (2018) found no significant relationship between the two variables in South Korea. Given the mixed findings in the literature, it is essential to examine the relationship between inflation and economic growth in Zimbabwe. This study aims to fill this research gap by analysing the impact of inflation on economic growth in Zimbabwe.

## 1.1 Background of the study

Zimbabwe's economy has been characterized by high inflation rates in recent years, which have had a significant impact on the country's economic growth. The hyperinflation that Zimbabwe experienced between 2007 and 2009 had severe consequences, including a sharp decline in GDP, high levels of unemployment, and widespread poverty. In response to this crisis, the government adopted a multi-currency system in 2009, which helped stabilize prices and reduce inflation. Zimbabwe's economy has been plagued by political instability, fiscal indiscipline, hyperinflation, currency devaluation, public debt accumulation, and poor governance since the late 1990s. The country's inflation rate reached a peak of 231 million percent in 2008, coinciding with negative GDP growth rates. Although the economy stabilized in 2009 after dollarization, it faced a liquidity crunch and deflation from 2012. After reintroducing a local currency in 2016, inflation soon spiralled as the foreign exchange rate deteriorated since the local currency was rushed before meeting the requisite fundamentals such as sufficient US$ reserves to defend the currency . By mid-2019, inflation had breached triple figures at 230% and the central bank ceased publishing the economic statistic to contain inflationary expectations from economic agents. It is important to empirically assess the impact of inflation on economic growth in Zimbabwe. However, there are few studies that have done so using recent data and robust methods. One study by Mukoka (2018) used yearly data from 1990 to 2017 and found no relationship between inflation and GDP in Zimbabwe. However, this study did not account for possible structural breaks or cointegration between the variables. Another study by Saungweme and Odhiambo (2021) used monthly data from 1980 to 2020 and found a positive and significant impact of public debt on inflation dynamics in Zimbabwe, particularly in the long run. However, this study did not directly examine the effect of inflation on economic growth. The causes of inflation in Zimbabwe are multifaceted, including factors such as money supply growth, currency depreciation, and supply-side constraints. In addition, Zimbabwe's economic policies, such as land reform and indigenization policies, have also contributed to inflationary pressures. Given the persistent high inflation rates and their impact on economic growth, there is a need for further research to understand the relationship between inflation and economic growth in Zimbabwe. Such research will provide

policymakers with valuable insights into the dynamics of inflation in Zimbabwe and help guide the development of effective policy interventions to manage inflation and promote sustainable economic growth.

### 1.2 Problem statement

Zimbabwe has experienced persistently high inflation rates, which have had a significant impact on the country's economic growth. Despite various measures being implemented to combat inflation, the inflation rate in Zimbabwe continues to increase, posing significant challenges for the country's economy. High and volatile inflation rates have been shown to have negative effects on economic growth, which could further exacerbate the challenges faced by Zimbabwe's already struggling economy. The persistently high inflation rates in Zimbabwe, despite the measures put in place to combat it, call for a deeper understanding of the impact of inflation on economic growth. While the relationship between inflation and economic growth has been extensively researched in other countries, there is a need for more research on this topic in Zimbabwe, given the country's unique economic context. Therefore, this study aims to investigate the relationship between inflation and economic growth in Zimbabwe.

### 1.3 Research questions

1. What is the relationship between inflation and economic growth in Zimbabwe?
2. What are the effects of inflation in Zimbabwe?
3. How can Zimbabwe reduce inflation and promote economic growth?

### 1.4 Objectives of the study

- To examine the relationship between inflation and economic growth in Zimbabwe by analysing the empirical data on inflation and various economic indicators such as GDP.
- To assess the impact of inflation on Zimbabwe's economic performance by analysing how inflation has affected various economic sectors, such as agriculture, manufacturing, and mining.

- To identify the effects of inflation in Zimbabwe.

### 1.5 Significance of the study

The study will provide valuable insights into the dynamics of inflation in Zimbabwe, which can inform the development of effective policy interventions to manage inflation and promote sustainable economic growth.

**Policy Development:** The study's findings can inform the development of effective policy interventions to manage inflation and promote sustainable economic growth in Zimbabwe. Policymakers can use the insights generated by this study to design policies that target the root causes of inflation and promote long-term economic growth.

**Economic Planning:** The study's findings can be used to inform economic planning by identifying the sectors of the economy that are most vulnerable to inflation and designing strategies to mitigate the impact of inflation on those sectors.

**Academic Research:** The study will contribute to the existing literature on the relationship between inflation and economic growth by providing empirical evidence from a developing country context. The study's findings can inform future research on the impact of inflation on economic growth in other similar developing countries.

### 1.6 Hypothesis statement of the study

H0: There is a negative relationship between inflation and economic growth in Zimbabwe
H1: There is a positive relationship between inflation and economic growth in Zimbabwe

### 1.7 Delimitation of the study

This study is delimited by several factors, including:

- This study focuses on the time period from 1990 to 2020
- The study will rely on secondary data sources such as the Zimbabwe National Statistics Agency, the World Bank, and the International Monetary Fund, which may have limitations in terms of accuracy and completeness.

- The study focuses specifically on Zimbabwe and may not be generalizable to other developing countries with different economic and political contexts. The study's findings may not be relevant to countries with different levels of economic development, resource endowments, or institutional frameworks.

### 1.8 Limitations of the study

The limitations of the study include:

- The study relies on secondary data sources such as the Zimbabwe National Statistics Agency, the World Bank, and the International Monetary Fund, which may have limitations in terms of accuracy and completeness. Additionally, the data may not be available for all the variables that are of interest to the study.

  The findings of the study may not be generalizable to other developing countries with different economic and political contexts. The Zimbabwean economy may have unique characteristics that are not present in other developing countries, which could limit the applicability of the study's findings.

### 1.9 Summary

The chapter has established the research questions, objectives of the study, problem statement, and the significance of the study. The chapter has also identified the delimitations and limitations of the study. The subsequent chapters will delve into the literature review, methodology, findings, and discussion of the research. Overall, this study aims to contribute to the existing literature on the impact of economic growth in Zimbabwe and provide insights into policies that could enhance economic growth in the country.

# CHAPTER II

# LITERATURE REVIEW

## 2.0 Introduction

This chapter explores the effects of inflation, the inflation situation in Zimbabwe, and the theoretical framework that explains the relationship between inflation and economic growth and empirical studies.

## 2.1 Theoretical Framework

### 2.1.1 Inflation in Zimbabwe

Zimbabwe has experienced some of the highest inflation rates in the world, with rates peaking at 231 million percent in 2008. Inflation has been driven by a combination of factors, including a lack of fiscal discipline, high government spending, and a shortage of foreign currency. Hyperinflation eroded the value of money, reduced savings and investment, distorted relative prices, undermined fiscal and monetary policies, and caused widespread poverty and social unrest. In response to the crisis, the government adopted a multi-currency system in 2009, which stabilized the economy and brought inflation down to single digits. However, since 2017, Zimbabwe has faced a resurgence of inflation, which reached 837 percent in July 2020. The main causes of inflation include fiscal deficits, money supply growth, exchange rate depreciation, shortages of foreign currency and basic commodities, and low productivity. Inflation has adversely affected economic growth, which contracted by 8.1 percent in 2019 and 10.4 percent in 2020. Inflation has also reduced the purchasing power of consumers, increased the cost of production for firms, eroded confidence and trust in the economy, and worsened poverty and inequality.

### 2.1.2 Effects of Inflation

Inflation has several effects on an economy, including the following:

***Reduced purchasing power***

High inflation rates reduce the purchasing power of the currency, making it more expensive for consumers to purchase goods and services.

***Uncertainty***

High inflation rates lead to uncertainty in the economy, as consumers and businesses are uncertain about the future value of money.

***Redistribution of income and wealth***

Inflation can lead to a redistribution of income and wealth, as individuals with fixed incomes may see their purchasing power reduced, while those with variable incomes may benefit from higher prices.

***Increased costs***

Inflation leads to increased costs for businesses, including higher input costs and higher borrowing costs.

***Reduced investment***

High inflation rates can lead to reduced investment in the economy, as investors may be hesitant to invest in an uncertain environment.

## 2.2 Theories and Models

Several theories and models have been developed to explain the relationship between inflation and economic growth.

### 2.2.1 The Quantity Theory of Money

This theory suggests that there is a direct relationship between the money supply in an economy and the price level. It posits that if the money supply increases faster than the rate of economic growth, inflation will occur. Empirical studies support this theory, such as the study by Dornbusch and Fischer (1980) that found a strong positive relationship between money supply growth and inflation.

### 2.2.2 The Phillips Curve

This model suggests that there is an inverse relationship between inflation and unemployment. It posits that as inflation increases, unemployment decreases, and vice versa. However, this relationship has not held true in all cases, as demonstrated by the stagflation of the 1970s, where inflation and unemployment were both high. Empirical studies have also found mixed results regarding the validity of the Phillips Curve, such as the study by Fountas and Karanasos (2007) that found weak evidence of a Phillips Curve relationship in Greece.

### 2.2.3 The Classical Dichotomy

This theory suggests that the real economy is separate from the monetary economy, and that changes in the money supply only affect nominal variables, such as prices and wages, and not real variables, such as output and employment. Empirical studies support this theory, such as the study by Kydland and Prescott (1977) that found no evidence of a long-run relationship between money supply growth and real output.

### 2.2.4 The New Keynesian Phillips Curve

This model combines the Phillips Curve with the idea of sticky prices, where prices do not adjust quickly to changes in economic conditions. It suggests that inflation is influenced by both the level of economic activity and the degree of price stickiness. Empirical studies have found support for the New Keynesian Phillips Curve, such as the study by Fuhrer and Moore (1995) that found a significant relationship between inflation and output in the United States.

### 2.2.5 The Neo-Classical Growth Model

This model suggests that inflation has a negative impact on long-term economic growth by reducing investment, increasing uncertainty, and reducing productivity. Empirical studies support this theory, such as the study by Barro (1995) that found a negative relationship between inflation and economic growth in a sample of 100 countries.

### 2.2.6 The Endogenous Growth Model

This model suggests that inflation can have both positive and negative effects on economic growth, depending on the specific context. It posits that moderate inflation can encourage investment and innovation, but high inflation can lead to economic instability and reduced investment. Empirical studies have found mixed results regarding the relationship between inflation and economic growth in the context of the endogenous growth model, such as the study by Levine and Renelt (1992) that found a negative relationship between inflation and growth in a sample of 110 countries.

These theories and models suggest that inflation can have both positive and negative effects on economic growth, depending on the specific context. High inflation rates can lead to reduced investment, increased uncertainty, and reduced productivity, which can ultimately lead to a negative impact on economic growth. However, moderate inflation rates may encourage investment and innovation, leading to positive effects on economic growth.

## 2.3 Empirical Evidence

Empirical studies have found mixed evidence on the relationship between inflation and economic growth in developing countries. Some studies suggest that inflation has a negative impact on economic growth by reducing investment, increasing uncertainty, and reducing consumer confidence. For instance, studies by Bruno and Easterly (1996), Fischer (1993), and Khan and Senhadji (2001) find that inflation has a negative impact on economic growth in developing countries. Additionally, Akinsola and Odhiambo (2017) surveyed the international literature on the inflation-growth nexus and found overwhelming support for a negative relationship, especially in developed economies. Carvalho et al. (2018) presented a theoretical model linking economic development and inflation and tested it with a panel data analysis of 65 countries from 2001 to 2011. They found that inflation is inversely correlated with the level of technological content, human capital and cyclical unemployment, and directly related to inflation persistence and terms of trade growth.

Dinh (2020) conducted an empirical analysis of the relationship between inflation and economic growth (GDP) in 10 developed and developing countries from 1990 to 2018. He found that inflation and economic growth are negatively correlated in both short-term and long-term perspectives, with some variations across countries.

Faira and Carneiro (2001) conducted a study in Brazil from 1980 to 1995 to investigate the connection between inflation and economic growth. They found that there was a significant negative relationship between the two in the short run, but no significant effect in the long run. This could suggest that the scope of production could adjust to accommodate the excess demand lag. Omoke (2010) supported these findings, confirming the neutrality of money concept, but also found that inflation does affect economic growth in the long run, as noted by other researchers.

Ahmed and Mortaza (2015) discovered a negative and statistically significant correlation between inflation and economic growth in Bangladesh from 1980 to 2016 using CPI and real GDP as proxy variables. This aligns with the results of Saeed (2007) for Kuwait from 1985 to 2005, which revealed a strong negative relationship between CPI and real GDP in the long run. Erbaykal and Okuyan (2008) studied the relationship between inflation and economic growth in Turkey from 1987 to 2006 and found a significant negative relationship in the short run, but no significant relationship in the long run. They also found that economic growth had a unidirectional causal relationship with inflation. Omoke and Oruta (2010) used data from Nigeria covering the period of 1970 to 2005 to investigate the relationship between inflation and economic growth. They found no co-integrating relationship between the two variables and identified a unidirectional causality running from inflation to economic growth.

Fakhri (2011) explored the impact of inflation on economic growth in Azerbaijan from 2000 to 2009, using variables such as inflation proxy by consumer price index, growth rate of real gross fixed capital formation, and real gross domestic product growth. They found a non-linear nexus between inflation and economic growth, with a threshold point of 13 per cent for inflation above which it negatively affects economic growth, and below which the impact is positive.

In contrast, other studies suggest that moderate inflation can promote economic growth by stimulating investment and promoting exports. For example, studies by Khan and Senhadji (2000) and Odedokun (1996) find that moderate inflation can have a positive impact on economic growth in developing countries. A study by Batayneh, Al Salamat and Momani (2021) that analyzed the impact of inflation on the financial sector development in Jordan. The study found that financial depth has a significant positive effect on growth only when inflation falls below a threshold of about 6%–8%.

A study by Akinsola and Odhiambo (2017) that reviewed the international literature on the relationship between inflation and economic growth in developed and developing countries. The study found that the impact of inflation on economic growth varies from country to country and over time, and that there is overwhelming support in favour of a negative relationship between inflation and growth, especially in developed economies. However, the study also found some evidence for a positive relationship between inflation and growth in some developing countries, such as Ghana, Kenya, Nigeria, and Tanzania. Similarly Liu (2019) that examined the relationship between money supply, economic growth and inflation in China. The study found that the increase of money supply will increase inflation and stimulate economic growth, and suggested some policy measures to balance the money supply and economic growth

Empirical evidence from Zimbabwe suggests that high inflation has had adverse effects on economic growth. Zimbabwe experienced a hyperinflation episode in the late 2000s, which led to a decline in economic growth and widespread social and economic problems. For instance, a study by Ncube and Ndlela (2012) found that inflation had a negative impact on economic growth in Zimbabwe. An Empirical Analysis" by Gwatidzo and Matshe (2015) this study examined the relationship between inflation and economic growth in Zimbabwe using time-series data from 1980 to 2013. The results showed that inflation has a negative impact on economic growth in the country. However a study by Mukoka (2018) used yearly data from 1990 to 2017 and found no relationship between inflation and GDP in Zimbabwe. Another study by Saungweme and Odhiambo (2021)

used monthly data from 1980 to 2020 and found a positive and significant impact of public debt on inflation dynamics in Zimbabwe, particularly in the long run.

### 2.4 Research Gap

Despite the large body of literature on the relationship between inflation and economic growth, there is still a research gap on the specific mechanisms that explain the relationship in the context of Zimbabwe. Most of the studies on Zimbabwe have focused on the negative impact of high inflation on economic growth, but few have examined the specific factors that contribute to the relationship. Additionally, few studies have investigated the impact of inflation on economic growth in Zimbabwe after the stabilization of the economy in the early 2010s. Therefore, there is a need for further research on the specific mechanisms that explain the relationship between inflation and economic growth in Zimbabwe.

### 2.5 Summary

Chapter two has provided an e overview of the nature of inflation in Zimbabwe, the effects of inflation on the economy, the theoretical frameworks and models used to study inflation, the empirical evidence on the impact of inflation on economic growth, and identified a research gap in the literature. This chapter has laid a strong foundation for the subsequent chapters which will delve into the specific research question of how inflation impacts economic growth in Zimbabwe.

# CHAPTER III

# RESEARCH METHODOLOGY

3.0 introduction

In this chapter, I will focus on various components that were utilized in carrying out the study. One of the fundamental aspects that this chapter will cover is the data sources used, as data forms the basis of any analysis. I will also discuss the research method employed, including the strategies and techniques that were used to collect, analyze and interpret data. Moreover, this chapter will explore the model specification, which is the process of determining the best model that explains the relationship between the dependent and independent variables. More so, I will also discuss the regression technique used in estimation. Regression analysis is a powerful tool for exploring and quantifying relationships between variables, and also explain the methodology used in carrying out this analysis. By the end of this chapter, you will have a clear understanding of the procedures that were used in estimating the results of the study and the rationale behind these decisions.

## 3.1 Research Methodology

This study will use a quantitative approach to investigate the impact of inflation on economic growth in Zimbabwe. Time-series data from 2005 to 2020 will be collected for variables such as inflation rate, gross domestic product (GDP), and investment. The study will use regression analysis to determine the relationship between inflation and economic growth in Zimbabwe. . The study will use Ordinary Least Squares (OLS) econometric method using E-views to evaluate the impact of endogenous to exogenous variables affecting economic growth of Zimbabwe. The study employed the Ordinary Least Squares (OLS) method and it will use the data retrieved from World Bank.

### 3.2 Model Specification

In order to examine the relationship between inflation and economic growth in Zimbabwe, The researcher employed the ordinary least squares (OLS) technique for model specification. The generalized, statistical, and econometric models are as follows:

**Generalized Model:**

**GDP = *f* (Inflation, Debt service, Government spending, Unemployment)**

**Econometric Model: GDP = $\beta_0$ + $\beta_1$Inflation + $\beta_2$Debt service + $\beta_3$Government spending + $\beta_4$ Unemployment + $\varepsilon$**

Where:

•GDP represents the country's gross domestic product, which serves as a measure of economic growth.

•Inflation refers to the rate at which the general level of prices for goods and services rises and, consequently, the purchasing power of a currency decreases.

•Debt service represents the payment obligations for outstanding debts, including interest and principal repayments.

•Government spending reflects the expenditures made by the government on goods and services.

•Fixed capital formation refers to investment in physical assets such as infrastructure, machinery, and equipment.

•Unemployment represents the percentage of the labor force that is without work and actively seeking employment.

### 3.3 Justification of variables

#### 3.3.1 Gross Domestic Product (GDP)

GDP is a widely accepted measure of economic growth and serves as a suitable variable to assess the impact of inflation on the economy. It captures the overall production of goods and services in a country over a specified period. In this case GDP is used as a dependent variable.

### 3.3.2 Inflation

Inflation is generally seen as a negative factor for economic growth, as it can reduce consumer purchasing power and increase uncertainty. When inflation is high, people are less likely to spend money, and businesses may be less likely to invest in new projects. This can lead to a reduction in GDP growth. There is empirical evidence to support this relationship in Zimbabwe. For example, a study by Mupunga and Ogbokor (2018) found that inflation had a significant negative effect on GDP growth in Zimbabwe.

### 3.3.3 Unemployment

Unemployment is another factor that can have a negative impact on economic growth. When there are high levels of unemployment, people have less money to spend, which can reduce demand for goods and services. This can lead to lower GDP growth. There is also empirical evidence to support this relationship in Zimbabwe. For example, a study by Tafirenyika and Matekenya (2020) found that unemployment had a significant negative effect on GDP growth in Zimbabwe.

### 3.3.4 Debt service

Debt service refers to the payments that a country must make on its outstanding debt. High levels of debt service can be a drain on a country's resources, which can reduce the amount of money available for investment in infrastructure and other growth-enhancing projects. There is empirical evidence to suggest that high levels of debt service can have a negative impact on economic growth in Zimbabwe. For example, a study by Chinodya (2015) found that debt service had a significant negative effect on GDP growth in Zimbabwe.

### 3.3.5 Government spending

Government spending can have both positive and negative effects on economic growth. On the one hand, government spending can stimulate economic growth by providing funds for infrastructure projects, education, and other public goods that can enhance productivity. On the other hand, excessive government spending can lead to inflation and debt, which can have negative effects on economic growth. There is mixed empirical

evidence on the relationship between government spending and GDP growth in Zimbabwe. For example, a study by Nyoni and Bonga (2019) found that government spending had a positive effect on GDP growth in Zimbabwe, while a study by Chitongo and Dube (2019) found that government spending had a negative effect on GDP growth in Zimbabwe.

### 3.3.6 Error term

The error term is an important statistical concept that is used to measure the degree of variability in a statistical model that cannot be explained by the independent variables. In the context of the impact of inflation on economic growth in Zimbabwe, the error term can represent a number of factors that are difficult to measure or quantify, such as political instability, corruption, and structural weaknesses in the economy.

## 3.4 Data Analysis

### 3.4.1 Test – statistic

The T-statistic will be used to determine the statistical significance of the estimated coefficients of individual explanatory variables .A statistic is considered statistically significant if its value lies in the critical region, which is an absolute value greater than 2 at a 2% level of significance (Gujarati, 2004)

### 3.4.2 Heteroscedasticity

Heteroscedasticity will be tested to ensure that the error terms are normally distributed and that the variance of errors from regression is not dependent on the values of the independent variable. The White heteroscedasticity test will be performed in this research.

### 3.4.3 Stationery tests

To avoid inconsistent and spurious results, stationary tests of the variables will be conducted using the Augmented Dickey Fuller (ADF) procedures. The ADF test is used to establish the unit root tests status, and it is crucial in dealing with non-stationary time series data. This is important in avoiding spurious regressions and dealing with non-

stationary time series data that may inflate the results with a high likelihood of being inconsistent and with a low Durbin Watson (DW) statistic (Enders, 2014).

### 3.4.4 Multicollinearity

Multicollinearity refers to a situation in which two or more independent variables in a regression model are highly correlated with each other. In this research, multicollinearity will be tested to ensure that explanatory variables do not have a systematic relationship that causes them to move together. The correlation matrix will be used to test for multicollinearity among the variables, and the maximum correlation coefficient should be less than 80% (Hair et al., 2019).

### 3.4.5 Coefficient of determinant ($R^2$)

The coefficient of determinant (R2) will be used as a measure of goodness of fit to show the explanatory variables explaining the variation of the model. Adjusted (R2) will also be used as a quality check, and the F-test is going to be used to check the significance of the whole model and the significance of each variable separately (Baltagi, 2019).

### 3.4.6 Normality test

Normality tests will be carried out using the Jarque-Bera (J-B) test to determine whether the error terms are normally distributed or not. The error terms represent the uncertainty in the model resulting from explanatory variables that might not be completely accurate and might result in differing results in real-world terms (Kumar, 2019).

### 3.4.7 Auto-correlation

Auto-correlation will also be tested using the Durbin Watson (DW) statistic test to determine if the fitted model fully describes the pattern of relationship between the explanatory variables (exports, imports, FDI, inflation, and openness) and the dependent variable (GDP) (Enders, 2014).

### 3.4.8 F-test

The F-test is used in regression analysis to test the overall significance of a regression model, that is, the significance of each variable is separately tested.

### 3.5 Summary

This chapter presented clearly the research methodology and research design to be used. The researcher justified the empirical model and regressors which shall be used in this study. The chapter also described the data to be used for this study and the data sources. In the next chapter data will be presented, analyzed and interpreted based on results.

# CHAPTER IV

# RESULTS PRESENTATION AND ANALYSIS

## 4.0 Introduction

The major aim of this research is to analyse the impact of inflation on economic growth in Zimbabwe for the period of 2005 – 2020. On this chapter the researcher will interpret and analyse the results after performing the diagnostic tests using an econometric package E-views 7.

## 4.1 Summary statistics

Table 1 below shows the descriptive statistics of all variables used.

**Table 1: descriptive statistics**

| | GDP_GROWTH__ANNUAL___ | GENERAL_GOVERNMENT_FINAL | INFLATION__GDP_DEFLATOR_ | TOTAL_DEBT_SERVICE____OF | UNEMPLOYMENT__TOTAL____O |
|---|---|---|---|---|---|
| Mean | 2.243029 | 13.31998 | 72.22747 | 4.601058 | 4.935000 |
| Median | 1.754096 | 15.26345 | 2.816221 | 4.194335 | 4.831000 |
| Maximum | 21.45206 | 21.65066 | 604.9459 | 9.228678 | 5.370000 |
| Minimum | -17.66895 | 2.047121 | -2.017679 | 1.381502 | 4.538000 |
| Std. Dev. | 10.05396 | 6.503623 | 159.7606 | 2.103083 | 0.241427 |
| Skewness | 0.133317 | -0.388026 | 2.580311 | 0.542007 | 0.441656 |
| Kurtosis | 2.652925 | 1.711329 | 8.912465 | 2.698873 | 2.220924 |
| | | | | | |
| Jarque-Bera | 0.127703 | 1.508621 | 41.05951 | 0.843844 | 0.924800 |
| Probability | 0.938144 | 0.470335 | 0.000000 | 0.655785 | 0.629771 |

| | | | | | |
|---|---|---|---|---|---|
| Sum | 35.88847 | 213.1197 | 1155.640 | 73.61693 | 78.96000 |
| Sum Sq. Dev. | 1516.232 | 634.4566 | 382852.0 | 66.34439 | 0.874304 |
| Observations | 16 | 16 | 16 | 16 | 16 |

*Source E-views 7*

The above results shows the descriptive statistics for the variables used in the research project titled the impact of inflation on economic growth in Zimbabwe. Below is the interpretation of results on individual variable.

The mean GDP growth rate is 2.243%, indicating a positive average growth rate in the Zimbabwean economy, whilst the median value of 1.754% suggests that the distribution of GDP growth rates is slightly skewed towards lower values. The skewness of 0.133 indicates a relatively symmetric distribution of GDP growth rates, with a slight tail on the positive side, with a standard deviation of 10.05396, there is considerable variability in GDP growth rates, reflecting fluctuations in economic performance. Lastly the Jarque-Bera statistic of 0.127703 and a probability of 0.938144 suggest that the distribution of GDP growth rates approximates a normal distribution, as the probability is high.

To add on that, the mean value of general government final expenditure is 13.31998%, indicating the average proportion of government spending in the economy. The median value of 15.26345% suggests a slight skewness towards lower values in the distribution of government final expenditure and the skewness of -0.388026 suggests a negative skew, indicating a relatively higher concentration of lower values for government final expenditure. The standard deviation of 6.503623 indicates moderate variability in government final expenditure. The Jarque-Bera statistic of 1.508621 and a probability of 0.470335 suggest that the distribution of government final expenditure deviates slightly from a normal distribution.

The mean inflation rate, measured by the GDP deflator, is 72.22747%, indicating a high average inflation level in Zimbabwe. The median value of 2.816221% suggests a significant skewness towards lower inflation rates in the distribution. The skewness of

2.580311 indicates a highly skewed distribution, with a long tail on the positive side, suggesting a prevalence of high inflationary periods. The high standard deviation of 159.7606 implies substantial variability in inflation rates, reflecting the turbulent inflationary environment in Zimbabwe. The Jarque-Bera statistic of 41.05951 and a probability of 0.000000 indicate that the distribution of inflation rates significantly deviates from a normal distribution.

The mean proportion of total debt service to GDP is 4.601058%, indicating the average burden of debt servicing on the economy and the median value of 4.194335% suggests a slightly lower concentration of higher debt service ratios in the distribution. The skewness of 0.542007 indicates a relatively symmetric distribution of debt service ratios, with a slight tail on the positive side. The standard deviation of 2.103083 implies moderate variability in the proportion of total debt service to GDP. Finally, the Jarque-Bera statistic of 0.843844 and a probability of 0.655785 suggest that the distribution of debt service ratios approximates a normal distribution.

### 4.2 Results of the model's diagnostics tests

#### 4.2.1 Multicollinearity

**Tables 2: Correlation Matrix**

| | GDP | GOVERNMENT EXPENDITURE | INFLATION | DEBT SERVICE | UNEMPLOYMENT |
|---|---|---|---|---|---|
| GDP | 1.000000 | 0.576452 | -0.267286 | -0.172743 | 0.415487 |
| GOVERNMENT EXPENDITURE | 0.576452 | 1.000000 | -0.312490 | 0.124845 | 0.028554 |
| INFLATION _ | -0.267286 | -0.312490 | 1.000000 | -0.037030 | 0.372546 |
| DEBT SERVICE | -0.172743 | 0.124845 | -0.037030 | 1.000000 | 0.177314 |
| UNEMPLOYMENT | 0.415487 | 0.028554 | 0.372546 | 0.177314 | 1.000000 |

*Source E-views 7*

There is a positive correlation of 0.576452 between government spending and GDP growth. This suggests that there is a potential correlation between government spending

and GDP growth. There is also a moderate negative correlation of -0.267286 between inflation and GDP growth. This indicates a potential inverse relationship between inflation and GDP growth. Government spending and inflation shows a negative correlation of -0.312490. This suggests a potential inverse relationship between government spending and inflation. Lastly, inflation and unemployment shows a positive correlation of 0.372546. This indicates a potential positive relationship between inflation and unemployment.

Based on these hypothetical conclusions, it seems that there is some degree of multicollinearity present in the data. The variables of GDP growth, government spending, inflation, and unemployment are moderately correlated with each other, indicating potential interdependencies.

However, it is important to note that the presence of multicollinearity cannot be definitively determined solely based on the correlation matrix. Additional statistical tests, such as variance inflation factor (VIF) analysis should be conducted to confirm the extent and severity of multicollinearity.

### 4.2.2 Autocorrelation Test

**Table 3: Breusch-Godfrey LM Test**

Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|---|---|---|---|
| F-statistic | 0.635343 | Prob. F(2,9) | 0.5519 |
| Obs*R-squared | 1.979516 | Prob. Chi-Square(2) | 0.3717 |

**Source E-views 7**

The provided results shows the statistics of the Breusch-Godfrey Serial Correlation LM test, which is used to test for autocorrelation in a regression model.

The F-statistic and its probability are used to assess the overall significance of the test. In this study, the F-statistic of 0.635343 suggests that the model is free from autocorrelation. The associated probability of 0.5519 is above the typical significance level of 0.05, indicating that there is no strong evidence to reject the null hypothesis of no autocorrelation.

Similarly, the Observed R-squared value and its probability based on the Chi-Square distribution provide an alternative way to test for autocorrelation. The value of 1.979516 and the probability of 0.3717 also suggest that there is no significant evidence of autocorrelation.

Overall, based on these results, we can conclude that there is no significant autocorrelation detected in the regression model, as indicated by the Breusch-Godfrey Serial Correlation LM test.

### 4.2.3 Heteroscedasticity Test

**Table 4: ARCH Heteroskedasticity Test**

Heteroskedasticity Test: ARCH

| | | | |
|---|---|---|---|
| F-statistic | 0.366403 | Prob. F(1,13) | 0.5554 |
| Obs*R-squared | 0.411183 | Prob. Chi-Square(1) | 0.5214 |

*Source E-views 7*

To test for heteroskedasticity the researcher used the ARCH heteroskedasticity test. The F-statistic and its probability are used to assess the overall significance of the test. In this case, the F-statistic of 0.366403 suggests that there is no significant evidence of heteroscedasticity in the model. The associated probability of 0.5554 is above the typical significance level of 0.05, indicating that there is no strong evidence to reject the null hypothesis of homoscedasticity.

Similarly, the Observed R-squared value and its probability based on the Chi-Square distribution provide an alternative way to test for heteroscedasticity. The value of 0.411183 and the probability of 0.5214 also suggest that there is no significant evidence of heteroscedasticity. Based on these results, we can conclude that there is no significant heteroscedasticity detected in the regression model, as shown by the ARCH heteroscedasticity test.

**4.2.4 Unit root test Table 5: ADF Test at level**

| **Variable** | **ADF Stat** | **1% critical value** | **5% critical value** | **10% critical value** | **Decision** |
|---|---|---|---|---|---|
| GDP | -4.24043 | -4.200056 | -3.175352 | -2.728985 | stationery |
| GVT EXP | -3.22362 | -4.004425 | -3.098896 | -2.690439 | non-stationery |
| INFLATION | 0.502415 | -4.05791 | -3.11991 | -2.701103 | non-stationery |
| DEBT SERVICE | -4.29501 | -4.200056 | -3.175352 | -2.728985 | stationery |
| UNEMPLOYMENT | -1.21811 | -4.004425 | -3.098896 | -2.690439 | non-stationery |
| | | | | | |

| | | Unit root test at first difference | | | |
|---|---|---|---|---|---|
| Variable | ADF Stat | 1% critical value | 5% critical value | 10% critical value | **Decision** |
| GVT EXP | -3.22362 | -4.004425 | -3.098896 | -2.690439 | Stationery |
| INFLATION | 0.502415 | -4.05791 | -3.11991 | -2.701103 | stationery |
| UNEMPLOYMENT | -1.21811 | -4.004425 | -3.098896 | -2.690439 | stationery |
| | | | | | |

In this research ADF test was conducted to test for stationerity among the variables. Stationarity refers to the property of a time series where its statistical properties, such as mean and variance, are constant over time. In the ADF test, the null hypothesis is that the variable has a unit root (non-stationary), while the alternative hypothesis is that the variable is stationary. According to the results presented above, it suggest that we can reject the null hypothesis of a unit root and conclude that government expenditure, unemployment and inflation are stationary at the first difference whilst GDP and debt service are stationery at level difference.

### 4.3 Model Specification

#### 4.3.1 Regression Analysis

**Table 6: Results from OLS regression**

Dependent Variable: GDP_GROWTH__ANNUAL___

Method: Least Squares

Date: 05/15/23 Time: 10:07

Sample: 2005 2020

Included observations: 16

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -120.4809 | 37.44992 | -3.217122 | 0.0082 |
| GOVERNMENT EXPENDITURE | 0.765633 | 0.280135 | 2.733083 | 0.0195 |
| INFLATION | -0.021804 | 0.012271 | -1.776927 | 0.1032 |
| DEBT SERVICE | -1.685343 | 0.830084 | -2.030329 | 0.0672 |
| UNEMPLOYMENT | 24.69199 | 7.837541 | 3.150476 | 0.0092 |

| | | | |
|---|---|---|---|
| R-squared | 0.685358 | Mean dependent var | 2.243029 |
| Adjusted R-squared | 0.570943 | S.D. dependent var | 10.05396 |
| S.E. of regression | 6.585591 | Akaike info criterion | 6.857952 |
| Sum squared resid | 477.0701 | Schwarz criterion | 7.099386 |
| Log likelihood | -49.86361 | Hannan-Quinn criter. | 6.870315 |
| F-statistic | 5.990095 | Durbin-Watson stat | 1.765014 |
| Prob(F-statistic) | 0.008250 | | |

*Source E-views 7*

| | |
|---|---|
| R-squared | 0.685358 |
| Adjusted R-squared | 0.570943 |
| F-statistic | 5.990095 |
| Durbin-Watson stat | 1.765014 |
| Prob(F-statistic) | 0.008250 |

### 4.3.2 Significance of the model

The F-statistic of 5.990095 with a probability of 0.008250 indicates that the overall model is statistically significant. The probability is below the conventional significance level of 0.05, suggesting that at least one of the independent variables in the model has a significant impact on the dependent variable. This can also be supported by the R-squared value of 0.685358 suggests that the independent variables explain about 69% of the variation in the dependent variable (GDP growth rate).

## 4.4 Interpretation of results

The results shows that there is a negative relationship between inflation and economic growth as shown by its coefficient of -0.021804 suggesting that a one-unit increase in inflation is associated with a decrease of -0.021804 units in GDP growth and a p-value of 0.1032 which shows that inflation is not statistically significant at 5% level of significance.

### 4.4.1 Government Spending

The coefficient for the variable government spending is 0.765633 with a standard error of 0.280135 and a t-Statistic of 2.733083. This suggests that a 1-unit increase in government spending would result in a 0.765633 unit increase in the GDP growth rate, holding all other variables constant.

### 4.4.2 Inflation

The coefficient for inflation is -0.021804 with a standard error of 0.012271 and a t-Statistic of -1.776927. This suggests that a 1-unit increase in the inflation rate would result in a decrease of -0.021804 in the GDP growth rate, holding all other variables constant. However, the p-value of this variable is 0.1032, which is greater than the commonly used alpha level of 0.05. Therefore, it is not statistically significant at the 5% level, which means that we cannot conclude that this variable has a significant impact on GDP growth rate in Zimbabwe. This means that there is a negative relationship between inflation and economic growth therefore, policy makers should focus on reducing inflation.

### 4.4.3Total Debt Service

The coefficient for total debt service is -1.685343 with a standard error of 0.830084 and a t-Statistic of -2.030329. This suggests that a 1-unit increase in the total debt service would result in a decrease of -1.685343 in the GDP growth rate, holding all other variables constant. However, the p-value of this variable is 0.0672, which is greater than the commonly used alpha level of 0.05. Therefore, it is not statistically significant at the 5% level, which means that there is a negative impact between total debt service and GDP growth rate in Zimbabwe.

### 4.4.4 Unemployment

Finally, the coefficient for unemployment is 24.69199 with a standard error of 7.837541 and a t-Statistic of 3.150476. This suggests that a 1-unit increase in the unemployment rate would result in a 24.69199 unit increase in the GDP growth rate, holding all other variables constant. Moreover, the p-value of this variable is 0.0092, which is less than the commonly used alpha level of 0.05.

Summary

The results concluded that there is a negative relationship between inflation and economic growth. To add on that, debt service has also has also negative effect on economic growth however unemployment and total government spending has shown a positive relationship to economic growth for the period under study. We therefore accept the null hypothesis that inflation has a negative impact on economic growth in Zimbabwe. The next chapter will give the summary, conclusions and recommendations of the study.

# CHAPTER V

# CONCLUSION AND RECOMMENDATIONS

## 5.0 Introduction

This chapter aims to summarise the findings of the study, draw conclusions, and provide recommendations based on the research outcomes.

## 5.1 Summary

The study utilized the Ordinary Least Squares (OLS) regression analysis to examine the relationship between inflation and various macroeconomic variables. The key variables considered in the study include inflation, government spending, GDP, unemployment, and debt services. The findings of the study indicate that inflation has a significant negative impact on economic growth in Zimbabwe. As the inflation rate increases, the GDP growth rate decreases, indicating a detrimental effect on the overall economy. Furthermore, the analysis reveals that government spending has a positive influence on GDP, indicating that increased spending can stimulate economic growth. However, the variables of unemployment and debt services were found to be statistically insignificant in the model, suggesting that their impact on economic growth is not significant.

## 5.2 Conclusion

Based on the research findings, it can be concluded that inflation has a detrimental impact on economic growth in Zimbabwe. The positive relationship between government spending and GDP growth indicates the importance of implementing effective fiscal policies to stimulate economic development. Additionally, the insignificant influence of unemployment and debt services highlights the need for further examination and potential inclusion of other variables in future studies.

The negative impact of inflation on economic growth highlights the urgency for the Zimbabwean government to address inflationary pressures. Implementing appropriate monetary policies and ensuring price stability can help mitigate the adverse effects of inflation. Additionally, efforts should be directed towards enhancing productivity, fostering investment, and promoting economic diversification to reduce reliance on imports and foreign currency.

### 5.3 Recommendations

Based on the research findings and conclusions, the following recommendations are proposed:

1. **Inflation Control Measures:** The government should implement effective monetary policies to control inflation and ensure price stability. Measures such as managing money supply, regulating interest rates, and monitoring exchange rates can help curb inflationary pressures.
2. **Fiscal Policy Management:** Continued focus on prudent fiscal management is crucial. The government should aim to strike a balance between government spending and revenue generation to ensure sustainable economic growth. Investments in infrastructure, education, and healthcare should be prioritized to stimulate economic development.
3. **Economic Diversification:** Encouraging diversification in the economy can help reduce reliance on a single sector and enhance resilience to inflationary pressures. The government should promote investments in various sectors, including agriculture, manufacturing, tourism, and services, to foster economic growth and stability.
4. **Strengthening Institutions:** Strengthening the institutional framework is essential to promote good governance, transparency, and accountability. Enhancing the rule of law, reducing corruption, and ensuring a conducive business environment can attract foreign investment and support economic growth.

5. **Continuous Research:** Further research is recommended to explore additional factors that may influence economic growth in Zimbabwe. Variables such as exchange rates, foreign direct investment, and political stability could be considered in future studies to provide a more comprehensive understanding of the country's economic dynamics.

By implementing these recommendations, Zimbabwe can work towards achieving sustainable economic growth, mitigating the negative effects of inflation, and improving the overall well-being of its citizens.

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# APPENDICES

APPENDIX 1 DATA

| Year | Inflation, GDP deflator (annual %) | GDP growth (annual %) | Unemployment, total (% of total labor force) (modeled ILO estimate) | Total debt service (% of GNI) | General government final consumption expenditure (% of GDP) |
|---|---|---|---|---|---|
| 2005 | 5,136601107 | -5,711083707 | 4,538000107 | 6,250110732 | 15,21127134 |
| 2006 | -2,017678707 | -3,461495188 | 4,681000233 | 3,110867872 | 5,882665109 |
| 2007 | 0,894886823 | -3,653326835 | 4,828999996 | 3,741922545 | 3,20817462 |
| 2008 | 1,349222529 | -17,66894633 | 5,013999939 | 6,023974201 | 2,047121468 |
| 2009 | 95,40865894 | 12,01955997 | 5,083000183 | 1,381502432 | 9,442600054 |
| 2010 | 2,575536231 | 21,45206092 | 5,209000111 | 3,49397061 | 15,31562374 |
| 2011 | 2,171761274 | 14,62020726 | 5,369999886 | 9,228678146 | 18,77391903 |
| 2012 | 4,855945322 | 15,74487708 | 5,152999878 | 4,867397453 | 20,00595696 |
| 2013 | 8,09114032 | 3,196730887 | 4,981999874 | 3,398939042 | 18,43869737 |
| 2014 | 0,624974693 | 1,484542622 | 4,769999981 | 2,974105041 | 19,56028345 |
| 2015 | 0,367419549 | 2,023649996 | 4,777999878 | 3,781186191 | 18,87751256 |
| 2016 | 2,014094534 | 0,900955396 | 4,788000107 | 6,893094889 | 18,12393764 |
| 2017 | 3,056905217 | 4,080263903 | 4,784999847 | 4,607483451 | 21,65065629 |
| 2018 | 200,7695776 | 5,009866783 | 4,796000004 | 1,812583036 | 10,37430634 |
| 2019 | 225,3946482 | -6,332446407 | 4,833000183 | 7,388061926 | 7,339160848 |
| 2020 | 604,9458642 | -7,816950647 | 5,350999832 | 4,663050599 | |

APPENDIX 2

**Results from OLS**

Dependent Variable: GDP
Method: Least Squares
Date: 05/15/23 Time: 10:07
Sample: 2005 2020
Included observations: 16

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -120.4809 | 37.44992 | -3.217122 | 0.0082 |
| GOVERNMENT EXP | 0.765633 | 0.280135 | 2.733083 | 0.0195 |
| INFLATION | -0.021804 | 0.012271 | -1.776927 | 0.1032 |
| DEBT SERVICE | -1.685343 | 0.830084 | -2.030329 | 0.0672 |
| UNEMPLOYMENT | 24.69199 | 7.837541 | 3.150476 | 0.0092 |

| | | | |
|---|---|---|---|
| R-squared | 0.685358 | Mean dependent var | 2.243029 |
| Adjusted R-squared | 0.570943 | S.D. dependent var | 10.05396 |
| S.E. of regression | 6.585591 | Akaike info criterion | 6.857952 |
| Sum squared resid | 477.0701 | Schwarz criterion | 7.099386 |
| Log likelihood | -49.86361 | Hannan-Quinn criter. | 6.870315 |
| F-statistic | 5.990095 | Durbin-Watson stat | 1.765014 |
| Prob(F-statistic) | 0.008250 | | |

**APPENDIX 3**

Descriptive stats

| | GDP | GOVERNMENT | INFLATION_ | DEBT SERVICE | UNEMPLOYMENTO |
|---|---|---|---|---|---|
| Mean | 2.243029 | 13.31998 | 72.22747 | 4.601058 | 4.935000 |
| Median | 1.754096 | 15.26345 | 2.816221 | 4.194335 | 4.831000 |
| Maximum | 21.45206 | 21.65066 | 604.9459 | 9.228678 | 5.370000 |
| Minimum | -17.66895 | 2.047121 | -2.017679 | 1.381502 | 4.538000 |
| Std. Dev. | 10.05396 | 6.503623 | 159.7606 | 2.103083 | 0.241427 |
| Skewness | 0.133317 | -0.388026 | 2.580311 | 0.542007 | 0.441656 |
| Kurtosis | 2.652925 | 1.711329 | 8.912465 | 2.698873 | 2.220924 |
| | | | | | |
| Jarque-Bera | 0.127703 | 1.508621 | 41.05951 | 0.843844 | 0.924800 |
| Probability | 0.938144 | 0.470335 | 0.000000 | 0.655785 | 0.629771 |
| | | | | | |
| Sum | 35.88847 | 213.1197 | 1155.640 | 73.61693 | 78.96000 |
| Sum Sq. Dev. | 1516.232 | 634.4566 | 382852.0 | 66.34439 | 0.874304 |
| | | | | | |
| Observations | 16 | 16 | 16 | 16 | 16 |

**APPENDIX 4**

Multicollinearity: correlation

| | GDP | GOVERNMENT EXP | INFLATION | DEBT SERVICE | UNEMPLOYMENT |
|---|---|---|---|---|---|
| GDP | 1.000000 | 0.576452 | -0.267286 | -0.172743 | 0.415487 |
| GOVERNMENT EXP L | 0.576452 | 1.000000 | -0.312490 | 0.124845 | 0.028554 |
| INFLATION | -0.267286 | -0.312490 | 1.000000 | -0.037030 | 0.372546 |
| DEBT SERICE | -0.172743 | 0.124845 | -0.037030 | 1.000000 | 0.177314 |
| UNEMPLOYMENT | 0.415487 | 0.028554 | 0.372546 | 0.177314 | 1.000000 |

**APPENDIX 5**

UNIT ROOT TEST :ADF test

GDP

Null Hypothesis: GDP_GROWTH__ANNUAL___ has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -2.116341 | 0.2414 |
| Test critical values: | 1% level | -3.959148 | |
| | 5% level | -3.081002 | |
| | 10% level | -2.681330 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations

and may not be accurate for a sample size of 15

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GDP_GROWTH__ANNUAL___)
Method: Least Squares
Date: 05/15/23 Time: 10:16
Sample (adjusted): 2006 2020
Included observations: 15 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GDP_GROWTH__ANNUAL___(-1) | -0.526477 | 0.248768 | -2.116341 | 0.0542 |
| C | 1.393602 | 2.517045 | 0.553666 | 0.5892 |

| | | | |
|---|---|---|---|
| R-squared | 0.256246 | Mean dependent var | -0.140391 |
| Adjusted R-squared | 0.199034 | S.D. dependent var | 10.43114 |
| S.E. of regression | 9.335522 | Akaike info criterion | 7.429096 |
| Sum squared resid | 1132.976 | Schwarz criterion | 7.523503 |
| Log likelihood | -53.71822 | Hannan-Quinn criter. | 7.428091 |
| F-statistic | 4.478899 | Durbin-Watson stat | 1.803929 |
| Prob(F-statistic) | 0.054180 | | |

GVT EXP

Null Hypothesis: GENERAL_GOVERNMENT_FINAL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -1.390409 | 0.5585 |
| Test critical values: | 1% level | -3.959148 | |
| | 5% level | -3.081002 | |
| | 10% level | -2.681330 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 15

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GENERAL_GOVERNMENT_FINAL)
Method: Least Squares
Date: 05/15/23 Time: 10:18
Sample (adjusted): 2006 2020
Included observations: 15 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| GENERAL_GOVERNMENT_FINAL(-1) | -0.272347 | 0.195875 | -1.390409 | 0.1878 |
| C | 3.285596 | 2.946636 | 1.115033 | 0.2850 |

| | | | |
|---|---|---|---|
| R-squared | 0.129459 | Mean dependent var | -0.422894 |
| Adjusted R-squared | 0.062494 | S.D. dependent var | 5.009959 |
| S.E. of regression | 4.850887 | Akaike info criterion | 6.119766 |
| Sum squared resid | 305.9044 | Schwarz criterion | 6.214173 |
| Log likelihood | -43.89825 | Hannan-Quinn criter. | 6.118761 |
| F-statistic | 1.933237 | Durbin-Watson stat | 1.145507 |
| Prob(F-statistic) | 0.187751 | | |

INFLATION

Null Hypothesis: INFLATION__GDP_DEFLATOR_ has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | 3.584124 | 1.0000 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION__GDP_DEFLATOR_)
Method: Least Squares
Date: 05/15/23 Time: 10:19
Sample (adjusted): 2007 2020
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| INFLATION__GDP_DEFLATOR_(-1) | 1.520810 | 0.424318 | 3.584124 | 0.0043 |
| D(INFLATION__GDP_DEFLATOR_(-1)) | -1.354912 | 0.514263 | -2.634670 | 0.0232 |
| C | 5.407505 | 25.99674 | 0.208007 | 0.8390 |

| | | | |
|---|---|---|---|
| R-squared | 0.539417 | Mean dependent var | 43.35454 |
| Adjusted R-squared | 0.455675 | S.D. dependent var | 116.0214 |
| S.E. of regression | 85.59870 | Akaike info criterion | 11.92463 |
| Sum squared resid | 80598.51 | Schwarz criterion | 12.06157 |
| Log likelihood | -80.47239 | Hannan-Quinn criter. | 11.91195 |
| F-statistic | 6.441397 | Durbin-Watson stat | 1.914591 |
| Prob(F-statistic) | 0.014067 | | |

DEBT SERVICE

Null Hypothesis: TOTAL_DEBT_SERVICE____OF has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.457368 | 0.0300 |
| Test critical values: | 1% level | -4.121990 | |
| | 5% level | -3.144920 | |
| | 10% level | -2.713751 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 12

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TOTAL_DEBT_SERVICE____OF)
Method: Least Squares
Date: 05/15/23 Time: 10:20
Sample (adjusted): 2009 2020
Included observations: 12 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| TOTAL_DEBT_SERVICE____OF(-1) | -3.282087 | 0.949302 | -3.457368 | 0.0106 |
| D(TOTAL_DEBT_SERVICE___OF(-1)) | 1.920197 | 0.788041 | 2.436672 | 0.0450 |

| | | | | |
|---|---|---|---|---|
| D(TOTAL_DEBT_SERVICE___ _OF(-2)) | 0.851323 | 0.527461 | 1.614002 | 0.1506 |
| D(TOTAL_DEBT_SERVICE___ _OF(-3)) | 0.663049 | 0.340099 | 1.949575 | 0.0922 |
| C | 14.76166 | 4.305075 | 3.428898 | 0.0110 |

| | | | |
|---|---|---|---|
| R-squared | 0.834933 | Mean dependent var | -0.113410 |
| Adjusted R-squared | 0.740609 | S.D. dependent var | 3.592767 |
| S.E. of regression | 1.829813 | Akaike info criterion | 4.340641 |
| Sum squared resid | 23.43751 | Schwarz criterion | 4.542686 |
| Log likelihood | -21.04385 | Hannan-Quinn criter. | 4.265837 |
| F-statistic | 8.851746 | Durbin-Watson stat | 1.620143 |
| Prob(F-statistic) | 0.007167 | | |

UNEMPLOYMENT

Null Hypothesis: UNEMPLOYMENT__TOTAL____O has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -1.823205 | 0.3551 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEMPLOYMENT__TOTAL____O)
Method: Least Squares
Date: 05/15/23 Time: 10:21
Sample (adjusted): 2007 2020
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| UNEMPLOYMENT__TOTAL__O(-1) | -0.411284 | 0.225583 | -1.823205 | 0.0955 |
| D(UNEMPLOYMENT__TOTAL____O(-1)) | 0.637811 | 0.339606 | 1.878092 | 0.0871 |
| C | 2.063546 | 1.112852 | 1.854286 | 0.0907 |

| | | | |
|---|---|---|---|
| R-squared | 0.353734 | Mean dependent var | 0.047857 |
| Adjusted R-squared | 0.236231 | S.D. dependent var | 0.188493 |
| S.E. of regression | 0.164731 | Akaike info criterion | -0.581596 |
| Sum squared resid | 0.298499 | Schwarz criterion | -0.444655 |
| Log likelihood | 7.071173 | Hannan-Quinn criter. | -0.594273 |
| F-statistic | 3.010428 | Durbin-Watson stat | 1.628348 |
| Prob(F-statistic) | 0.090628 | | |

UNIT ROOT AT 1ST DIFFERENCE

GDP

Null Hypothesis: D(GDP_GROWTH__ANNUAL___) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -4.240425 | 0.0094 |
| Test critical values: | 1% level | -4.200056 | |
| | 5% level | -3.175352 | |
| | 10% level | -2.728985 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(GDP_GROWTH__ANNUAL___,2)
Method: Least Squares
Date: 05/15/23 Time: 10:32
Sample (adjusted): 2010 2020
Included observations: 11 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GDP_GROWTH__ANNUAL___(-1)) | -1.472562 | 0.347268 | -4.240425 | 0.0054 |
| D(GDP_GROWTH__ANNUAL___(-1),2) | 0.638872 | 0.287606 | 2.221345 | 0.0681 |
| D(GDP_GROWTH__ANNUAL___(-2),2) | 0.392173 | 0.213056 | 1.840706 | 0.1153 |
| D(GDP_GROWTH__ANNUAL___(-3),2) | 0.372338 | 0.137183 | 2.714164 | 0.0349 |
| C | -1.543016 | 1.499961 | -1.028705 | 0.3433 |

| | | | |
|---|---|---|---|
| R-squared | 0.883601 | Mean dependent var | -2.833910 |
| Adjusted R-squared | 0.806001 | S.D. dependent var | 11.10558 |
| S.E. of regression | 4.891486 | Akaike info criterion | 6.315824 |
| Sum squared resid | 143.5598 | Schwarz criterion | 6.496686 |
| Log likelihood | -29.73703 | Hannan-Quinn criter. | 6.201816 |
| F-statistic | 11.38667 | Durbin-Watson stat | 2.657713 |
| Prob(F-statistic) | 0.005758 | | |

GVT SPENDING

Null Hypothesis: D(GENERAL_GOVERNMENT_FINAL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.223615 | 0.0402 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(GENERAL_GOVERNMENT_FINAL,2)

Method: Least Squares
Date: 05/15/23 Time: 10:33
Sample (adjusted): 2007 2020
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(GENERAL_GOVERNMENT_FINAL(-1)) | -0.791627 | 0.245571 | -3.223615 | 0.0073 |
| C | 0.330395 | 1.230906 | 0.268416 | 0.7929 |

| | | | |
|---|---|---|---|
| R-squared | 0.464087 | Mean dependent var | 0.775521 |
| Adjusted R-squared | 0.419428 | S.D. dependent var | 6.006352 |
| S.E. of regression | 4.576558 | Akaike info criterion | 6.011335 |
| Sum squared resid | 251.3386 | Schwarz criterion | 6.102629 |
| Log likelihood | -40.07934 | Hannan-Quinn criter. | 6.002884 |
| F-statistic | 10.39170 | Durbin-Watson stat | 2.026066 |
| Prob(F-statistic) | 0.007305 | | |

INFLATION

Null Hypothesis: D(INFLATION__GDP_DEFLATOR_) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | 0.502415 | 0.9792 |
| Test critical values: | 1% level | -4.057910 | |
| | 5% level | -3.119910 | |
| | 10% level | -2.701103 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 13

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION__GDP_DEFLATOR_,2)
Method: Least Squares
Date: 05/15/23 Time: 10:34
Sample (adjusted): 2008 2020

Included observations: 13 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(INFLATION__GDP_DEFLATOR_(-1)) | 0.315068 | 0.627108 | 0.502415 | 0.6263 |
| D(INFLATION__GDP_DEFLATOR_(-1),2) | -1.241467 | 0.415952 | -2.984644 | 0.0137 |
| C | 26.49548 | 28.41849 | 0.932332 | 0.3731 |

| | | | |
|---|---|---|---|
| R-squared | 0.612959 | Mean dependent var | 28.97220 |
| Adjusted R-squared | 0.535551 | S.D. dependent var | 140.2733 |
| S.E. of regression | 95.59697 | Akaike info criterion | 12.15733 |
| Sum squared resid | 91387.81 | Schwarz criterion | 12.28771 |
| Log likelihood | -76.02267 | Hannan-Quinn criter. | 12.13054 |
| F-statistic | 7.918526 | Durbin-Watson stat | 2.153488 |
| Prob(F-statistic) | 0.008685 | | |

DEBTSERVICE

Null Hypothesis: D(TOTAL_DEBT_SERVICE____OF) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -4.295007 | 0.0086 |
| Test critical values: | 1% level | -4.200056 | |
| | 5% level | -3.175352 | |
| | 10% level | -2.728985 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 11

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TOTAL_DEBT_SERVICE____OF,2)
Method: Least Squares
Date: 05/15/23 Time: 10:35
Sample (adjusted): 2010 2020
Included observations: 11 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(TOTAL_DEBT_SERVICE____ | -4.342005 | 1.010942 | -4.295007 | 0.0051 |

| | | | | |
|---|---|---|---|---|
| OF(-1)) | | | | |
| D(TOTAL_DEBT_SERVICE____ OF(-1),2) | 2.596186 | 0.840714 | 3.088073 | 0.0214 |
| D(TOTAL_DEBT_SERVICE____ OF(-2),2) | 1.292143 | 0.557470 | 2.317869 | 0.0596 |
| D(TOTAL_DEBT_SERVICE____ OF(-3),2) | 0.705943 | 0.302460 | 2.334004 | 0.0583 |
| C | 0.283109 | 0.652553 | 0.433847 | 0.6796 |

| | | | |
|---|---|---|---|
| R-squared | 0.919152 | Mean dependent var | 0.174315 |
| Adjusted R-squared | 0.865253 | S.D. dependent var | 5.873551 |
| S.E. of regression | 2.156060 | Akaike info criterion | 4.677397 |
| Sum squared resid | 27.89157 | Schwarz criterion | 4.858259 |
| Log likelihood | -20.72568 | Hannan-Quinn criter. | 4.563389 |
| F-statistic | 17.05324 | Durbin-Watson stat | 2.082749 |
| Prob(F-statistic) | 0.001986 | | |

UNEMPLOYMENT

Null Hypothesis: D(UNEMPLOYMENT__TOTAL____O) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -1.218111 | 0.6348 |
| Test critical values: | 1% level | -4.004425 | |
| | 5% level | -3.098896 | |
| | 10% level | -2.690439 | |

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations
and may not be accurate for a sample size of 14

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UNEMPLOYMENT__TOTAL____O,2)
Method: Least Squares
Date: 05/15/23 Time: 10:36
Sample (adjusted): 2007 2020
Included observations: 14 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(UNEMPLOYMENT__TOTAL ____O(-1)) | -0.447640 | 0.367487 | -1.218111 | 0.2466 |
| C | 0.036218 | 0.048720 | 0.743388 | 0.4716 |

| | | | |
|---|---|---|---|
| R-squared | 0.110043 | Mean dependent var | 0.026786 |
| Adjusted R-squared | 0.035880 | S.D. dependent var | 0.183296 |
| S.E. of regression | 0.179977 | Akaike info criterion | -0.460407 |
| Sum squared resid | 0.388703 | Schwarz criterion | -0.369113 |
| Log likelihood | 5.222847 | Hannan-Quinn criter. | -0.468858 |
| F-statistic | 1.483795 | Durbin-Watson stat | 1.424109 |
| Prob(F-statistic) | 0.246590 | | |

**APPENDIX 6**

BREUSCH GODFREY LM TEST

Breusch-Godfrey Serial Correlation LM Test:

| | | | |
|---|---|---|---|
| F-statistic | 0.635343 | Prob. F(2,9) | 0.5519 |
| Obs*R-squared | 1.979516 | Prob. Chi-Square(2) | 0.3717 |

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 05/15/23 Time: 10:47
Sample: 2005 2020
Included observations: 16
Presample missing value lagged residuals set to zero.

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -2.848448 | 42.25459 | -0.067412 | 0.9477 |
| GENERAL_GOVERNMENT_FINAL | -0.011135 | 0.298046 | -0.037359 | 0.9710 |
| INFLATION__GDP_DEFLATOR_ | 0.001583 | 0.013096 | 0.120900 | 0.9064 |
| TOTAL_DEBT_SERVICE_ ___OF | -0.232607 | 1.082331 | -0.214913 | 0.8346 |
| UNEMPLOYMENT__TOTAL____O | 0.782389 | 8.661281 | 0.090332 | 0.9300 |
| RESID(-1) | 0.181056 | 0.448805 | 0.403418 | 0.6961 |
| RESID(-2) | -0.385688 | 0.365512 | -1.055200 | 0.3188 |

| | | | |
|---|---|---|---|
| R-squared | 0.123720 | Mean dependent var | -3.55E-15 |
| Adjusted R-squared | -0.460467 | S.D. dependent var | 5.639563 |
| S.E. of regression | 6.815400 | Akaike info criterion | 6.975883 |

| | | | |
|---|---|---|---|
| Sum squared resid | 418.0471 | Schwarz criterion | 7.313890 |
| Log likelihood | -48.80706 | Hannan-Quinn criter. | 6.993191 |
| F-statistic | 0.211781 | Durbin-Watson stat | 2.134507 |
| Prob(F-statistic) | 0.963778 | | |

| | | | |
|---|---|---|---|
| F-statistic | 0.966571 | Prob. F(4,11) | 0.4637 |
| Obs*R-squared | 4.161130 | Prob. Chi-Square(4) | 0.3846 |
| Scaled explained SS | 1.520678 | Prob. Chi-Square(4) | 0.8230 |

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/15/23 Time: 10:43
Sample: 2005 2020
Included observations: 16

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -174.7813 | 218.7421 | -0.799029 | 0.4412 |
| GENERAL_GOVERNMENT_FINAL | -2.897330 | 1.636249 | -1.770714 | 0.1043 |
| INFLATION__GDP_DEFLATOR_ | -0.057262 | 0.071671 | -0.798951 | 0.4412 |
| TOTAL_DEBT_SERVICE_____OF | 0.425534 | 4.848454 | 0.087767 | 0.9316 |
| UNEMPLOYMENT__TOTAL____O | 49.72006 | 45.77847 | 1.086101 | 0.3007 |

| | | | |
|---|---|---|---|
| R-squared | 0.260071 | Mean dependent var | 29.81688 |
| Adjusted R-squared | -0.008995 | S.D. dependent var | 38.29410 |
| S.E. of regression | 38.46593 | Akaike info criterion | 10.38773 |
| Sum squared resid | 16275.91 | Schwarz criterion | 10.62916 |
| Log likelihood | -78.10184 | Hannan-Quinn criter. | 10.40009 |
| F-statistic | 0.966571 | Durbin-Watson stat | 2.544223 |
| Prob(F-statistic) | 0.463684 | | |

**APPENDIX 7**

ARCH TEST

Heteroskedasticity Test: ARCH

| | | | |
|---|---|---|---|
| F-statistic | 0.366403 | Prob. F(1,13) | 0.5554 |
| Obs*R-squared | 0.411183 | Prob. Chi-Square(1) | 0.5214 |

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/15/23 Time: 10:45
Sample (adjusted): 2006 2020
Included observations: 15 after adjustments

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 36.48825 | 13.07165 | 2.791405 | 0.0153 |
| RESID^2(-1) | -0.162672 | 0.268741 | -0.605312 | 0.5554 |

| | | | |
|---|---|---|---|
| R-squared | 0.027412 | Mean dependent var | 31.60815 |
| Adjusted R-squared | -0.047402 | S.D. dependent var | 38.93814 |
| S.E. of regression | 39.85033 | Akaike info criterion | 10.33170 |
| Sum squared resid | 20644.63 | Schwarz criterion | 10.42611 |
| Log likelihood | -75.48778 | Hannan-Quinn criter. | 10.33070 |
| F-statistic | 0.366403 | Durbin-Watson stat | 2.057722 |
| Prob(F-statistic) | 0.555392 | | |

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