ADDIS ABABA UNIVERSITY

COLLEGE BUSINESS AND ECONOMICS

DYNAMIC EFFECTS OF FISCAL DEFICIT FINANCING ON INFLATION IN ETHIOPIA: MARKOV REGIME-SWITCHING MODEL APPROACH

A thesis submitted to the school of graduate studies, Addis Ababa University College of business and economics department of economics in Partial fulfillment of the requirements for the degree of Masters in Economics (Economic Policy Analysis)

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DECLARATION STATEMENT

I hereby declare that the thesis titled '**the dynamic effects of fiscal deficit financing on inflation In Ethiopia: Markov regime-switching model approach**.' I have conducted under supervision of Mesele Araya (PHD) in partial fulfillment requirement for degree of masters of Science in economics (Economic policy analysis) and submitted to Addis Ababa University, College of business and economics, department of Economics is entirely work of mine. The interpretations put forth are based on my reading and understanding of the original texts and they are not published anywhere in the form of books, articles and reports. The proper attribution of all sources and materials utilized in this thesis has been made.

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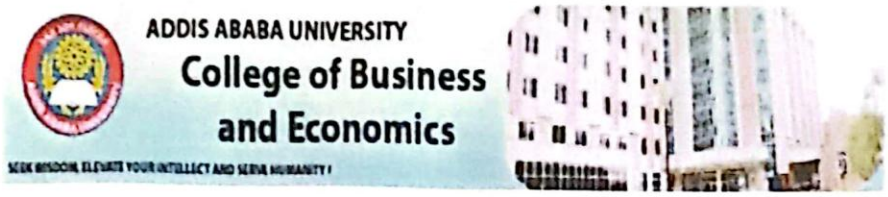

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This is to certify that the thesis titled, —The Dynamic Effect of Fiscal Deficit Financing on Inflation in Ethiopia: Markov regime-switching model Approach' was conducted by Yomif Tadesse under the supervision of Mesele Araya (PHD), submitted in partial fulfillments for the degree of Master of Science in Economics (Economic Policy Analysis) complies with regulations of the university and meets the accepted standards with respect to originality and quality

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Table of Contents

The lists of figures

List of tables

List of acronyms

IMF: international monetary fund

GDP: gross domestic product

CPI: consumer price index

MOF: ministry of finance

NBE: national bank of Ethiopia

CBE: commercial bank of Ethiopia

DBE: development bank of Ethiopia

ADB: African development bank

MRSM: Markov regime switching model

FDF: fiscal deficit financing

FTPL: fiscal theory of price level

QTM: quantity theory of money

WB: World Bank

BD: budget deficit

TP: transition probabilities

ADF: augmented dickey fuller

WDI: world development indicators

Abstract

Ethiopia's rapid economic growth over the past two decades has been accompanied by a persistent fiscal deficit and soaring inflation, which raised concern about the sustainability of the growth path in the face of inflationary pressure. Thus, examining the relationship between inflation and fiscal deficit financing has drawn substantial attention from researchers and scholars, as financing budget deficits is confirmed both in theoretical and empirical literature to often lead to higher inflation. This study examines the dynamic effects of fiscal deficit financing on inflation in Ethiopia using a Markov regime-switching model (MRSM) approach to capture the nonlinear relationship between fiscal deficit financing and inflation. The Fiscal Theory of Price Level (FTPL) was adopted as a theoretical framework in this research. FTPL is a macroeconomic postulation that highlights the consequences of the dominance of fiscal policy activities over monetary policy and its effect on price stability due to the government's deficit financing. The maximum likelihood estimation (MLE) method has been used to estimate the model for the time series dataset spanning the period from 1980 to 2022. The paper revealed the presence of two fiscal regimes in Ethiopia and the inconsistency in the regimes of fiscal deficit financing over the study period. The findings of this study further indicate that fiscal deficit financing has a stronger impact under the higher regime of deficit financing, whereas, in the lower regime of fiscal deficit financing, the impact of financing government budget deficits on inflation over the study period remains muted in Ethiopia. Keeping other things constant, budget deficit financing increases inflation by 0.9230973 (92%) under a high regime of fiscal deficit financing, while in a low regime of fiscal deficit financing, deficit financing causes inflation to rise by 0.0867 (8.67%) in Ethiopia. Furthermore, the system stays in State 1 with a transition probability of 36.8% and in State 2 with a transition probability of 55.9%. Therefore, this paper recommends that the government of Ethiopia should follow a consolidated fiscal policy that broadens revenue sources for the public sector, tightens the fiscal gap, and ensures fiscal sustainability with low regime deficit financing and a reasonable level of inflation.

Keywords: Inflation, fiscal deficit financing, regime effects, fiscal dominance, fiscal theory of price level

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Over the last two decades, Ethiopia has experienced a high economic growth rate, which has been accompanied by persistent inflation and other macroeconomic imbalances, including the fiscal budget deficit (IMF, 2020). Since 2003, the country has registered a double-digit average growth rate (exceeding the 10 percent ceiling set by the national development plan) with an inflationary growth path. In Ethiopia, the highest average annual inflation rate, 15%, was recorded between 2003 and 2020 among all peer countries growing at 5% or above (Leonce et al, 2021). In contrast, Atnafu (2020) asserts that prior to 2004, Ethiopia's growth trajectory was not inflationary, with an average annual inflation rate of 2.5% that had not yet reached double-digit inflation.

The mechanisms of financing the fiscal deficit are one of the primary sources that exert an inflationary impact on the economy. In essence, the government can finance its deficit in three ways: by issuing bonds to the public, receiving a direct advance from the central bank (i.e., printing money), and running down the foreign exchange reserves. According to Gebremeskel (2020), Ethiopia experienced an average annual fiscal financing of approximately 8.5 million birr (including grants) and 14.5 million birr (excluding grants) for the period spanning from 1974 to 2017. Furthermore, for the same time frame, the budget deficit (including and excluding grants) demonstrated a positive correlation with inflation, with correlation coefficients of 4.09 and 11.11, respectively. The National Bank of Ethiopia's data indicates that between 1974 and 2017, the yearly averages of inflation and growth of broad money were 9.84% and 16.45%, respectively. During the period from 1974 to 1990, these averages were 8.32% and 12.54%, respectively; from 1991 to 2017, the average inflation rate was 10.76%, and the average growth rate of broad money was 18.60%. These statistics clearly demonstrate the presence of domestic imbalances and their correlation with inflationary pressures in Ethiopia.

Inflation is characterized by continuous, sustained, and persistent increase in the general price level of an economy. This results into a decrease in the purchasing power of money, as a large amount of money is chasing limited commodities during an inflationary period. Inflation is

limited to situations where price hikes affect all aspects of the commodity markets. Although the definition of inflation is not highly debated, its causes are more contentious. Many authors have proposed a single cause for the overall rise in prices, while others have taken a more philosophical approach, reflecting the diverse perspectives within the field of economics (Labonte, 2011).

Fiscal deficits occur when governments spend more than they earn, which is a common occurrence in the global economy, as recognized in both microeconomic and macroeconomic theories. According to Pettifor (2018), the idea that fiscal consolidation is necessary to address fiscal deficits is a form of microeconomic thought. The perception that fiscal deficits are similar to household deficits arises from the notion that they represent an excess of government expenditure over government revenue. Additionally, macroeconomic theories suggest that an increased deficit will lead to higher demand (consumption expenditures, investment expenditures, government expenditures, less tax receipts, and exports less imports) and, in turn, make a perception of higher income. Budget deficits can also be attributed to unfavorable macroeconomic factors, such as recessions, inefficient financial markets, and poor capital market performance, as highlighted by Cochrane (2019) and Pettifor (2018.

The relationship between fiscal deficit financing and inflation has been widely studied and is a crucial aspect of economic policy. According to the fiscal policy (FP) view of inflation, high and persistent inflation is primarily caused by excessive monetary financing of fiscal deficits. This occurs when the government's budget deficit is financed through direct advances from the central bank, which increases the monetary base and puts upward pressure on inflation. These two variables are critical to macroeconomic policy and significantly affect a country's economy. It is essential for policy makers to understand how they are interlinked in order to make informed decisions about managing budget deficits and finding effective strategies to finance the gap while accounting for inflation.

The negative effects of a fiscal deficit have led to instability in various macroeconomic variables, particularly inflation, in several countries. The degree of this instability varies depending on the current state of each nation's economy and the prevailing monetary fiscal policy regime (Ryan et al., 2022). The relationship between fiscal and monetary policy through the growth of the money stock, which provides income to the fiscal authority, plays a crucial role in determining how the

economy responds to fiscal deficit financing. Financing a fiscal deficit can lead to high inflation in developing countries with underdeveloped financial sectors, inefficient tax systems, less independent central banks, and limited access to external borrowing. In this situation, central bank interventions to control the price level can exacerbate inflationary dynamics (Leeper, 1991; Wallace et al., 1981; Banerjee et al., 2022). African countries, with their heavy reliance on volatile and climate-sensitive revenue sources such as agricultural product exports and oil, along with a narrow tax base, face a significant threat to the sustainability of their budgets and macroeconomic stability (Moses, 2017).

Studies have shown that the relationship between fiscal deficits and inflation dynamics remains subdued in the short run in advanced, high-income countries with stable political environments, efficient tax systems, and access to external financing sources. These developed countries can sustain large fiscal deficits without causing inflation, thanks to their sound monetary and fiscal policy regimes (Bassetto 2010). Similarly, Luis & Marco (2003) find empirical evidence on the deficit financing-inflation nexus in different groups of countries based on their economic conditions and level of financial development. They argue that while there is a weak positive correlation between fiscal deficit financing and inflation in countries with moderate inflation levels, there is no statistically significant evidence in nations with very low levels of inflation. Moreover, these countries' efficient and more transparent system of governance allows them to implement effective policy regimes to avoid excessive inflationary pressure resulting from large fiscal imbalances. Access to the international financial market at a very low interest rate is another positive factor that helps them finance the gap (Nguyen et al., 2021).

Price stability is a crucial macroeconomic policy target for central banks in every economy, as it is vital for fostering long-term economic growth. Central banks play a key role in maintaining a stable price and low inflation regime by examining the type of policy regime and its impact on inflation in the respective economy. Unsustainable fiscal deficit financing can have a negative impact on price stability and the overall health of the economy, particularly if it is caused by increased monetization. Central bank financing of deficits can be detrimental to economic growth and stability, and continuous financing of structural deficits may undermine central bank operational autonomy, which is in line with monetarist perspectives.

It is clear that numerous developing countries grapple with fiscal policy-related budget deficit issues and challenges. Ethiopia is among these nations, having experienced fluctuations in fiscal budget balances and a volatile economic climate. Yemane (2008) asserts that, in addition to monetary growth, high budget deficits significantly contributed to Ethiopia's inflationary process. Likewise, Alemu (2020) emphasizes that the primary causes of Ethiopia's rampant inflation are its budget imbalances and excessive money supply. Moreover, evidence supports the notion that Ethiopia's budget deficits have driven the increase in its money supply, lending credence to the theory that governments in less developed countries often resort to monetization to offset a considerable portion of their deficits.

Ethiopia has been challenged by large public debt for a long time, especially in the last two decades, due to a significant increase in debt. By 2022, the country's outstanding public debt have reached USD 60 billion, which is 53% of the Gross Domestic Product (GDP), though it shows significant improvement from the 60% (of the GDP) rate registered in 2018, which was a record debt-to-GDP ratio. It has reached a point where it must suspend servicing its debt, waiting for creditors' goodwill to restructure it. The Ethiopian debt problem is primarily a liquidity rather than a solvency problem, chiefly due to its underdeveloped export sector covering less than half of its imports (Alemayehu. et al., 2023).

Many studies in this area overlooked the dynamic nature of the relationship between fiscal deficit financing and inflation, often assuming linear relationships. Therefore, this paper has investigated the problems of persistent financing fiscal deficit and their respective contributions to soaring inflation from a broader perspective, especially in the context of the impact of regime policy switching on the dynamics of inflation in Ethiopia.

1.2 Statement Problem

Ethiopia's experience of a double-digit economic growth rate has raised concerns about the sustainability of the growth path in the face of inflationary pressure. Like in most developing countries, government expenditure is the main driver of economic growth in Ethiopia as public infrastructure, education, health and other mega projects are financed by the government. Thus, the trends of government's financing fiscal deficit and its impacts on consumer price index (CPI) stability and economic growth have been the primary subjects of concern to multiple stakeholders, including fiscal policy authority, the Central Bank of Ethiopia, the private sector,

civil society, domestic and international investors and other prominent international financial institutions like the IMF, the World Bank and Rating Agencies, among others.

Fiscal deficit financing refers to the government's net borrowing/lending to bridge the gap between expenditures and revenue receipts. In developing countries like Ethiopia, where the public sector plays a predominant role in stimulating and financing economic development, a budget deficit is inevitable. In these countries, the mounting public pressure to spend is accompanied by the inability of these countries to generate sufficient tax revenue due to poor tax collection systems (the tax to-GDP ratio remained at only 11.1% by 2019/2020, according to MOF) and underdeveloped domestic financial markets, have contributed to the persistent budget deficit. Furthermore, these countries are frequently compelled to finance these deficits primarily through money creation, which can result in persistent inflation (Gerezgiher et al., 2015)

In Ethiopia, the budget deficit has occupied a significant portion of the GDP for decades. In 1980 and 2000, the deficit ratio to GDP was 0.51% and 4.2% of GDP, respectively. It then increased further to reach 6.34% of GDP in 2015 before declining to 2.92%, 4.55%, and 4.92% of GDP in 2016, 2017, and 2018, respectively (MoF bulletin). The fiscal deficit in Ethiopia has consistently persisted due to factors such as high government expenditures and poor tax revenue collection. During the fiscal year 2019/20, the amount of government expenditure was birr, and the amount of government expenditure was birr 479.5 billion compared with birr 124.4 billion in the 2011/12 fiscal year. i.e., over the past 10 years, government spending has grown at an annual average rate of 21.0 percent, while the revenue from taxes grows only 13% in absolute values between 2015/16- 2019/20 (MoF, 2021)

In order to meet its budgetary obligations, the government must find alternative fiscal financing due to the increasing fiscal deficit that can't be financed by public bonds, T-bills, and low tax revenue collections. A common and convenient method for the government is to borrow directly from a less dependent central bank that is accountable to the government. Each year, the Ministry of Finance obtains a considerable amount of funds from the National Bank of Ethiopia to address the fiscal needs of the government.

In financing of government's budget deficit, The National Bank of Ethiopia (NBE) plays a significant role, through both direct and indirect quasi-fiscal operations. In 2017/2018, NBE provided birr 24.5 billion direct advance to finance the government deficit, which is 1.1% of

GDP. As of September 2018, the NBE's outstanding claims on the central government amounted to Birr 166.7 billion, which represented 7.6% of the country's GDP or 95.3% of the monetary base or reserve money (Muluneh, 2019). Moreover, the NBE provides indirect financing to the government by extending credit to the Development Bank of Ethiopia (DBE) to purchase treasury bills and grants liquidity to the Commercial Bank of Ethiopia (CBE) in the form of 5-year bonds, amounting to Birr 27 billion in 2016/17. These operations demonstrate that the NBE is the primary funding source for the budget gap and is considered an instrument for achieving the fiscal authority's targets. Direct borrowing from the central bank to meet the fiscal deficit can increase the money supply and cause inflation. Therefore, the NBE's quasi-fiscal operations are vital in filling the budget gap while minimizing inflationary pressures.

In Ethiopia, the severity and extent of the problem of fiscal deficit financing on inflation are paramount since the country has experienced consistently higher fiscal deficit for years. From 1990 to 2022, the budget deficit has been around -3.26 % on average, with a low record of -8.90 % in 2000 and a peak record of 6.60% in 2003. Particularly in recent years, following internal conflict, drought, and the effects of Russia's invasion of Ukraine on commodity prices, the fiscal deficit widened to 4.2% of GDP in 2022 from 2.8% in 2021. Additionally, the deficit was also widened by the increase in defence spending and weak revenue performance. Both growth and inflation were adversely impacted as Real GDP growth fell to 5.3% in 2022 from 5.6% in 2021 but remained above East Africa's average (4.7% in 2021 and 4.4% in 2022), and Inflation rose to 34% in 2022 from 26.6% in 2021 (ADB, 2023)

Although several previous studies have investigated the relationship between fiscal deficit financing and inflation dynamics, there remains a lack of consensus regarding the impact of deficit financing on inflation and the direction of causality. Among many researchers, McMillan and Beard (1982), Tekin-Kor and Ozmen (2003), Tiwari et al. (2015), and Maansi and Goel (2022) found no evidence for a direct relationship between fiscal deficit financing and inflation, in some cases question the direction of causality. In contrast, Durguti (2020), Mebratu (2016), Minyahil (2020), Victor et al., 2022), Yemane (2008), and Mohammed (2022) establish an argument that budget deficit financing has an inflationary impact. The potential effects of deficit financing on inflation are still a matter of debate, highlighting the need for further research.

Much research conducted in Ethiopia regarding this topic reveals that there is a positive relationship between the two, although they have focused only on linear relationships, neglecting the dynamic nature of the interaction between the two. However, Catão and Terrones (2005) indicate that the limited success of empirical studies in explaining this issue is probably because of the failure to take into account the non-linearity of the correlation between fiscal deficit and inflation. Therefore, it is worth examining the dynamic impacts of fiscal deficit financing on inflation in Ethiopia. To the best of my knowledge, no study on this topic has been conducted using a Markov regime-switching model (MRSM) approach. This model provides a novel approach to investigate the intrinsically dynamic nature of the relationship between fiscal deficit financing and inflation, which previous researchers have not fully explored.

1.3 Objective of the Study

1.3.1 General Objective of the study

The study employed a dynamic Markov-switching model to analyze the effects of persistent fiscal deficit financing on inflation dynamics under different states or regimes of deficit financing from 1980 to 2022.

1.3.2 Specific objectives of the study include;

- Explore the trends of fiscal deficit financing and inflation dynamics over time in Ethiopia
- To assess how deficit financing is interlinked with inflation dynamics under different regimes of deficit financing in Ethiopia.
- Estimate transition probabilities between different regimes to understand the likelihood of persistence in different economic states and the speed of transitions among identified states.

1.4 Hypothesis of the Study

As stated in the previous section of this paper, this study investigated the dynamic effects of fiscal deficit financing on inflation in Ethiopia. Depending on the methodology used in this paper, the following categories of hypotheses have examined.

H0: The impact of fiscal deficit financing on inflation dynamics is not varying across different financing regimes.

H1: The impact of fiscal deficit financing on inflation dynamics is significantly different across financing regimes.

1.5 The significance of the study

Even though there were few researchers studied the causal link between budget deficit financing (BDF) and inflation, for instance by WoldeRufael (2008) and Alemu (2020), they didn't study the regime (shift in the state of deficit financing) effects of fiscal deficit financing on inflation dynamics in Ethiopia. As a result, this study aims to examine, accounting for the possibility of regime changes, the dynamic relationship between fiscal deficit and inflation employing Markov switching-regime model (MRSM), which provides a more comprehensive understanding of the interplay among these variables. The application of the Markov switching-regime model to the Ethiopian context can contribute to the existing literature on fiscal deficit financing and inflation dynamics, offering valuable insights and evidence on the regime-specific dynamics of the Ethiopian economy.

1.6 scope and limitations of the study

This paper dealt with the regime effects of fiscal deficit financing on the dynamics of inflation in Ethiopia. The variables of interest are inflation rate and budget deficit, with some variables incorporated to account for the influences of key macroeconomic indicators like money supply, real exchange rate, real interest rate and output gap. The study applied the Markov regime switch model (MRSM) and used annual time series data spanning from 1980-2022.

One of the primary limitations this study encountered was the availability and quality of data, particularly the high-frequency data, which better fit the nature of the econometric model we employed. In Ethiopia, financial sectors don't consistently report data in a more frequent manner. Hence, we relied on the less frequent dataset (annual), which may not adequately capture a rapid change possibly happened macroeconomic variables. In the future, authors believe that conducting research using higher quality and more frequent data than the annual dataset can provide comprehensive insights into the topic.

1.7 Organization of the Study

This paper is organized into five chapters. The author of the research provides a concise introduction to the studied issue in the opening chapter, aiming to facilitate a better understanding. Chapter two presents a summary of both theoretical and empirical literature. The third chapter introduces the methodology, estimation method, and data collection technique and specifies variables. In the fourth chapter, the results of the Markov switching model analysis are

reported, along with their interpretation and statistical outputs. Lastly, chapter five concludes the article with recommendations for future policy based on the presented findings.

CHAPTER TWO

REVIEW OF RELATED LITERATURES

2.1 Theoretical Literature Review

2.1.1 Definition and Basic Concepts of Fiscal Deficit

The fiscal deficit is a vital concept in public finance, characterized by the disparity between a government's total expenditure and its total revenue generated within a specific time frame, usually a fiscal year. This metric serves as a crucial indicator of a government's financial health and its aptitude for efficiently managing its expenses. A small budget deficit is among the more common indicators of economic stability or good fiscal policy performance. It is believed that public finance shapes the course of economic development. It affects resource use and financing patterns and, together with monetary and exchange rate policies, influences the rate of inflation (Demirew, 1998). The revenue side of the budget is directly dependent upon the performance of economic activities at any given time. While government expenditure has often been considered in the economic literature as the instrument of economic policy (exogenous variable), even in stable economies, the spending part of government appears to be much slower (Amanuel, 2021).

2.1.2 Inflation

Neoclassical economists define inflation as a rapid and sustained increase in the general price level, primarily caused by excessive growth in the money supply. For Keynesians, inflation occurs when the money supply increases beyond the economy's full employment level, leading to demand-pull inflation (Sisay, 2008). Generally, inflation is understood as an ongoing rise in the general price level, measured in units of currency. The inflation rate is the annualized percentage growth of a broad index of money prices (White, 2008). It is a primary concern of monetary policy, serving as a key indicator of macroeconomic stability. The causes of inflation can vary across different economies and periods. However, some common factors are widely recognized as main determinants, including the money supply, exchange rates, interest rates, and various supply-side variables. Budget deficits have also been identified as significant determinants of inflation, though their impact varies across different studies and contexts.

Many macroeconomic theories emphasize that fiscal deficit financing (FDF) can lead to inflation by changing money stock through money creation (seignorage) to fund the state's budget disparity. Among these theories, monetarists maintain that fiscal deficit financing is directly inflationary on a one-to-one basis through seignorage, given that it leads to greater money growth. The government may fund budget deficits by resorting to borrowing from domestic and overseas sources and by employing monetization. This money creation can lead to increased interest rates, which in turn can result in private investments being crowded out, a reduction in the growth rate of real output, and a rise in prices. In contrast, Keynes' view emphasizes the impact of government spending on aggregate demand, which in turn leads to an increase in general price levels in both the short-run adaptive expectation and long-run rational expectation scenarios (Osei et al., 2022).

Apart from the opposing viewpoints of monetarists and Keynesians concerning the effects of fiscal deficit financing on inflation dynamics, various additional theoretical frameworks are pertinent to this topic. These frameworks include the Ricardian equivalence theory, the theory of fiscal price, the seignorage theory of hyperinflation, and the political and institutional theory of fiscal deficits and their impact on inflation dynamics, among others. This section intends to deliver a comprehensive critical evaluation of all pertinent theoretical literature in this study. Hence, in this study, the aforementioned relevant theories of fiscal deficit financing and their implications on general price dynamics are scrutinized and deliberated.

2.1.3 The fiscal theory of price level (FTPL)

The fiscal theory of the price level is a theoretical framework for understanding how monetary and fiscal policies interact in the determination of macroeconomic outcomes. The key insight is that future fiscal conditions determine the current price level, whereby monetary and fiscal policy are connected by the government budget constraint. The primary role of the central bank is to regulate the price level. This responsibility is implied by economic theory, especially the quantity theory of money of Friedman (1948), which posits that inflation is always and everywhere a monetary phenomenon. This notion has been supported by numerous empirical studies, as demonstrated by Robert Lucas' Nobel lecture in 1996, which highlighted the connection between price fluctuation and change in money stock. However, this traditional

analysis has been challenged by the Fiscal theory of price level, which maintains that the price level is determined by the budgetary policies of the fiscal authority (Fuerst et al., 2000; Thomas et al., 2022).

The Fiscal Theory of the Price Level (TFPL) asserts that the price level is predominantly shaped by fiscal policies. This notion is presented in two forms: the weak form and the strong form. The weak form of TFPL contends that inflation is unequivocally a monetary phenomenon, and that the growth of money is determined by the fiscal authority. The weak form TFPL commences by examining basic budgetary arithmetic and its implications for monetary policy, particularly the "unpleasant arithmetic" of Sargent and Wallace (1981), which establishes a direct relationship between monetary and fiscal policies. Since seignorage, or revenue generated from money creation, is a potential source of income, long-term monetary and fiscal policies are jointly determined by fiscal budget constraints. The weak form TFPL assumes that the fiscal authority moves first by committing to a path for primary budget surpluses or deficits, forcing the monetary authority to generate the seignorage required to maintain solvency, which is compatible with Sargent and Wallace. Consequently, the central bank has no control over the money supply (Sargent, Wallace, 1981; Fuerst & Carlstrom, 2000).

On the other hand, the strong-form version of the fiscal theory of the price level maintains that fiscal policy determines future inflation but is independent of future money growth. Unlike the weak theory, where inflation is still (ultimately) a monetary phenomenon, the strong form FT maintains that fiscal policy affects the price level and the path of inflation independent of monetary policy changes. This implies that even if money growth remains constant, fiscal policy can dictate the general price level and the inflation rate. Consequently, the strong form of the fiscal theory of the price level challenges the notion that inflation is purely a monetary phenomenon, as suggested by the works of Sargent and Wallace (1981), Woodford (1994), Carzoneri, Cumby, and Diba (1998), Carlstrom and Fuerst (1999), and Komulainen and Pirttila (2002). Thus, the central bank may be unable to commit to an inflation objective.

2.1.4 Keynesian perspective of budget deficit financing

The Keynesian theory argues that fiscal deficit financing, which involves the government's involvement in the economy, has inflationary effects due to the rise in aggregate demand. This

idea is rooted in the deficit financing mechanisms and the aggregate demand and supply theory. A core principle of the Keynesian theory is that the government may use both monetary and fiscal policies as interventionary measures to influence employment and output levels. According to the Keynesian aggregate demand theory, wages in the labor market do not adjust instantly, leading to unemployment levels below the natural rate being possible through fiscal and monetary policies. The Keynesian theory of income determination assumes that the prices of goods and services, including wages, are primarily fixed due to wage contracts and other factors. In this theory, the equilibrium level of output is determined by the requirement that output equals aggregate demand. The government's spending and tax changes have an impact on output in the economy, particularly when investment is declining. When the government increases its spending, it boosts demand for goods and services, leading to an increase in aggregate demand, equilibrium output, and the general price level (Keynes, 1936).

2.1.5 Monetarist Theory

The hypothesis of monetarists is based on the quantity theory of money of the classical economist Irving Fisher, which proposes that inflation is driven by money growth. The traditional QTM of classical economists establishes an argument that an increase in the quantity of money would bring about an equal proportionate rise in the price level. According to Fisher, as the quantity of money in circulation increases, the other things remain unchanged; the price level also increases in direct proportion and the value of money decreases and vice-versa (Fisher, 1911).

The contemporary quantity theory of money posits that the growth of output is considered exogenous. Money velocity remains stable, consequently, alterations in the money supply dictate the fluctuations in the price level within the economy. Through a monetarist lens (Friedman, 1968), the primary view is that fiscal deficit funding is predominantly a monetary occurrence. As per this perspective, the financing of unregulated government budget deficits by the central bank (monetization) involves the government directly borrowing resources from the central bank (Direct Advances) to support its budget shortfalls, often resulting in escalated inflation rates. The monetarist doctrine asserts that it is the monetization of budget deficit funding that typically

triggers expansions in the monetary base (i.e. high-powered money), thereby inducing heightened inflation levels in the economy (Friedman, 1956; Friedman, 1968).

2.1.6 The Ricardian equivalence perspective of fiscal deficit

The core tenet posited by the Ricardian equivalence theory asserts that fiscal deficits of the government are exclusively linked to the postponement of tax payments. This deduction leads to the apathy of taxpayers towards settling their taxes presently or in the future with accrued interest. Such behavior stems from the forward-looking nature of economic actors who understand that their present consumption hinges solely on their permanent or lifetime earnings, rather than the timing of governmental taxes. Nonetheless, the assumptions underpinning the Ricardian equivalence theory have encountered rebuke in various empirical inquiries. Diamond (1965), for instance, critiqued the theory on the grounds that it would be applicable only under the assumption of infinite lifespan for economic agents. Similarly, Feldstein (1988) scrutinized the prevalent altruistic presumption advanced by Barro (1974) in support of the theory. Feldstein contended that there exists no substantial empirical proof validating the occurrence of intergenerational wealth transfers within families. Seater (1993) further censured the Ricardian equivalence theory by asserting that a notable portion of households is without children and therefore less apprehensive about burdening future generations with elevated tax obligations. According to Seater (1993), childless economic agents would augment their current expenditure if the government were to exchange present debt for future taxes without regard for the welfare of forthcoming generations.

2.1.7 The Seignoirage Theory of Hyper-Inflation

Seigniorage is one of the mechanisms utilized for government deficit financing. It is described as the act of the central bank issuing currency to support general government expenditures, essentially operating as an inflationary levy on real monetary assets within an economy. The increase in seigniorage revenue allocated to the government with the aim of funding its planned outlays can lead to inflation, as it intensifies the rate at which the money supply expands in the economy. The academic literature offers a more elaborate explanation of seigniorage, framing it as the difference between the cost of producing currency and its nominal value. Various academics, including Oblath et al. (1994) and Hochreiter et al. (1996), have analyzed the importance of seigniorage as a revenue source. Research by Gros (2004) and Cukrowski (2001)

has confirmed that seigniorage revenue is indeed a key method through which the central government supports its financial expenditures. There are numerous interpretations of seigniorage in practice, with the choice of a specific seigniorage concept depending on monetary, fiscal, or operational factors. Considering these categorizations, Drazen (1985) outlines three main interpretations of seigniorage, specifically (i) monetary seigniorage, (ii) opportunity cost, and (iii) fiscal seigniorage. Consequently, the current body of scholarly work lacks a universally accepted definition of seigniorage.

2.1.8 Tax-Smoothing Hypothesis

The hypothesis focuses on the government's desire to minimize tax distortions associated with revenue generation efforts, aiming to keep tax rates relatively constant in response to changes in government spending and economic conditions. According to this hypothesis, tax distortions are more likely to increase proportionally with the tax revenue collected by the government. The relationship between the tax smoothing hypothesis and fiscal policy lies in the idea that governments use tax smoothing as a strategy to manage fiscal imbalances caused by temporary shocks to government spending and output. This theory assumes that household income is exogenous, and the Government raises revenue only using a distorting tax system (e.g. labour taxes there are costs associated with enforcing the tax system, called 'collection costs.' Therefore, the government's desire to minimize distortions results in government policy actions that smooth out the path of taxes over time. The hypothesis assumes that the government optimizes deficits over time and explains why deficits might be high in many countries, such as emerging and developing nations (Barro, 1979).

2.1.9 Strategic Debt Accumulation Theory

This theory, formulated by Tabellini and Alesina (1990), is grounded on the optimal selection made by a policy-maker regarding expenditures in the present and future periods, taking into account the optimal decision made by their opponent in an election competition. The policy-maker's optimal decision is posited to be unimodal and quantitative, thus needing to align with the preference choice of the median voter. As per this theory, the policy-maker aligning their policies with the median voters' preference choice will secure election or re-election. The aim of this theory is to elucidate the factors influencing the decisions of diverse policy-makers in a

democratic context and how these decisions can result in strategic accumulation of debt within a nation. It suggests that a policy-maker anticipating succession by a member of their own political party will refrain from accumulating debt in the current period by avoiding escalating current expenditures relative to future government expenditures.

Aghion and Bolton (1990) established the theory regarding the strategic role of deficit financing and public debt that considers the possible effects of a government on voters' behavior, which is neglected by the theory mentioned above. They developed a political-economic model of the strategic role of debt, which demonstrates how over-accumulation can have a strategic influence on voter's behavior and attitudes. The model considers a closed economy in which two political powers are trying to win elections in two successive periods. Elections are held at the beginning of each period. The government provides a public good during either period. In period one the government can choose between proportional income tax and issuing government bonds to be sold to other economic agents (deficit financing). The interest rate is determined by internal factors in the economy. During the second period, only taxes are available to finance both debt repayments and expenditure on the public good. Thus in period two, the government do not default on outstanding public debit and will decide when and how much of the inherited debt they will repay.

2.3 Empirical review literature

Though the theoretical literature reviewed so far asserted that fiscal deficit financing leads to inflation, many empirical works on the interlink between fiscal deficits and its financing on inflation dynamics remained inconclusive. The following section formally examines the empirical literature on studies related to the subject matter conducted across various countries. It begins with an overview of cross-country empirical literature, followed by a more focused analysis of the Ethiopian context. Ultimately, the section concludes with a summary of the key findings derived from the empirical literature review. In particular, the study aims to investigate the causal relationship between fiscal deficit financing and inflation, considering the relevant econometric models and data sets employed.

2.3.1 Dynamic relationship between deficit financing and inflation across a countries

Terrones and Catao, (2005) researched to determine whether there is a causal link between government fiscal deficit and inflation in a panel consisting of 107 nations. The panel data utilized for this study spanned the period from 1960-2001. The selected nations were categorized as developed, developing, low inflationary, and high inflationary economies. The model employed in the study incorporated various variables, such as gross domestic product, government budget deficits, inflation rate, and money supply. The interactions among these variables were thoroughly analyzed. The study's findings indicated a positive and significant influence of government fiscal deficit on inflation in developing and high-inflation countries. Moreover, it was revealed that government fiscal deficits do not determine inflation in low-inflation and developed economies.

Similarly, Kwon, Robinson, and McFarlane (2009) explored the correlation between government fiscal policy, monetary expansion, and price rise across a dataset consisting of 71 chosen nations. The dataset utilized in this inquiry covers the period from 1963 to 2004. The researchers posited that the impact of national debt on inflation is notably positive in emerging nations. However, the study found no significant relationship between national debt and inflation in advanced economies within the designated sample. Moreover, the investigation categorized the 57 developing countries into low and high-debt brackets. Through this classification, it was unveiled that the escalation of national debt plays a significant role in determining inflation in developing nations characterized by high levels of debt.

(Koyame, 2012) investigates the causal link between inflation, money supply and budget using data from Congo and Belgium. Inflation occurs when the growth rate of the money supply exceeds the rate of growth of the economy, according to monetarists, as explained in the quantity theory of money. This monetarist linkage, from the creation of base money to inflation, shows that when central banks issue money at a rate that is higher than the demand for cash balances at the existing price level, the generated extra demand in the goods and services market pushes up the price level in the economy. Therefore, the budget deficit must cause the money supply to grow to a level necessary for the functioning of the economy, which is inflationary.

Lin and Chu (2013) conducted an investigation into the relationship between fiscal deficit and inflation within a specified panel consisting of 91 economies during the period of 1960 to 2006. The study employed the dynamic panel quantile regression (DPQR) model with the autoregressive distributional lag (ARDL) specification. Through the utilization of the DPQR model, the research estimated the effects of deficits on inflation across different quantiles, facilitating a dynamic adjustment in accordance with the ARDL framework. The outcomes of the study suggest a uniform impact of fiscal deficits on inflation within OECD nations, while displaying a varied effect in non-OECD countries. Additionally, the research identified central bank independence, tax base, availability of domestic and external debt financing, and political stability as potential factors contributing to the observed differences in the effects of fiscal deficits on inflation between OECD and non-OECD economies.

Tahira and Hassan (2015) conducted an analysis of the relationship between fiscal deficits and inflation in eleven Asian nations over the period 1981-2010, considering the presence of dependent central banks and fragile financial markets. The empirical findings utilizing the system GMM approach indicate that deficits have an inflationary impact within the chosen sample. Particularly noteworthy is the amplification of inflationary pressures stemming from budget deficits in situations where financial markets lack full maturity and central banks face constraints in pursuing their objectives. The study ultimately posited that deficits play a causal role in driving inflation in the aforementioned eleven Asian countries. Chibber and Shafik (1990) delved into the determinants of inflation in Ghana, scrutinizing the interplay among inflation, fluctuations in exchange rates, cereal production levels, the persistence of inflation, and the dynamics of money supply. Their analysis uncovered a notable influence of cereal production, exchange rate movements, and short-term inflation persistence on inflation trends in Ghana, whereas long-term inflation dynamics were predominantly shaped by alterations in the money supply. Notably, the study emphasized the overarching influence of monetary factors in alignment with Ghana's monetarist perspective on inflation.

Hamburger and Zwick (1981) investigated the causal association between fiscal deficits and the expansion of the money supply in the United States of America during the time period spanning from 1954 to 1976. They tested Barro’s theoretical money supply model. They proxied fiscal deficits as a budget deficit ratio to gross national product, measured unemployment, central

government total spending and the growth of money supply. The findings of their study indicated that fiscal deficits positively impacted the growth of the money supply and subsequently influenced inflation dynamics.

Another research from Babara (2003) examines the inflationary impacts of government fiscal policy in an optimizing general equilibrium monetary model with capital accumulation, flexible price and wealth effects for the quarterly data set of Euro area. The result shows that government budget deficit, high debt level and slow fiscal adjustment negatively affect price stability in the presence of independent monetary authority. Moreover, the paper suggests wealth effects enlarge the price level response to fiscal variables. The effects produced by fiscal expansions on price dynamics are due to the behaviour of consumers, as the fiscal variables influence individuals' consumption plans and the demand for real money balances.

Recently G. Kaur (2018) examined the relationship between fiscal deficit and inflation in India using a data set spanning from 1971 to 2015. The econometric framework employed for the study was the Johansen co-integration and Granger causality technique. The finding of the study reveals the long-run relationship between fiscal deficit, money supply, exchange rate volatility and inflation, though the Granger causality doesn't confirm the direction of causality between inflation and fiscal deficit. This doesn't support the fiscal theory of price level. In addition, Vishal Sharma and Ashok Mittal (2021) studied the fiscal deficit-inflation nexus in India for the period from 1981 to 2017 by employing the Autoregressive Distributed Lag (ARDL) and Nonlinear Autoregressive Distributed Lag (NARDL) approaches. The results of the ARDL approach found no evidence of a linear relationship between fiscal deficit and inflation in the Indian context, and the empirical findings of the NARDL model confirmed the nonlinear relationship between fiscal deficit and inflation in the long run. Furthermore, their finding indicates no causal link between money supply and inflation, supporting the ideas of the Fiscal Theory of the Price Level (FTPL) in the case of India. FTPL postulates that public debt and taxation policies drive price levels; monetary policy has an indirect role only.

Sadia (2012) analyses Bangladesh's fiscal deficit-CPI inflation nexus using the ARDL co-integration approach suggested by Pesaran and Shin (1995) based on annual data set from 1974 to 2010. The study finds that fiscal deficits have inflationary effects in the long run, along with

factors like real GDP, inflation expectations and the floating exchange rate regime. In Nigeria, IA. Danlami et al. (2019) also investigated the short-run and long-run dynamic effects of fiscal deficit financing on inflation using the autoregressive distributed lag (ARDL) model for the data set spanning from 1970 to 2016. The study results reveal that fiscal deficit is inflationary both in the short run and long run during the study period.

Nathan et al. (2013) analyzed the relationship between budget deficit and inflation in fifteen ECOWAS countries for the period of 1980-2011. The findings of their study reveal that in the long run, there is a positive, significant relationship between budget deficit and inflation in some countries of the panel, while it has a negative relation in other countries. They concluded that a budget deficit financed through monetization and a rising money supply will always lead to inflation. However, there is a difference in tendency toward the relationship between budget deficit and inflation in developed and less developed countries.

Nurudeen et al (2015) researched non-linear relationship between fiscal deficit and inflation for selected 51 countries in Africa from 1999-2011. The selected economies are further classified as high-inflation/low-income countries and moderate-inflation/middle-income countries. The study employed the fixed effect and GMM model to examine the non-linear relationship between fiscal deficit and inflation. The findings of this investigation indicate that the two macroeconomic Variables have a non-linear relationship for the whole sample of the pane and subgroups. One percentage increase in deficit results in a 0.25 increase in the inflation rate, while it can be greater once deficits reach 23% of GDP.

Employing the Vector Error Correction Model (VECM) model and Granger causality test, Mohammed Ibrahim Abdu (2022) researched the relationship between fiscal deficit and inflation from 1981 to 2020 in Egypt. The results indicate that fiscal deficit significantly affects inflation in the long run, as the increase in fiscal deficit increases the inflation rate. The results of the Granger causality test reveal a two-way causality relationship between fiscal deficit and inflation in the short run. This relationship is captured through the causal effect of money supply on the inflation rate and the interest rate. The interest rate also affects the fiscal deficit, eventually affecting the inflation rate. On the other hand, the interest rate does not seem to affect the

inflation rate in the short run. These results indicate that the problem of inflation in Egypt seems to be a fiscal rather than a monetary phenomenon.

Maansi (2022) studied the fiscal deficit- inflation nexus in two contemporary giant economies of Asia, China and India, from 1986 to 2017 for both countries. Gross fiscal deficit, money supply, exchange rate, crude oil prices and output gap are the key variables in determining inflation. The econometric framework used chiefly comprises of co-integration analysis, vector error correction model, Granger causality and impulse response functions. Findings The findings of this paper support the hypothesis that fiscal deficits are inflationary only in the Indian context and that the Ricardian equivalence cannot be negated for China, at least in the short run. The paper warrants a broader policy framework to address structural bottlenecks to ensure non-inflationary growth, keeping in mind the structural views on inflation. Furthermore, the paper fosters more remarkable synthesis between monetary and fiscal policies, especially considering the global economic disruptions to which the world economy is subject.

The recent research in Ghana by Osei and Olawale (2022) confirmed a positive relationship between fiscal deficit financing and inflation dynamics in Ghana's context. This study investigated the Regime effects of Fiscal deficit financing and its impact on inflation dynamics in Ghana for data sets spanning from 1980 to 2018 using the Markov-Switching Regime Dynamic model (MSRDM) approach. The researchers adopted the Fiscal theory of price level as a theoretical framework for this study, highlighting the consequences of fiscal dominance over monetary policy and the effects of governments' fiscal deficit financing on price stability. The estimation results from the model confirmed the presence of two fiscal regimes in Ghana, and the regime of fiscal deficit financing persisted over the study period. Moreover, the study found that fiscal deficit financing had a substantial impact on inflation dynamics in Ghana in the higher regime of deficit financing, while its impacts in the lower regime remained relatively insignificant.

2.3.2 Related Empirical literature from Ethiopia

Yemane (2008) investigated the causal link between fiscal deficit, money supply and inflation in Ethiopia from 1964 to 2003. The study employed a bounds test approach to co-integration due to Pesaran et al. (2001) and a modified version of the Granger causality test of Toda and Yamamoto

(1995). The study's empirical results show a long-run co-integrating relationship among the series of variables. Moreover, the paper reveals unidirectional Granger causality from money supply to inflation and budget deficits to inflation. However, the study concludes that fiscal policy does not seem to impact the money supply growth.

Negash (2014) investigated the causal long-run relationship between budget deficit, broad money supply, and inflation in Ethiopia. The employed Vector Error Correction Model (VECM) approach for the annual time series data set spanning from 1975 to 2012 and Granger causality have also been tested. The parameters of the system were estimated by using the Johansen estimation approach. The results show a positive causal relationship between money supply and inflation in the short and long run. It also shows that a budget deficit affects money supply and inflation in the long run. However, this is not conclusive when taking into account the Granger causality test. However, both money supply and inflation do not Granger cause a government budget deficit.

Another research by Kumadebis (2016) examined the macroeconomic effects of fiscal policy shocks in Ethiopia using a Bayesian Vector Auto Regression model. It examined the dynamic responses of output, inflation, interest rate and exchange rate to fiscal policy shocks employing quarterly data from 2000/01Q1 to 2015/16Q4. The empirical evidence suggests that government spending shock positively impacted output and inflation, but the effect was too small. The inflation response to the net tax was medium and negative. Moreover, positive shocks to recurrent expenditure had a persistent positive impact on actual output. Recurrent expenditure appeared to be responsible for inflationary pressure.

Another study from Minyahil (2020) analyzed the long-run relationship between budget deficit and inflation in Ethiopia, controlling for money supply. He used a time series data set spanning from 11980 to 2018. The study employed the conventional least square regression method of Laney and Willet (1983) and Engle-Granger (1981) for the co-integration test. The result indicates that budget deficit financing and money supply are the main drivers of Ethiopia's galloping inflation. Furthermore, budget deficits have been the root cause of money supply growth in Ethiopia, while empirical support is given to the hypothesis that governments of least-developed countries resort to monetizing a large portion of their deficits. Though the study has

confirmed the long-run causal link among these variables, the researcher believes this paper neglected the dynamic and non-linear relationship between fiscal deficit and inflation.

In summary, the empirical literature reveals that most of the research has been conducted on the relationship between fiscal deficit and inflation dynamics globally, and few papers in Ethiopia such as Minyahil (2020), Kumadebis (2016), Negash (2014), and Yemane (2008) have confirmed the positive relationship between these two macroeconomic variables. However, it is evident that the causal links are specific to the economies, as some empirical literature shows no significant relationship in certain countries. Moreover, the research conducted recently in Ghana confirms the presence of two regimes in fiscal deficit financing. However, the papers we reviewed so far show the linear link between the two variables; this study fills this gap by examining the intrinsically dynamic relationship using the Markov Switch Model.

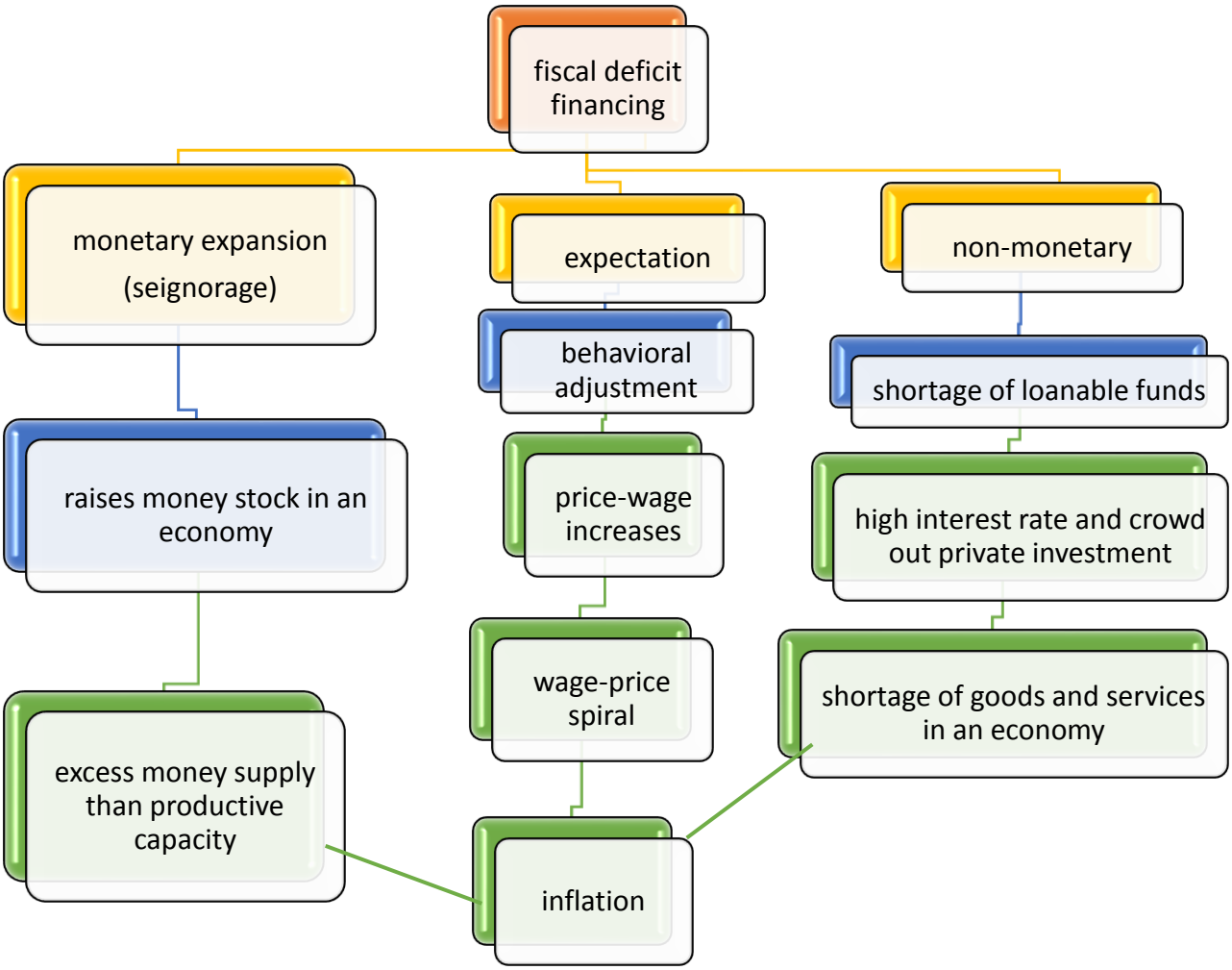
2.4 Conceptual Framework

Fiscal deficit financing can be passed through inflation rates through three possible channels. The first channel is through monetary expansion (seignorage). When a government opts to finance its deficit by printing money, it directly increases the monetary base. This increase in the money supply can lead to an imbalance where the amount of money in circulation exceeds the economy's productive capacity. As a result, the excess money chases the same amount of goods and services, leading to price increases. This process can create a feedback loop where continued printing of money to cover deficits exacerbates inflationary pressures.

The second channel is expectation; when economic agents anticipate higher inflation, they adjust their behavior accordingly. Businesses may proactively raise prices to preserve their profit margins, while workers may request a higher wage to keep pace with projected price increases. This conduct can result in a wage-price spiral, where wages and prices persistently drive each other up, culminating in enduring inflation. The third channel illustrates the effects of financing budget deficits on inflation in the absence of changes in money stock (non-monetary). In this scenario, the central bank refrains from injecting additional funds into the economy. However, the budget deficit results in an increase in interest rates and a scarcity of loanable funds. Consequently, higher interest rates may discourage private investors from borrowing money,

thereby reducing the level of investment. This crowding-out effect can also lead to a shortage of goods and services, ultimately contributing to higher prices in the economy.

Figure 1: Transmission mechanism



CHAPTER THREE

Methodology and Model Specification

3.1 Data Set

Secondary data have been employed for the purpose of this study. It relies on time series data spanning the period from 1980 to 2022 to analyze the regime based dynamic effects of fiscal deficit financing on inflation in Ethiopia. This study employed the annual data set of inflation proxies by consumer price index (CPI), real gross domestic product (RGDP), real interest rate (RIR), real effective exchange rate (REER) collected from World Bank Development indicators (WDI). The broad money supply (M2) has obtained from national bank of Ethiopia (NBE). The budget deficit as a percentage of gross domestic product (BD) was collected from international monetary fund (IMF). The variable of interest are inflation rate and budget deficit, and we extend the model to account for the influences of key macroeconomic indicators like broad money supply (M2), interest rates, real exchange rate and real exchange rate.

For the real interest rate (RIR) I had a missing data for the first five years (1980-1984) in our time series dataset of study period. To ensure the integrity and continuity of our analysis, we employed an imputation techniques to fill the gap. This approach allows us to maintain the consistency of our dataset, facilitating more reliable and comprehensive analyses.

3.2 Methodology

3.2.1 Dynamic Markov Regime-Switching Model

Taking into account the intrinsically dynamic interplay between fiscal deficit and inflation, the study employed employ a dynamic Markov Regime-switching model adapted from Osei et al (2022). The Markov Regime switching model was developed by James Hamilton (1989) and remains one of the most robust non-linear time-series approaches in the econometric literature review. This modeling approach is particularly well-suited for capturing changes in economic regimes, enabling a nuanced examination of the interactions between fiscal deficit financing and inflation, which makes the model more dynamic in its application to economic data. It introduces time-variation in the parameters in the form of their state- or regime-specific values. Many

macroeconomic variables undergo structural breaks or regime changes in which time series behavior seems to change quite dramatically.

The Markov switching econometric method enables the econometric model to alternate between different states (regimes), thereby enhancing its dynamic application to economic data. An innovative feature of the Markov regime-switching approach is that an unobservable state-dependent variable, which is presumed to adhere to the first-order Markov chain process, governs the switching mechanism of the model. The model's Markovian nature entails that the state-dependent variable's previous value will determine its current value. Hence, a particular feature of the model will dominate for a specific period, and it can switch to another feature in future periods when regime changes occur. The structure of the Markov regime-switching model can be expressed as follows: assuming s_t represents the state-dependent variable, and it takes on the value of (0) and (1). Consequently, a simple Markov regime-switching model for the variable y_t comprises two autoregressive specifications;

$$y_t = \begin{cases} \alpha_0 + \beta y_{t-1} + e_t, & s_t = 0 \\ \alpha_0 + \alpha_1 + \beta y_{t-1} + e_t, & s_t = 1 \end{cases} \quad (1)$$

Where $|\alpha| < 1$, and e_t is i.i.d innovative term with zero mean ($\mu = 0$) and constant variance, δ_e^2. Equation (1) indicates the first-order stationary autoregressive AR (1) stable process with a constant mean of $\frac{\alpha_0}{1-\beta}$ when $s_t = 0$, and switches to a new first-order autoregressive stable process with a mean of $\frac{\alpha_0+\alpha_1}{1-\beta}$ when $s_t = 1$. Since the changing of the value intercept from α_0 to $\alpha_0 + \alpha_1$ is not perfectly foreseeable and not a deterministic event rather it is random; we need an encompassing model of both equations as it is imperfectly predictable;

$$y_t = \alpha_{s_t} + \beta y_{t-1} + e_t \quad (2)$$

Where s_t is random state dependent variable, taking the value 0 or 1. Thus, this model posits the existence of two dynamic structures at varying level depending on the values of the state dependent variable when $\alpha_{1\neq}0$ and hence, y_t affected by two distinict regimes with different means. The state shift from one regime to another controlled by state dependent variable, s_t.

The regime indicator variables $s_t.is$ strictly assumed to follow the first order Markov chain

p($s_t = j|s_{t-1} = i) = p_{ij}$ process with the transition probability of;

$$\mathbf{P}=\begin{vmatrix} p(s_t = 0|s_{t-1} = 0) & p(s_t = 1|s_{t-1} = 0) \\ p(s_t = 0|s_{t-1} = 1) & p(s_t = 1|s_{t-1} = 1) \end{vmatrix} \quad (3)$$

$$\mathbf{P}=\begin{vmatrix} p_{00} & p_{10} \\ p_{01} & p_{11} \end{vmatrix} \quad (4)$$

Where p_{ij} = (i, j = 0, 1) shows the transition probabilities of the process will be in regime $s_t = j$ conditioned on $s_{t-1} = i$. Its presume that the row of the transition probabilities sum to unity by construction, thus satisfying the condition p_{i0}+p_{i1}=1. The random feature of the state dependent variable governed by the properties of the transition matrix and it holds only two coefficients, $p_{00}\ and\ p_{11}, respectivily.$

The structure of y_t is jointly regulated by the state dependent variable s_t and the random features of the error term ,e_t. The transition proabilities govern the persistence of each states and the state dependent variables oversees the random and regular changes of model features and properties. One advantage of the Markov regime switching methodology over other models, such as threshold models, is that it is more straightforward to employ in estimation since it does not require selecting a priori threshold variable. Conversely, the regime properties of the Markov-switching method are founded upon the law of probabilities and are largely determined by the type of data. Nonetheless, a significant drawback of the Markov regime-switching approach is the difficulty in interpreting the results, as the state variables are unobservable, though the method remains implementable.

A general form of the Markov-switching model which allows for more general dynamic structures, can be expressed as follows:

$$y_t = \alpha_0 + a_1 s_t + \beta_0 y_{t-1} + \beta_1 y_{t-2} + \cdots + \beta_k y_{t-k} + e_t \quad (5)$$

Where $s_t = 0, 1$ denotes the Markovian state variables with the transition matrix still given as;

$$\mathbf{P}=\begin{vmatrix} p(s_t=0|s_{t-1}=0) & p(s_t=1|s_{t-1}=0) \\ p(s_t=0|s_{t-1}=1) & p(s_t=1|s_{t-1}=1) \end{vmatrix}$$

This model is the k-order autoregressive dynamic structure and Markov switching parameter model where, e_t are independently and identically distributed (i.i.d) innovative term with zero mean ($\mu = 0$) and constant variance, δ_e^2. For the n-dimensional time series (Y_t), we can re-write the above model as follows:

$$Y_t = \alpha_0 + \alpha_1 s_t + \beta_0 Y_{t-1} + \beta_1 Y_{t-2} + \cdots + \beta_k Y_{t-k} + e_t \quad (6)$$

Where $s_t = 0, 1$ still represents the Markovian state variables with the transition matrix still given as;

$$\mathbf{P}=\begin{vmatrix} p(s_t=0|s_{t-1}=0) & p(s_t=1|s_{t-1}=0) \\ p(s_t=0|s_{t-1}=1) & p(s_t=1|s_{t-1}=1) \end{vmatrix}$$

Where e_t are independenty identically distrubuted i.i.d. with zero mean and variance covariance matrix given by Σ_0. $\beta_i (i = 1, 2 \ldots k)$ are $n \times n$ matrices of parameters. The model above is obviously the Markov switching Autoregressive model (MS-VAR) with switching intercept. This Markov switching VAR is a generalization that is implementable, though, it may always not be realistic to require n-dimensional distinct variables to switch simultaneously.

The above Markov switching model can further be generalized since more than binary-state Markov switching model can be allowed to assume n values, suggesting that n > 2 in this case and we can derive the n-state Markov switching model with the following transition matrix and probabilities, P_{ij} respectively;

$$P = \begin{bmatrix} P_{00} & \cdots & p_{0n} \\ \vdots & \ddots & \vdots \\ p_{no} & \cdots & p_{nn} \end{bmatrix} \quad (7)$$

Thus, the y_t will now governed by current s_t and past state variables, s_{t-1}. Assume that, $\overline{y}_t = y_t - \alpha_0 - \alpha_1 s_t$, then it follows that,

$$\overline{y}_t = \beta_1 \overline{y}_{t-1} + \ldots + \beta_k \overline{y}_{t-k} + e_t \quad (8)$$

Hence, $\overline{y}_t(and\ thus\ y_t)$ depends not only on s_t, but also on $s_{t-1} \ldots . s_{t-k}$. As there are 2^{k+1} possible values of the collection ($s_t, s_{t-1} \ldots . s_{t-k}$), the generalization model above can viewed as equation (5) with 2^{k+1} states total.

3.2.2 Model Specification (The Empirical Markov Regime-Switching Model for Ethiopia)

The model can be specified as below;

$$CPI_t = f(St, BD, control\ variables) \quad (19)$$

Where CPI_t, is an inflation rate proxied to consumer price index, BD is our explanatory variable along with other conditional variables. Equation (19) above shows that inflation is a function of those variables in the brackets when St is the unobservable regime-specific variable.

In order to investigate the effects of fiscal deficit financing (FDF) on inflation in Ethiopia, we employed an econometric methodology inspired by Hamilton's (1989, 1990) Markov Regime switching approach. This approach takes into account the current phase of the economic state and the government's spending trends, both of which significantly impact fiscal deficit financing. Furthermore, we will also estimate a state-dependent model to complement our inflation model.

$$CPI_t = \beta_0 S_t^N + \beta_{1,}(s_t^N)BD_t + \beta_{2,}(s_t^N)M2_t + \beta_{3,}(s_t^N)REER_t + \beta_{4,}(s_t^N)RIR_t + \beta_{5,}RGDP_t + S_t^N e_t \quad (20)$$

Where $s_t \in (1, 2, 3 \ldots . N)$ represents the state of fiscal deficit at time t and an exponent N shows the process is in specific regime called N. it must be noted that, the dependent variable will have different intercepts depending on, in what regime the process lay and the equation will be definitely different in other state of the model, for example in higher regime deficit financing if the current equation is referring to the low regime of financing. The above Markov Regime Switching dynamic model follows the first order Markov chain process $P(s_t = j|s_{t-1} = i) = p_{ij}$ with the transition matrix $p^N = (p_{ij}) for\ all\ i, j \in (1,2, \ldots . N)$. . β_{1,s_t}, β2,st, β_{3,s_t}, $\beta_{4,s_t}\ and\ \beta 5, st$ are the coefficients for the independent variables in regime s_t. The other parameters can also take different values due to the type of fiscal policy regime at a particular

point in time and it must also be noted that the variance of the error term is state dependent. Where CPI_t, is inflation rate proxied to consumer price index at time t, BDt is budget deficits at time t, M2t is broad money supply, $RIR_t is\ real$ interest rate at time t, REERt is real effective exchange rate and $RGDP_t$ represents real gross domestic product, respectively.

3.2.3 The Estimation Method (Quasi-maximum likelihood estimation)

The estimation of the coefficients vector in the general Markov switching model will be as per (chung-ming kuan, 2002) as presented in equation , can be undertaken using the Quasi-Maximum likelihood estimation method, as follows;

$$\theta = (\beta_0, \beta_1, \beta_2 \ldots . \beta_k, \sigma_e^2, p_{00}, p_{11}) \quad (9)$$

Where θ is the vector of the coefficients Markov switching model, Let $Y^t = (Y_t, Y_{t-1}, Y_{t-2}, \ldots . , Y_1)$ denotes the collection of actual economic variables based on information set available at time *t*. in the same fashion, assume that Y^T is set of actual economic variable based on the full sample information set. It is necessary to assess the conditional expectation, or optimal forecast, of the scenario $s_t = i, i = 0,1$ based on the distinict information available to be able to evaluate the likelihood of the state dependent variable. The optimal forecast for the state variable includes the prediction probabilities based on information before time t given by $P(s_t = i\ /Y^{t-1}; \theta)$, the filtered probabilities focused on the current and past information set given by $P(s_t = i|Y^t; \theta)\ and\ smoothing\ probabilitues\ given\ by\ P(s_t = i|Y^T; \theta)$. The Quasi-log likelihood function can be used to drive the Quasi-maximum likelihood estimates (QMLE) in the following form;

The density Y_t conditional on Y^{t-1} and $s_t = i, i = 0, 1$ under the assumption of normality represented as follow;

$$f(Y_t/s_t = i, Y^{t-1};\ \theta) = \frac{1}{\sqrt{2\pi\sigma_e^2}} \exp\{\frac{-(Y_t - \alpha_0 + \alpha_1 s_t + \beta_0 Y_{t-1} + \cdots . + \beta_k Y_{t-k})^2}{2\sigma_e^2}\} \quad (10)$$

Given the prediction probability is expressed as follows;$P(s_t = i\ /Y^{t-1};\theta)$, then the density of Y_t condintional only on Y^{t-1} can be written as follows;

$$f(Y_t|\ Y^{t-1}\ ;\theta) = P(s_t = 0|Y^{t-1};\theta)\text{f}(p(Y_t|s_t = 0, Y^{t-1},\theta)$$

$$+\ P(s_t = 1|Y^{t-1};\theta)\text{f}(p(Y_t|s_t = 1, Y^{t-1},\theta) \qquad (11)$$

Equation (11) indicates that for i=0, 1 the filtered probability of state dependent variable s_t can be formulated as;

$$P(s_t = i|Y^t;\theta) = \frac{P(s_t=i|Y^{t-1};\theta)f(p(Y_t|s_t=i,Y^{t-1},\theta)}{f(Y_t|\ Y^{t-1}\ ;\theta)} \qquad (12)$$

hence, we can formulate the relationship between filtered probabilities and prediction probability based on Bayes theorem as follow;

$$P(s_{t+1} = i|Y^t;\theta) = p_{0i}P(s_t = 0|Y^t;\theta) + p_{1i}P(s_t = 1|Y^t;\theta) \qquad (13)$$

Where $p_{0i} = P(s_{t+1} = i|s_t = 0)$ and $p_{1i} = P(s_{t+1} = i|s_t = 1)$ are transition probabilities. The equation (11), (12), and (13) above Form recusive system for *t=1….T. To* derive both the filtered probabilities and the conditional densities based on the initial values for t=1...T, we can iterate equation (11), (12), and (13). Thus, the quasi log-likelihood can formulated as follow;

$$\mathcal{L}_T(\theta) = \frac{1}{T}\sum_{t=0}^{T} ln\ f(Y_t|\ Y^{t-1}\ ;\theta) \qquad (14)$$

The equation (14) is the complex non-linear function of vector of coefficients, (θ). Once we find the quasi log-likelihood, we can now estimate the parameters employing the appropriate estimators. To compute the predicted probability and filtered probabilities, we use the estimated parameters. Besides, the smoothed probabilities, $P(s_t = i|Y^T;\theta)$ can be estimated as;

$$P(s_t = i|s_{t+1} = j, Y^T;\ \theta) =\ P(s_t = i|s_{t+1} = j, Y^t;\ \theta) \qquad (15)$$

$$\frac{p_{ij}P(s_t=i|Y^t;\theta)}{P(s_{t+1}=j|Y^t;\theta)} \qquad (16)$$

To further express the smoothed probability for *i, j= 0,1;*

$$\mathrm{p}(s_t = i|Y^T;\theta) = P(s_{t+1} = 0|Y^T;\theta)\, P(s_t = i|s_{t+1} = 0,\ Y^t;\ \theta)$$

$$+\, P(s_{t+1} = 1|Y^T;\theta)\, P(s_t = i|s_{t+1} = 1,\ Y^t;\ \theta) \quad (17)$$

$$P(s_t = i|Y^T;\theta) = P(s_t = i|Y^t;\theta) \times \frac{p_{ij}P(s_{t+1}=0|Y^T;\theta)}{P(s_{t+1}=0|Y^t;\theta)} + \frac{p_{ij}P(s_{t+1}=1|Y^T;\theta)}{P(s_{t+1}=1|Y^t;\theta)} \quad (18)$$

Iterating the equation 18, 13 and 11 backward given the initial value of filtered probability, the smoothed probabilities, $P(s_t = i|Y^T;\theta)$ can be obtained for *t=T-1....k+1*. The estimated smooth probabilities are computed from the estimated parameter of the system accordingly.

3.3 Description of Variables and Prior expectation

Budget deficit (BD):- the budget balance of a nation is determined by its government's expenditures and revenue for particular fiscal year. A budget deficit occurs when the government expenditures exceeds the revenue they bring in. budget deficits are particularly measured by in absolute terms and as a percentage of country's GDP. Positive relationship is expected between budget deficit and inflation. An increase in budget deficits results in an increase in money supply, which in turn leads to rise in price level. Furthermore, an increase in budget deficit financing can leads to government loans rise, an increase in interest rate, which results in inflation. Therefore, an expected correlation between the budget deficit and inflation is positive.

Inflation (proxies to CPI):- The Consumer Price Index (CPI) is a measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food, and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them. Changes in the CPI are used to assess price changes associated with the cost of living.

Real Gross domestic Product (RGDP):- is an economic indicator that represents the total value of goods and services produced within a country's borders over a specific period, adjusted to inflation, usually one year. It includes private and public consumption, government spending, investments, and net exports all measured in constant prices to account for changes in the price level. RGDP serves as a comprehensive measure of a country's economic activity. Additionally, there is a positive relationship between GDP and inflation. This is because an increase in per capita income from GDP growth stimulates demand levels, which, in turn, leads to higher prices

when supply remains stable. Thus, the expected relationship between RGDP and inflation is positive.

Broad Money (M2):- Broad money supply, also known as M2, is a reliable indicator of a nation's money supply. Money supply refers to the total quantity of assets that households and businesses can utilize for payment purposes or hold as short-term investments, including currency, checking account balances, and other items that serve as a medium of exchange. The formula for determining M2 is the sum of M1 (Narrow Money) and Quasi Money (saving deposit + time deposit). Milton Friedman's (1960) theory posits that inflation is always and everywhere a monetary phenomenon. When the money supply expands at a rate greater than the rate of real output growth, inflation will result. This occurrence is due to an excess of money in circulation relative to the available goods and services. As such, the relationship between money supply and inflation is expected to be positive.

Real effective exchange rate (REER):- is a weighted average of country's currency value compared to a group of other major currencies. It measures the strength of a currency relative to a basket of other currencies, and the weights are determined by comparing the relative trade balance of a country's currency against that of each country in the index. An increase in the REER indicates a strong currency, which increases the purchasing power of the domestic currency to buy commodities and decreases the price level. Therefore, the expected sign of the REER's effect on inflation is negative.

Real interest rate (RIR):- is an interest rate that has been adjusted to inflation. Therefore, it is nominal interest rate minus inflation rate. Depending on prevailing inflation rate, real interest can be lower than or greater than nominal interest rate. It reflects the actual cost of borrowing funds for borrowers and real return for lenders accounting for inflation. Central banks rise interest rates to control high risk of inflation. Therefore, there is negative correlation expected between real interest rate and inflation.

CHAPTER FOUR

4 DATA ANALYSIS AND INTERPRETATION

In this chapter, different methods of analysis have been undertaken (both descriptive and econometric analysis). To demonstrate the trends of some time series variables included in the model and examine their relationship with the inflation rate, the line graph is used for the data spanning the period of 1980-2022. Particularly, the econometric methodology discussed in the previous chapter, the Markov regime switching model, has been applied in this section to show the causal interlink between inflation and budget deficit financing across different regimes. When we say regime, in this case, it's not referring to the political regime. Rather, it is the distinct economic circumstance, such as a high-budget deficit financing regime or a low-budget deficit financing state. The chapter starts with descriptive analysis using line graphs and proceeds with performing the unit root test using augmented Dickey fuller (ADF) and Phillip-perron test. The next part of the chapter deals with the model estimation, and afterwards, the filtered and smoothed probabilities have been estimated

4.1 Descriptive analysis

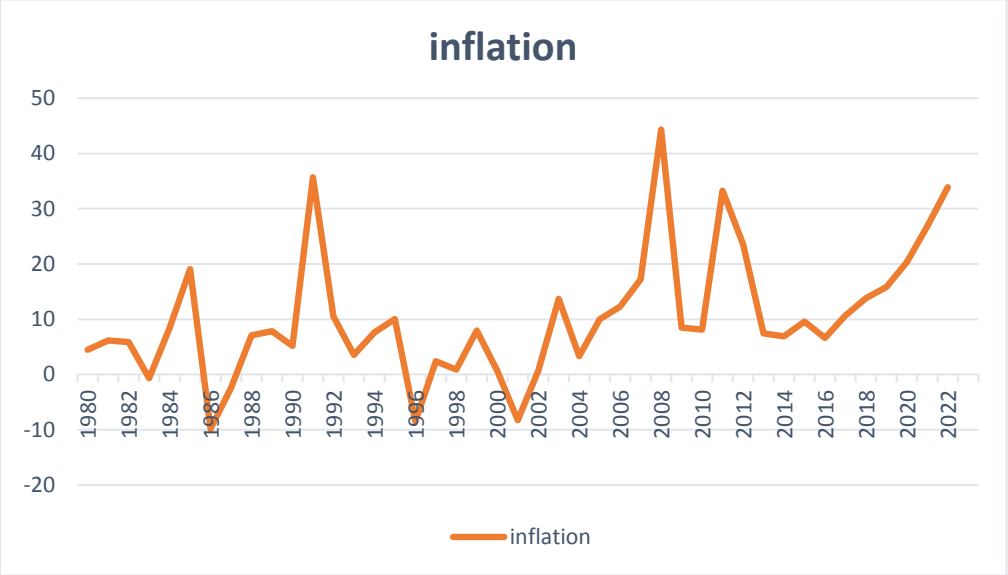
In this section of the paper, we examine the trends of certain main variables incorporated into our model using simple line graphs. The variables included in this section are the Consumer price index (CPI), the government budget deficit, revenue and expenditure of government, and the broad money supply

4.1.1 Trends of Inflation 1980-12022

Ethiopia's inflation patterns generally show that the rate of inflation has considerably varied over time. Prior to 2006, inflation in Ethiopia remained relatively at a low level, with the notable exception of 1991, when it spiked to its highest level of 35.7% due to political unrest and rising food prices. However, since 2006, there has been a significant increase in inflation despite the country's substantial economic growth during that period. The data from the World Bank Development indicators (WDI) indicates that Ethiopia encountered higher inflation rates, notably in 1991 and 2008. In 2008, inflation reached its highest level ever recorded at 44.3%. Following this peak, inflation rates showed a relatively modest trend from 2012 to 2018. By 2018, inflation stood at 13.8%, but it rose again significantly to 33% in 2022. These trends highlight the complex interplay between political stability, economic growth, and inflation in Ethiopia.

Despite periods of economic expansion, inflation has remained a persistent challenge, reflecting underlying vulnerabilities in the economy and the impact of both domestic and international factors on price levels.

Figure 2: Trends of inflation in Ethiopia (1980-2022)



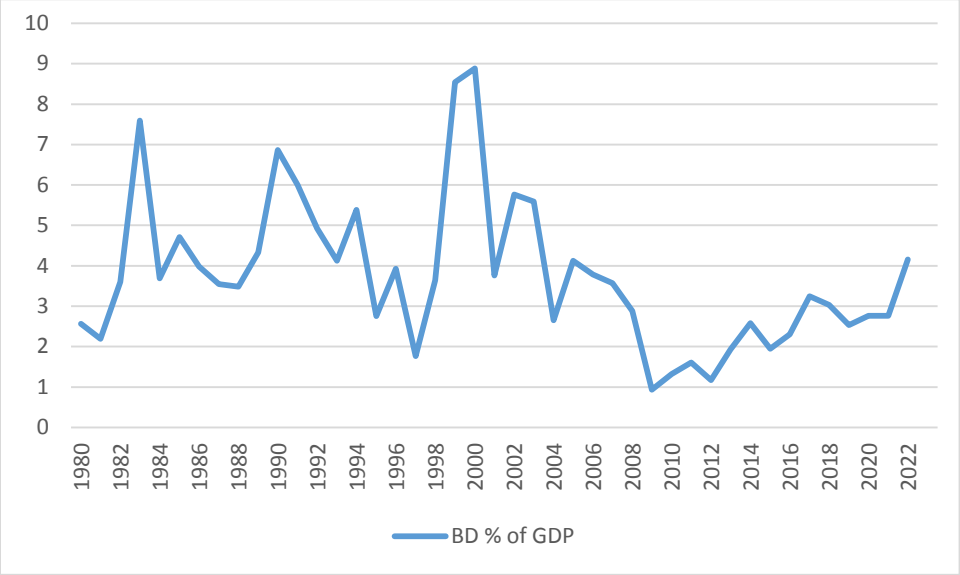
Source: authors own computation (data from WDI)

4.1.2 Trends of budget deficit percentage of GDP (1980-2022)

The budget deficit in terms of percentage of gross domestic product (GDP) for the period of this study spanning from 1980 to 2022 was also exhibit varying patterns, reflecting different phases of fiscal policy and economic conditions. The budget deficit as a percentage of GDP was at its lowest point in 2009 when it reached 0.9 per cent. This indicates a period of relatively tight fiscal management. In contrast, the 2000 fiscal year was the year there was a sharp peak in BD as it exceeded 8 percent of GDP. This peak could be attributed to significant fiscal expansion, possibly due to increased government spending or a decline in revenues. For the remainder of the period under consideration, the graph shows fluctuations in the budget deficit percentage. Throughout the 1980s and 1990s, there were several notable peaks and troughs, indicating periods of both fiscal expansion and consolidation. From the early 2000s onwards, there has been a general trend towards reducing the budget deficit, although there are still occasional increases. In recent years, the budget deficit percentage has shown a slight upward trend, particularly noticeable in the years following 2018, culminating in an increase to around 4 per cent of GDP

by 2022. This suggests a phase of increased fiscal activity, possibly driven by economic policies aimed at stimulating growth or responding to economic challenges.

Figure 3: budget deficit trends



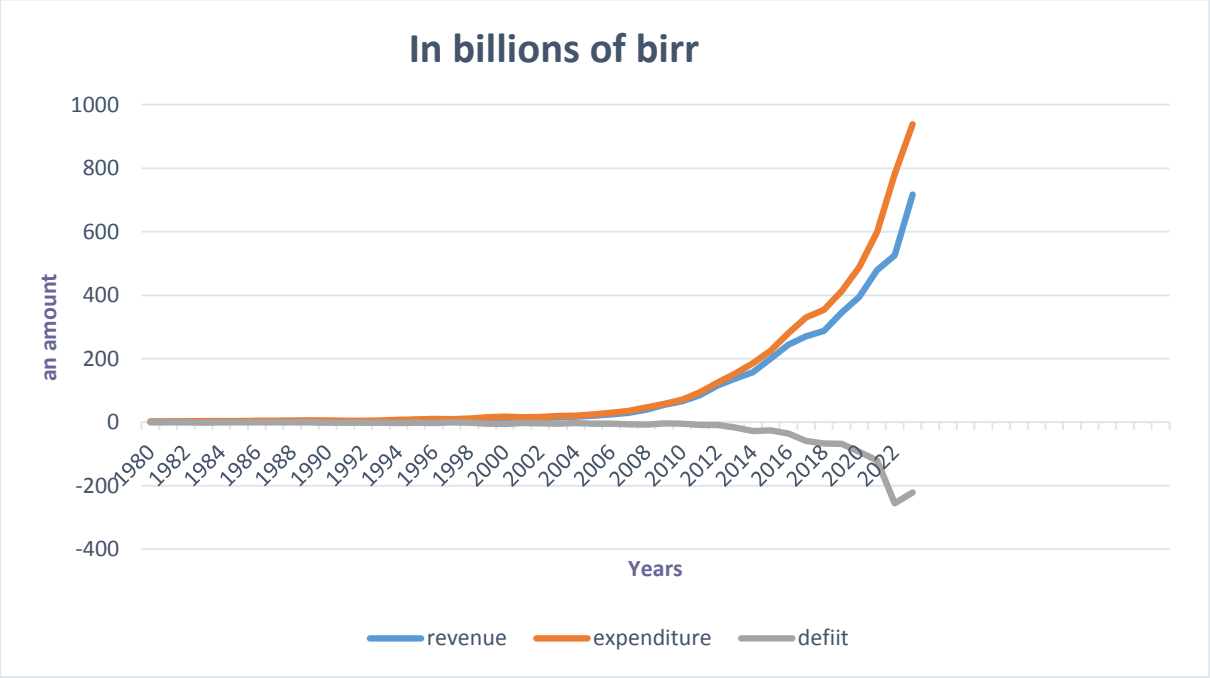
Source: authors own computation (data from IMF)

4.1.3 The trends of BD in relation to government revenue and expenditure

We observe three periods in the trend of budget deficit in relation to government revenue and expenditure from the figure above. The first period was from 1980 to about 1994 when the budget deficit was more or less not as high as in recent years and the growth seemed steady. The second period is from 1994 to 2012 when the government expenditures started to soar, and the budget gap began to widen gradually. This period marked a new era of the political landscape in Ethiopia when the Ethiopian People's Revolutionary Democratic Front took control of power. With the shift of power, the new government's expenditure began to soar, and the gap began to widen. Data from the IMF demonstrated in Figure 4 reveals that the third period was post-2012 when a surge in government expenditure was higher, and the economy underwent a bigger budget deficit. During this period, the government implemented a series of five-year national development plans called the Growth and Transformation Plan (GTP I), which spanned the period from 2010 to 2015, and GTP II, which spanned the period from 2015 to 2020. At this time, the government spending on ambitious infrastructure projects, regardless of low revenue, leads to higher financing of fiscal deficit.

In developing countries like Ethiopia, where the government finances most of public expenditures with a low revenue level due to an underdeveloped financial sector and inefficient tax system, financing the budget deficit can lead to inflation.

Figure 4: The trends of budget deficit, government revenue and expenditure since 1980



Source: Author's computation (data from IMF)

Even though the revenue from tax is not as high as that of an advanced nation and has a narrow tax base, the main source of the Ethiopian government is tax. The remaining revenue comes from non-tax and grants.

Budget deficit financing is deemed to exert an inflationary impact on an economy when the government finances the gap by monetizing through a rise in the money supply and crowding out the private economy otherwise. This is because government fiscal gap financing can increase the interest rate and cost of borrowing for the private investment sector, which in turn slows down output growth and creates an inflationary impact.

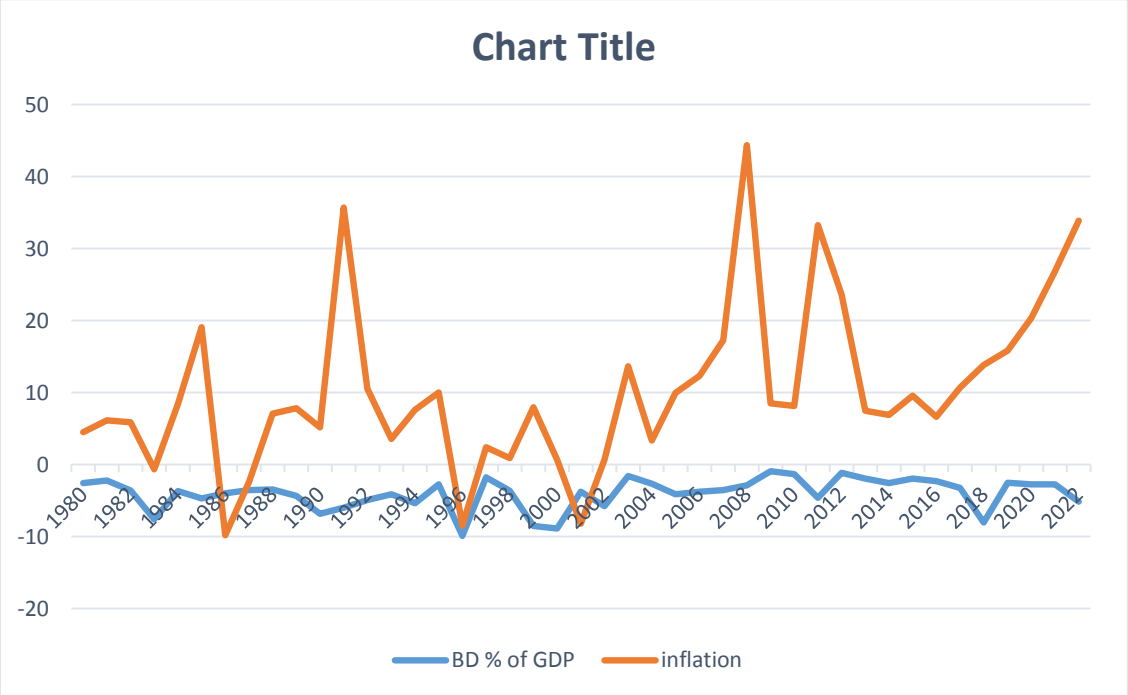
4.1.4 Trends of Budget Deficit Percentage of GDP and inflation (1980-2022)

As illustrated in Figure 2, which depicts the annual trends of the consumer price index (CPI) and the budget deficit as a percentage of GDP, there is a noticeable correlation between higher

inflation rates and larger budget deficits. The data reveal that inflation was relatively higher during periods when the budget deficit was substantial, particularly in the years 1984, 1992, 2000, 2012, and 2018. This pattern suggests a potential causal relationship, indicating that significant increases in the budget deficit in Ethiopia could be a contributing factor to rising price levels.

The graph shows that in 1984, both inflation and the budget deficit spiked, reflecting economic instability during that period. Similarly, in 1992, Ethiopia experienced another surge in both inflation and the budget deficit, which can be attributed to political and economic transitions. The year 2000 saw another peak in the budget deficit, exceeding 8 percent of GDP, coinciding with a high inflation rate. From 2012 to 2018, the trends continued to align, with noticeable peaks in inflation corresponding to periods of larger budget deficits. This trend persisted into 2022, where the budget deficit percentage increased to around 4 percent of GDP, while inflation also rose significantly. Hence, the data suggest that periods of higher budget deficits are often accompanied by increased inflation, highlighting the sensitivity of Ethiopia's economy to fiscal policy changes. Managing the budget deficit appears to be crucial for controlling inflation and maintaining economic stability.

Figure 5: the trends of inflation rate and budget deficit percentage of GDP



Source: authors own computation (data from IMF and WDI)

4.2 Econometric Estimation

4.2.1 Unit Root Test

In order to accurately estimate the empirical model, it is essential to examine the properties of chosen macroeconomic variables. The unit root test serves as the initial step in analyzing time series data, and it helps to properly comprehend the characteristics of the data generation process. This analysis is a crucial prerequisite for effectively and efficiently examining the estimated models. Conducting the unit root test is necessary because many macroeconomic variables usually exhibit non-stationary characteristics, and including these variables in the model regression may result in spurious regression or can generate misleading results. Hence, the Augmented Dickey-Fuller stationary test was carried out for all variables in our model to determine whether the variables had unit roots, as presented in Table 1 below. Accordingly, except for the consumer price index (CPI), budget deficit percentage of gross domestic product (BD), and real interest rate (RIR) the other variables had units at their level as we failed to reject the null hypothesis of the presence of unit root, which demonstrates the insignificance of the test statistics at least at 1 per cent critical value. The consumer price index was stationary at a level where we reject the null hypothesis of unit root at 1 per cent, as shown in, while the budget deficit (BD) and real interest rate was also stationary at a level as we reject the H0 at 5 percent level of significance (see Table 1).

For the rest of the variables, the Augmented Dickey-Fuller test of stationarity was undertaken at their first difference (see Table 1). Thus, real effective exchange rate (REER) is stationary at their first difference as we rejected the null hypothesis of unit root at 1 percent level of significance. The two variables. i.e. Real gross domestic product (RGDP) and broad money supply (M2), are found to be stationary at their second difference as we rejected the null hypothesis of unit root at 1 per cent of 2^{nd} difference (table 1)

Table 1: Unit root test statistics summary at level and difference (ADF)

Augmented dickey fuller test for stationarity			
Variables	Level/1st difference/ 2nd difference	ADF test statistics	p- values
Consumer price index (CPI	Level	-4.143	0.0008***
Budget deficit percentage of gross domestic product (BD%GDP)	Level	-3.615	0.0055**
Broad money supply (M2)	Level	29.384	1.0000
	1st difference	3.810	1.0000
	2nd difference	-4.443	0.0003***
Real domestic gross product (RGDP)	Level	12.868	1.0000
	1st difference	-1.101	0.7146
	2nd difference	-8.582	0.0000***
Real effective exchange rate index (REER)	Level	-1.285	0.6362
	1st difference	-5.225	0.0000***
Real interest rate percentage (RIR)	Level	-3.595	0.0059**

*Note: - the *, ** and *** denotes significance at 10%, 5% and 1%, respectively.*

Source: Author's own computation STATA 14

The Phillips-perron test was also undertaken for all of the variables. The results were the same as those of the augmented dickey fuller test we had seen before. Hence, the consumer price index, real interest rate, and budget deficit percentage of gross domestic product were I(0). The real effective exchange rate I(1). Nevertheless, the two remaining variables. I.e. real gross domestic product and the broad money supply are integrated of degree two I(2) as we rejected the null hypothesis of unit root at their second difference (see table 2). Once we carry out the stationarity test for all variables, we can proceed with model estimation as we will not face spurious regression.

Table 2: The Phillip-perron test summary at level and difference

Phillip-perron test for stationarity			
Variables	Level/1st difference/ 2nd difference	Phillip-perron test statistics	p- values
Consumer price index (CPI	Level	-4.158	0.0008***
Budget deficit percentage of gross domestic product (BD%GDP)	Level	-3.609	0.0056**
Broad money supply (M2)	Level	45.900	1.0000
	1st difference	8.779	1.0000
	2nd difference	-4.353	0.0005***
Real domestic gross product (RGDP)	Level	9.277	1.0000
	1st difference	-0.506	0.8909
	2nd difference	-10.331	0.0000***
Real effective exchange rate index (REER)	Level	-1.367	0.5981
	1st difference	-5.144	0.0000***
Real interest rate percentage (RIR)	Level	-3.493	0.0082**

*Note: - the *, ** and *** denotes significance at 10%, 5% and 1%, respectively.*

Source: author's own computation STATA 14

4.2.2 Lag Length Selection

Determining an appropriate lag to include in a model plays a crucial role in econometric analysis, as this has a significant impact on the results of the analysis. It is imperative to include the optimal lag in running our models. Among several criteria for selecting the optimal lag length, we applied the Akaike information criteria (AIC), which is more appropriate for a small sample size. The number of lags that minimize Akaike information criteria is considered to be the

optimal lag length to include, and the model with the smallest information criteria will be chosen. Selecting the lag length of one and two is the most common for the annual time series dataset. This study also carried out a lag length selection test by iteratively estimating the model to determine possible lag lengths, which minimize the Akaike information criteria for six variables in the model, and two have been chosen as optimal lag lengths by this test.

4.2.3 Test of the existence of switching regimes

Table 3: Regime switching tests of budget deficit percentage of GDP

Variable		**coefficients**	**St. Err.**	**Z**	**p>|z|**	**[95% conf. interval**	
Budget deficit % GDP	State1	0.777833	.2434698	3.19	0.001	0.300641	1.255025
	State2	6.343908	1.009298	6.29	0.000	4.36572	8.322096

Source: own computation on STATA 14

As per Hamilton (1990), the regime-switching modelling of fiscal deficit financing can be more reliable in capturing breaks in time series data, swings in macro variables and shocks in an economy. Given the significance of the topic, it is crucial to estimate and analyze the regime-switching effects of fiscal deficit financing on inflation in Ethiopia. A regime-switching test was conducted using the conceptual measures of budget deficit for fiscal deficit financing to verify the presence of regime-switching effects. The results of the test presented in Table 3, the evidence suggest that the budget deficit financing in Ethiopia displays two distinct regimes, which are characterized by highly significant p-values

In state 1, the coefficient for the budget deficit as a percentage of GDP is 0.77833, with a standard error of 0.24. The z-value for this state is 3.19, and the p-value is significant at 0.001. This suggests that in this regime, changes in the budget deficit percentage have a statistically significant impact on the dependent variable. Accordingly, we label State 1 as a low regime of fiscal deficit financing since the coefficient of the variable in this state is relatively much lower than that of State 2.

In State 2, the coefficient is markedly higher at 6.343908, with a standard error of 1.009298. The z-value for this state is even more substantial at 6.29, with an extremely significant p-value of 0.000. This indicates that in the second regime, the budget deficit percentage has a much larger

and highly significant impact on the dependent variable. Hence, this study label state 2 as high regime of fiscal deficit financing.

4.2.4 Regime effects of fiscal deficit financing on inflation in Ethiopia

Based on the investigation of fiscal deficit financing and its impact on inflation in Ethiopia, it is evident that a Markov regime-switching model approach provides a robust framework for comprehending this dynamic. By conceptualizing the budget deficit as a standard measure of fiscal deficit financing, we can better capture the nuances of how fiscal policies influence inflationary trends. The regime-switching model demonstrates that both the low regime and high regime of fiscal deficit financing have a significant and positive relationship with inflation, though with varying degrees of impact. This means that regardless of whether the fiscal deficit is relatively large or small, an increase in the budget deficit consistently and strongly leads to higher inflation in a high deficit financing regime and the impact remains soft in a low deficit financing regime even though the relationship is positive. This relationship underscores the sensitivity of the Ethiopian economy to fiscal policies, where even moderate increases in the budget deficit can exert upward pressure on prices.

In the low regime, the impact of financing fiscal deficit remains subdued as a 1 per cent rise in the budget deficit financing increases the inflation rate only slightly by 0.0867411 or 8.6 percent other things remain constant. According to this result, low deficit financing has a low inflationary impact in Ethiopia. Meanwhile, in the high regime, the coefficient of BD % GDP is 0.9230973 indicates an even stronger impact on inflation than in state 1, as a one per cent rise in fiscal deficit financing leads to a 92 per cent increment in the inflation rate keeping other variables constant. These results in Ethiopia comply with the view fiscal theories of the price level, which establishes an argument that when the fiscal deficit is monetized, it will have a significant impact on the inflation rate. The fiscal policy (FP) view of inflation is that high and persistent inflation is primarily caused by excessive monetary financing of fiscal deficits. This occurs when the government's budget deficit is financed through direct advances from the central bank, which increases the monetary base and puts upward pressure on inflation.

Table 4: regime effects fiscal deficit financing on inflation

Markov-switching autoregression						
Sample: 1984 - 2022				No. of obs = 39		
Number of states = 2				AIC = 5.7096		
Unconditional probabilities: **transition**				HQIC = 5.9239		
Log likelihood = -97.337533				SBIC = 6.3068		
CPI	Coef	St. Err	z	p>|z|	[95%	conf. interval]
RGDP	0.0759331	.0167565	4.53	0.000	0.0430897	0.1087739
Cons.	8.124671	1.120201	7.25	0.000	5.929118	10.32022
Low regime of budget deficit financing (state 1)						
BD%GDP	.0867411	.0188205	-4.61	0.000	.0498536	.1236286
M2	1.19e-10	1.18e-12	101.13	0.000	1.17e-10	1.22e-10
REER	.0285156	.0013009	21.92	0.000	.0259659	.0310652
RIR	-.2047777	.0036462	-56.16	0.000	-.2119241	-.1976313
High regime of fiscal deficit financing (state 2)						
BD%GDP	.9230973	.060584	15.24	0.000	.8043548	1.04184
M2	2.56e-10	1.44e-11	17.81	0.000	2.28e-10	2.85e-10
REER	.7816782	.0097469	80.20	0.000	.7625745	.8007818
RIR	-.3091889	.0176246	-17.54	0.000	-.3437324	.2746454

Source: Author's own computation on STATA 14 software

The Markov regime-switching model unveils a fascinating interplay between broad money supply (M2) and inflation in Ethiopia. The impact of M2 on inflation appears to be minimal, even though the coefficients indicate a positive relationship in both regimes. In a low regime, the M2's coefficient is statistically significant (1.19e-10) with a p-value of 0.000. However, the coefficient is extremely small, suggesting the effects of rise in M2 remain muted. In the high regime, the coefficient is slightly higher at 2.56e-10 with a statistically significant p-value of

0.000, maintaining a positive relationship with minimal impact. Thus, the consequence of the rise in both low regime fiscal deficit financing and high deficit financing periods is almost negligible in Ethiopia. The structure of the Ethiopian economy might limit the influence of money supply changes on inflation. For instance, inflation might be driven more by supply-side factors or external shocks rather than changes in the money supply.

The real effective exchange rate (REER) appears to have a considerable effect on the consumer price index (CPI) in Ethiopia, as revealed by the Markov regime-switching model. These two variables maintain a positive and strongly significant relationship in both regimes. In the low regime, a 1 unit increase in REER is associated with around a 2.85 per cent increase in inflation, while in the high regime, the same increase in REER leads inflation to rise even higher at 78 per cent. This relationship may be attributed to Ethiopia's high import dependency for goods and services, as an increase in REER makes imports more expensive, thereby causing the overall price level to rise. Given Ethiopia's structure of economy which characterized by supply-side constraints and demand-pull effects, the REER turn out to have positive impact on inflation. Furthermore, during periods of high deficit financing, increased external vulnerabilities and higher import costs exacerbate inflation pressure on the Ethiopian economy.

The central banks use an interest rate as one monetary instrument to account for inflation. The relationship between real interest rates and inflation in Ethiopia indicates significant and negative impacts in both low and high regimes of budget deficit financing. In this study, the coefficients for real interest rate (RIR) suggest that changes in interest rates have notable effects on inflation. In the low regime, for every one per cent increase in RIR, inflation decreases by around 20 per cent, while in the high regime, for every one per cent increase in real interest rate, inflation decreases by 30.9 per cent. The effect is more pronounced in the high regime of fiscal deficit financing, suggesting that real interest rate adjustments are more effective in curbing inflation during periods of high fiscal deficit financing.

The real GDP reflects long-term growth trends of an economy and underlying productive capacity. The reason this study keeps real gross domestic product (RGDP) is that unlike the budget deficit financing and inflation, which can be highly sensitive to short-term policy changes and shocks, it evolves more gradually, i.e., it may not have a regime-switching effect on inflation. The output from our estimation indicates the significant and positive relationship

between RGDP and inflation in Ethiopia with a p-value of 0.00. However, the coefficient of RGDP 0.0759331 in this study reveals that there is limited impact associated with this macro variable on inflation regardless of the regimes. This means a one percentage increase in RGDP leads the consumer price index to rise by 7.5 per cent.

4.2.5 Transition probabilities and duration of transition

From the transition probabilities test of the model (see table 4), the transition probabilities of maintaining state 1 are 36.8 percent, while those of maintaining state 2 are 55.9 percent. The probability that state 1 transited to state 2 (representing a high deficit financing regime) is 63 percent, while the reversal is 44 percent. The findings suggest a relatively higher propensity for the economy to remain in a high-deficit financing state. This indicates a degree of persistence in more aggressive fiscal policies characterized by elevated deficit levels.

If there will be a transition between the two states eventually, the average expected duration for state 1 is about 1.6 years (about one year and a half), and to reverse the order, it is about 2.3 years (two years and three months). This reveals that there is a relative lack of persistence in the budget deficit financing regime in Ethiopia, as different administrations have failed to maintain the state of low deficit financing for a long period of time. These findings emphasize a trend of inconsistency and volatility in Ethiopia's budget deficit financing framework over time. Despite contrasting governments, there seems to be a persistent struggle to maintain a low-deficit financing state for extended periods. This inability to maintain consistency suggests difficulties in attaining fiscal discipline and stability in budget management, which may have far-reaching implications for macroeconomic stability, inflation patterns, and long-term development prospects.

Table 5: The transition probabilities and duration of the transition

Transition	Probabilities Estimate	Std. Err.	[95% Conf.	Interval]
p11	**.3681997**	.1294728	.1637217	.6343438
p12	**.6318003**	.1294728	.3656562	.8362783
p21	**.4402081**	.1037351	.2562819	.6421594
p22	**.5597919**	.1037351	.3578406	.7437181

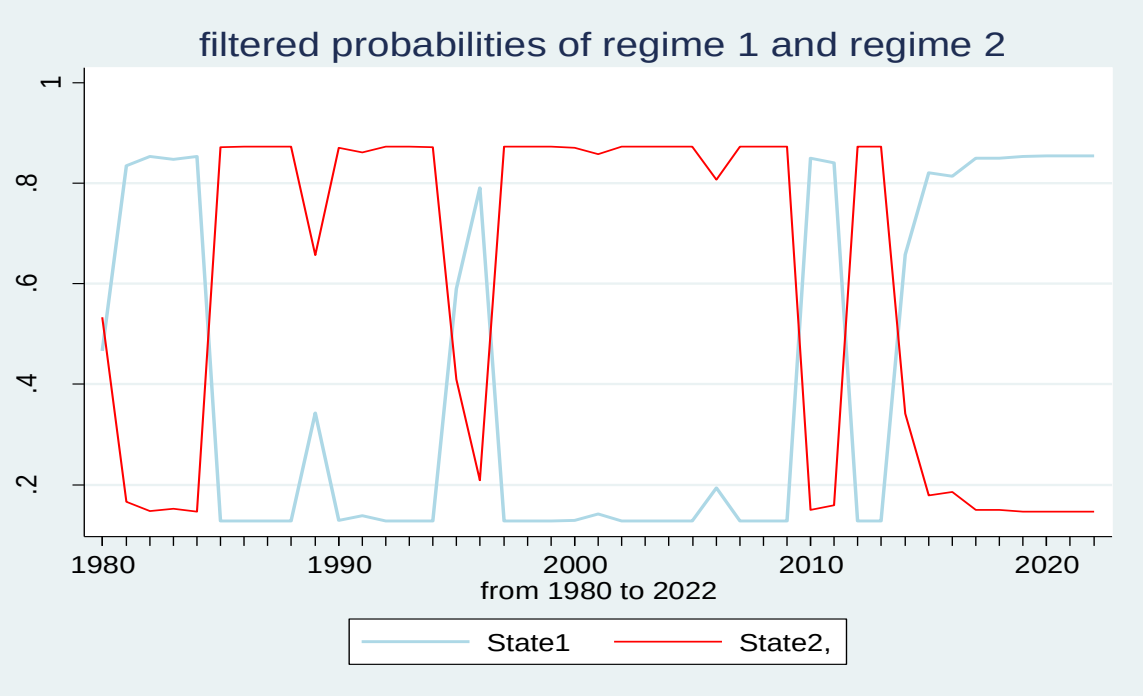
Expected Duration	Estimate	Std. Err.	[95% Conf.	Interval]
State1	**1.582779**	**.3243537**	**1.195774**	**2.73481**
State2	**2.271653**	**.5353151**	**1.557246**	**3.901954**

Source: own computation

4.2.6 The filtered probabilities for two regime

The categorization of regimes based on filtered probabilities of the estimated Markov regime switching model also confirms the presence of regime of fiscal deficit financing in Ethiopia which complies with the results of estimation of the model.

Figure 6: filtered probabilities



Sources: Author's own computation STATA14

The system begins with a high probability of being in state 2, with 53.4% in the first year of our sample period. There are notably significant fluctuations between states over time. From the first year of the sample period onwards till around 1984, state 1 (represents the low regime of fiscal deficit financing) starts with high probability as indicated by the light blue line (see figure 5). Afterwards, the probability of being in State 1 dropped sharply, and the system switched to State 2 (which represents the high regime of fiscal deficit financing). State 2 dominated for the majority of the 1980s and 1990s first half until 1995, as demonstrated by the red line in Figure 5. From the late 1990s to 2010, they experienced high volatility with frequent shifts in states, suggesting the inconsistency of the regime of fiscal deficit financing in Ethiopia. The graphical analysis that employed the filtered probabilities provided substantial validation for the findings obtained from the Markov regime-switching model estimates. Therefore, the impact of the surge in fiscal deficit financing on inflation dynamics was found to be more pronounced in regime 2 relative to regime one, as indicated by the estimated model, which assumes that all variables in the model switch between the two regimes.

Upon conducting an exhaustive analysis to test the hypothesis that the impact of fiscal deficit financing on inflation dynamics varies significantly across distinct financing regimes, the results unequivocally support the alternative hypothesis (H1). Through rigorous empirical modelling and interpretation, it has been demonstrated that the effect of budget deficit financing on inflation exhibits substantial disparities contingent upon the underlying financing regimes. Contrary to the null hypothesis (H0), which posits uniformity in the impact of fiscal deficit financing across different regimes, the results reveal a nuanced reality wherein distinct financing strategies have divergent effects on inflation dynamics. This substantiates the notion that financing fiscal deficits cannot be considered a homogenous determinant of inflation but rather a multifaceted phenomenon intricately intertwined with the particular modalities through which they are financed. These findings underscore the importance of taking into account the complexities of financing regimes in assessing the inflationary implications of fiscal deficit policies, which have significant implications for policymakers seeking to formulate effective macroeconomic strategies tailored to the specific characteristics of their fiscal frameworks. Hence, the empirical evidence presented herein decisively confirms the validity of H1 by elucidating the intricate relationship between fiscal deficit financing and inflation dynamics across diverse financing regimes.

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusion

Ethiopia has consistently experienced persistent fiscal deficit and soaring inflation in the last few decades under consideration, which have been attributed to a variety of factors. Hence, it has become a key topic of interest for researchers to examine the interplay between financing budget deficits and inflation in Ethiopia. A budget deficit occurs when the government's expenditure for a given fiscal year exceeds the revenue it brings in. This is considered one of the most important variables in maintaining the macroeconomic stability of a country. Inflation, on the other hand, refers to a sustained increase in prices of goods and services. In recent decades, Ethiopia has seen a rise in both budget deficits and inflation rates, making it imperative to examine the relationship between these two variables in the country over the period from 1980 to 2022.

This study examined the dynamic effects of fiscal deficit financing on inflation in Ethiopia using the Markov regime-switching model approach for the period spanning 1980 to 2022. The findings of this paper revealed the presence of two fiscal deficit financing regimes in Ethiopia. A test carried out to check whether fiscal deficit financing exhibits the switching regimes using the budget deficit as a percentage of GDP as a conceptual measure demonstrated that there exist regimes of deficit financing with highly significant p-values of 0.001 in state 1 and 0.000 in state 2. As per the results from Markov switching autoregression estimation, budget deficit has a positive and strong relationship with inflation in a high fiscal deficit financing regime, whereas, in the low regime of deficit financing, the impacts remain subdue even though the relationship stayed positive with coefficients 0.9230973, 0.0867411, respectively.

The broad money supply (M2) came out with no meaningful effects on inflation in Ethiopia, irrespective of fiscal deficit financing regimes. Real effective exchange rates (REER) have a positive and significant impact on inflation, with a relatively higher impact in the high regime of fiscal deficit financing. Real interest rate (RIR) has a negative and significant relationship with inflation in Ethiopia as central banks employ it to arrest inflation. Besides, the real gross domestic product (RGDP) has a positive and significant interplay with inflation regardless of the fiscal deficit financing regimes. However, its impact remains soft in Ethiopia, according to the estimation results.

Furthermore, this study found the lack of persistence of policy in Ethiopia in the transition from one regime to another. The statistical transition probabilities and duration of transition suggest that Ethiopia failed to sustain a low deficit financing regime, which has a relatively moderate impact on inflation. This paper demonstrated that the high regime of budget deficit financing persists for a long period with a relatively higher duration of transition.

Therefore, this study concluded that fiscal deficit financing strongly impacts inflation dynamics in the underlying high regime, whereas in the low regime, fiscal deficit financing is less impactful relative to other factors**.**

5.2 policy recommendation

The results of this study indicate that the implementation of fiscal policy can have varying impacts on inflation dynamics in the Ethiopian economy, depending on the chosen regime by fiscal authorities. The dynamic and regime-dependent nature of the relationship between fiscal deficit financing and inflation, as highlighted in the study, underscores the need for a multifaceted and adaptive policy approach. According to the conclusion of this research paper, the government of Ethiopia should sustain a low regime of fiscal deficit financing in order to attain a stable and healthy level of inflation rates. Hence, the following policy recommendations have been provided based on the findings of this study:

- **Strengthen fiscal discipline and revenue generation**: To this end, the fiscal authority of the country can pursue consolidated fiscal policy reform that aims to increase tax revenue while managing expenditures demand. Enhancing tax collection efficiency to increase tax revenues by broadening a tax base, reducing tax evasion, and improving administration efficiency can help reduce dependency on deficit financing and strengthen fiscal discipline. Additionally, expenditure reforms should focus on expenditure-reducing and expenditure-switching policies that promote increased capital expenditure and funding for infrastructure projects, which can have a strong impact on long-term economic growth.
- **Pursuing prudent debt management strategies**: the government should implement a comprehensive debt sustainability framework to ensure the public debt remains at a manageable level. Besides, strengthening central bank independence can help reduce reliance on direct borrowing from the National Bank of Ethiopia to finance budget

deficits, which contributes to inflationary pressures. Instead, explore market-based financing options, like issuing government securities.

- **Promoting financial market development**: Strengthening and deepening domestic financial markets offers robust financing options for the government and reduces dependencies on the central bank. This includes developing a robust bond market and improving financial market infrastructure. Moreover, it provides alternative sources of financing their investments for the private sector and adequate returns on investments.
- **Regular Policy Review**: Conduct regular reviews and evaluations of fiscal policies to assess their effectiveness and make necessary adjustments. Utilize empirical data and analytical tools to monitor the impact of fiscal deficit financing on inflation and other macroeconomic variables.

Implementing these policy recommendation can help Ethiopia manage its fiscal deficit more effectively, mitigate inflationary pressures, and fostering sustainable growth. By bolstering fiscal discipline, promoting fiscal-monetary policy coordination, and promoting financial market development, Ethiopia can achieve greater stability and resilience.

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Appendixes

1. Regime effects of fiscal deficit financing on inflation in Ethiopia

Markov-switching autoregression

Sample:	1984 - 2022	No. of obs	= 39
Number of states =	2	AIC	= 5.7096
Unconditional probabilities:	transition	HQIC	= 5.9239
		SBIC	= 6.3068

Log likelihood = -97.337533

CPI	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
CPI						
RGDP D2.	.0759318	.0167565	4.53	0.000	.0430897	.1087739
_cons	8.124671	1.120201	7.25	0.000	5.929118	10.32022
State1						
bd D1.	.0867411	.0188205	4.61	0.000	.0498536	.1236286
M2 D2.	1.19e-10	1.18e-12	101.13	0.000	1.17e-10	1.22e-10
reer D1.	.0285156	.0013009	21.92	0.000	.0259659	.0310652
rir D1.	-.2047777	.0036462	-56.16	0.000	-.2119241	-.1976313
ar L2.	.3632236	.0048381	75.08	0.000	.353741	.3727061
State2						
bd D1.	.9230973	.060584	15.24	0.000	.8043548	1.04184
M2 D2.	2.56e-10	1.44e-11	17.81	0.000	2.28e-10	2.85e-10
reer D1.	.7816782	.0097469	80.20	0.000	.7625745	.8007818
rir D1.	-.3091889	.0176246	-17.54	0.000	-.3437324	-.2746454
ar L2.	.4685001	.2439781	1.92	0.055	-.0096881	.9466884
sigma1	.091759	.0168071			.0640823	.1313892
sigma2	9.953076	1.474237			7.445236	13.30565
p11	.3681997	.1294728			.1637217	.6343438
p21	.4402081	.1037351			.2562819	.6421594

2. Transition probabilities

```
. estat transition

Number of obs = 39
```

Transition Probabilities	Estimate	Std. Err.	[95% Conf.	Interval]
p11	.3681997	.1294728	.1637217	.6343438
p12	.6318003	.1294728	.3656562	.8362783
p21	.4402081	.1037351	.2562819	.6421594
p22	.5597919	.1037351	.3578406	.7437181

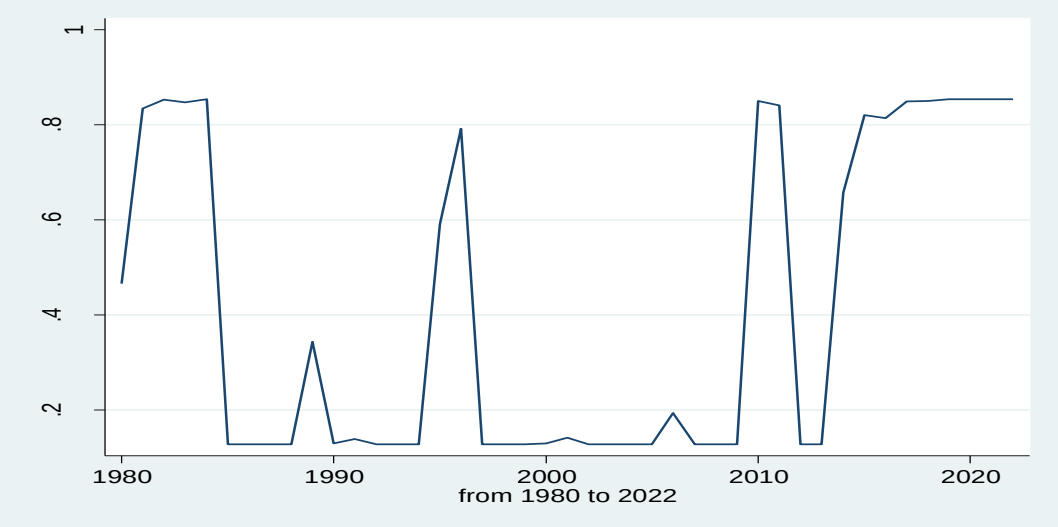
3. Duration of transition

```
. estat duration

Number of obs = 39
```

Expected Duration	Estimate	Std. Err.	[95% Conf.	Interval]
State1	1.582779	.3243537	1.195774	2.73481
State2	2.271653	.5353151	1.557246	3.901954

4. Filtered probabilities of regime one



5. Filtered probabilities of regime two