THE IMPACT OF INFLATION ON ECONOMIC GROWTH: A CASE STUDY OF SUDAN

BY

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF ECONOMICS AND DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN ECONOMICS OF THE UNIVERSITY OF NAIROBI

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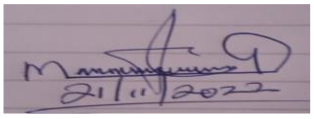
DECLARATION

This research project is my own original work and has not been presented for any award in any other university.

Signature:  Date: **21/11/202**

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This research project is presented for examination with my approval as the university supervisor

Signature …… Date: **01/12/2022**…

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DEDICATION

I dedicate this project to my family and the African Union Commission, who have been the main source of support and strength during the development of the project. This project is also especially dedicated to friends and classmates.

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I would like to give thanks to God for his protection and blessings this far. Secondly, I thank my family and the African Union Commission for the support they gave both moral and financial throughout the process. Further, I thank the University of Nairobi especially the Department of Economics and Development Studies for the opportunity they offered me to undertake my master studies.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADF: Augmented Dickey- Fuller

APEC: Asia-Pacific Economic Cooperation

CBN: Central Bank of Nigeria

CBS: Central Bank of Sudan

CPI: Consumer Price Index

GDP: Gross Domestic Product

IMF: International Monetary Fund

OECD: Organization for Economic Cooperation and Development

OLS: Ordinary Least Squares

VAR: Vector Autoregressive

WDI: World Development Indicators

ABSTRACT

Sudan's economic strategy has been concerned with ensuring price stability while maintaining sustainable expansion of the economy, but the findings from previous papers on effect of price rises on expansion of economy in Sudan produced contradictory results. The objective of this paper was to study the impact of price increase on Sudanese economy applying yearly information from the WDI between 1990 and 2020 and linear regression model. The research also applied pre- estimation and post estimation tests.

According to the study, the threshold level of inflation in Sudan is 7.4 percent and the inflation have significant and negative impact, which is 20 percent decrease in GDP in Sudan, owing to the recent decline in purchasing power of the Sudanese pound caused by the reduction of subsidies in Sudan and there was also negative correlation between GDP and inflation after doing the correlation test.

The study determined that the exchange rate has a positive but insignificant effect on Sudanese GDP expansion, and that GCF has positive and insignificant effect on Sudanese GDP growth. The results also revealed FDI has an important and significant effect on Sudanese GDP expansion, whereas net export has a positive but insignificant impact.

CHAPTER ONE
INTRODUCTION

1.1 Background information

The core goal of macroeconomic policy in most nations is to create sustainable economic development while maintaining price stability (Ismaila & Imoughele, 2015). The focus on stable prices in economic policy implementation is intended to foster sustained economic growth and strengthen the purchasing power of local currency, among other things (Umaru and Zubairu, 2012). The debate over whether persistence increase in prices is detrimental to the economy has lately erupted among policymakers and mainstream economists, with several studies predicting a substantial link among inflation nexus economic growth, meaning inflation is harmful to growth (Kurihara, 2013). In general, the rate of capital creation influences the pace of economic growth, and capital growth in the economy is always influenced by accumulation and saving culture in the country and investment rates (Datta & Kumar, 2011).

Sudan has been mired for so long in social conflict and civil war that led to a loss of about three-quarters of its oil output when South Sudan broke apart in July 2011 (World Bank, 2012) and since 1999, the oil industry has contributed considerably to Sudan's GDP development. For over a decade, the economy was powered by increased in crude oil production, high global prices for crude oil, and this has led to decline in GDP due to loss of foreign currency gains since the economic shock of South Sudan's separation (Lado, 2015). Sudan's already precarious economic situation was exacerbated in 2012 by the suspension of oil production in South Sudan for more than a year, as well as the resulting loss of oil transit payments (Munive, 2014).

Sudan faced severe US ban and sanctions on Sudan, which were removed in October 2017. Sudan is striving to diversify its sources of income away from oil, like gold mining and agriculture, while also implementing a cost-cutting program (Giumelli, & Weber, 2022). Sudan is the world's largest supplier of gum Arabic, accounting for 75-80 percent of global output. Agriculture even now utilizes 80 percent of the labor force (IMF report, 2018). Battles in Southern Kordufan, Darfur, and the Blue Nile states, limited infrastructure in vast areas with a significant portion of the population's reliance on agricultural output keep nearly half of the population poor.

After South Sudan independence, the republic of Sudan came up with a new currency, the Sudanese pound, which is still in use today but has lost value (Nyadera, 2018). Khartoum devalued the currency lawfully in June 2012 by taking austerity measures such as progressively lowering energy subsidies. Sudan also has a high inflation rate, which peaked at 47 percent in November 2012 but has since fallen to about 35 percent (World Bank, 2013). Countries with high inflation rates in the 1970s, notably those in South America, saw their rate rise, giving rise to the view inflation to be harmful on economic progress (Barro, 2013). Xiao (2009) found the impact of inflation on GDP to have been linked in several Asian studies, such as those from India and to these studies, the real GDP and the income per capita rates in China ranged from 2.68 to 4.84 percent, between 1961 and 1977, and the Chinese economy progressed steadily until 1978, while the growth rate varied over time from 1978 to 2007. China's GDP and per capita income increased at rates of 9.992 percent as well as 8.69 percent, respectively in that period as well (Shi, Yu, Huang, Hu, Yin, Chen & Wu, 2014).

East African nation statistics for instance, indicated that, Kenya enjoyed five years of highly favorable growth in the economy, including four separate years of growth above 4 percentage points between 2003 and 2009 (Tchouamou, 2013). Kenya's estimated annual inflation, on the other hand, surged from 18.5 percent in the second quarter of 2008 to 27.2 percent in March 2009, before falling to approximately 24.3 percent in July 2009. According to Adam, (2016), Uganda's economy grew at a rate of 7.8% per year since 2000, with overall inflation declining from 5.1 percent in 2006 to 3.5 percent in 2009. From 1990 to 1999, Rwanda's projected annual real GDP per capita which was negative while, between 2006 and 2009, Rwanda was having an average yearly GDP rate of about 7.3 percent (Stein, 2010) and whereas Tanzania's economic growth has been sensitive to a few internal and external shocks.

Financial experts, politicians, and central bankers in both industrialized and developing nations have long been fascinated by the link among inflation and economic growth, and this fascination continues (Ndoricimpa, 2017; Seleteng, Bittencourt, and Van-Eyden, 2013). Upholding price stability in the economy is one of the most essential tasks of monetary authorities and this approach assumes that monetary policy supports long-term development and growth by increasing the purchasing power of local currency and lowering price increase, hence leading to country's GDP expansion (Ruggie, 2020). Policymakers and mainstream economists had long

disputed inflation -economic growth nexus. This relates to the debate over whether hyperinflation is bad for business. This has become a heated topic (Umaru and Abdulrahman, 2012). In terms of the Sudan economy, following a slight budget deficit in 2012 after Southern region got independent which is now South Sudan, the government's finances worsened from 2014 to 2016 SCB, 2018). During the era, oil production outages, internal fighting, drought, and occasional assistance inflows all put a burden on the country's economy (Agbloyor, Gyeke-Dako, Kuipo & Abor, 2016). In contrast, expenditures increased dramatically, with recurrent spending, including security expenses, overshadowing infrastructure investment, and the country's budget deficit increased to 23 percent of GDP in 2016. The central bank issued credit to fund the vast bulk of the required financing (CBS, 2019). So essentially, the Bank of Sudan released money to help the government to fund its activities. At the same time, central bank reserves had plummeted to less than $100 million by the beginning of 2017 (Twijnstra, 2015).

Latest improvements, on the other hand, have begun to tilt the country's fiscal trajectory in a more favorable direction. The fiscal budget approved in November 2016 evidenced enhanced management performance as well as initial success in implementing a re - growth program that also included diverse revenue measures and a significant decrease in expenditures, with the goal of significantly narrowing the public debt and reducing the state's domestic financing needs (IMF, 2017).That included a considerable slowdown of economic development, and the IMF noted in March 2017 that while the fiscal budget included increases in revenue and excise taxes, expenditure on travel, wages, and the purchase of goods and services was restrained (Vogel,2021).

The International Monetary Fund praised good fiscal reduction for increasing the reliability and exposure to international monetary assistance, leading in a fiscal surplus in 2017 and a reversal to a deficit in 2018 if additional reforms prove challenging since funding deficit spending with bank loans would inevitably result in increase in base money, leading the money supply to expand (IMF, 2018). Figure 1.1 shows the trends in inflation rates, whereas Figure 1.2 shows consumer spending on key goods.

Figure 1. 1: Inflation (% change)

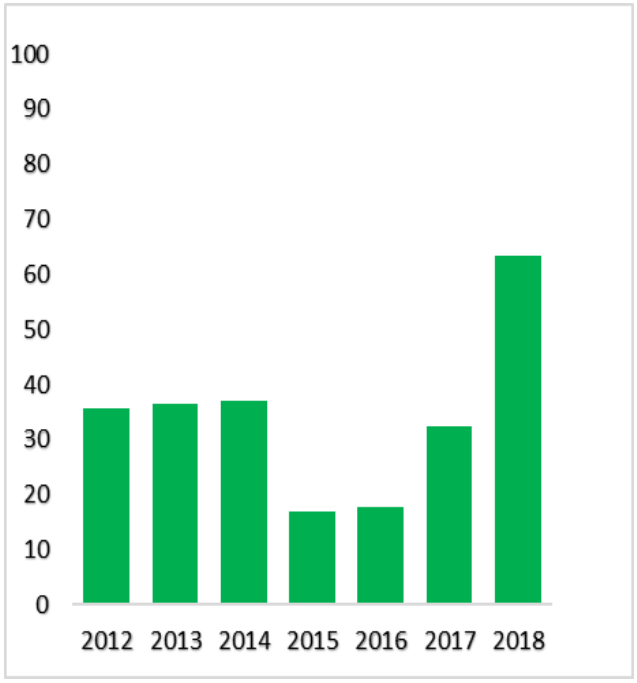
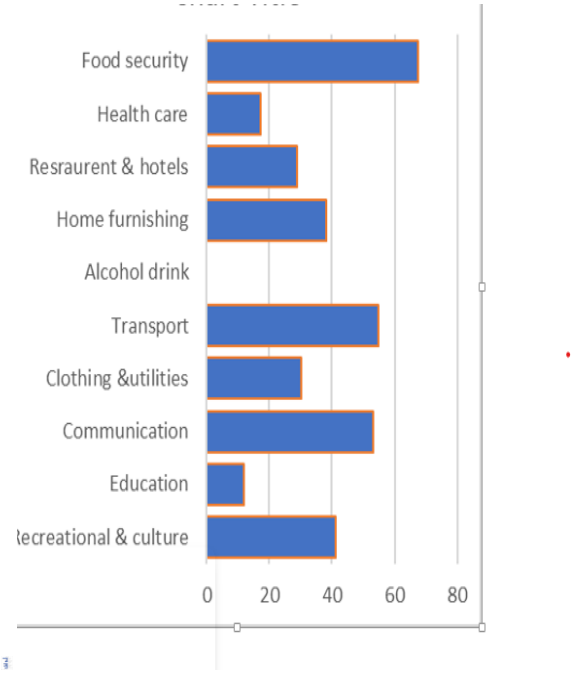


Figure 1. 2: Household spending (%), 2016



Source: IMF report, 2018.

According to figure 1.1, the Government of Sudan between 2018 and 2019 started experiencing public uprising that resulted into violence protests, causing its economic situation to swiftly worsen in the second half of the year, with inflation reaching 63.3 percent and failing to recover in 2019. The internal strike, low global oil prices, oil field being closed in the neighboring South Sudan where Sudan economy depend on partly, and other negative factors like war in Nuba Mountain and Sothern Darfur, all contributed to a decrease in economic activity in 2020. According to the IMF, the country's recession would moderate in 2022 with GDP falling by only 3.4 percent. While oil output is expected to rise and oil prices to rise slightly, the countries demographic dynamics will make economic expansion impossible. According to the IPC, (2021), the latest data shows that an estimated 7.3 million people in Sudan (16% of the population analyzed) are in high levels of acute food insecurity.

Figure 1. 3: Real GDP growth (%)

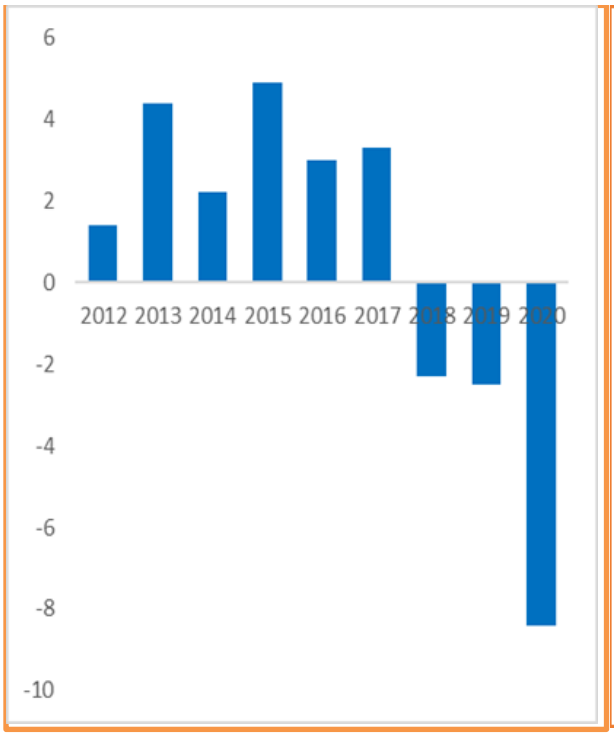
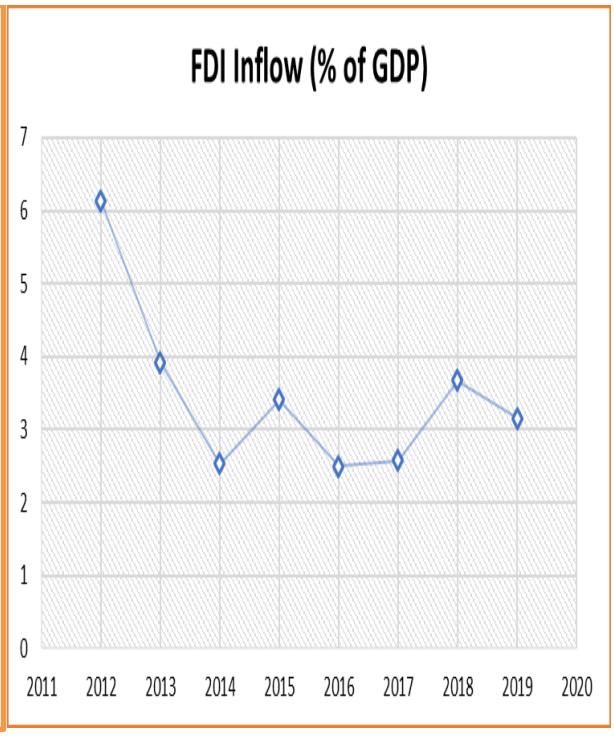


Figure 1. 4: FDI inflows



Sources: IMF, (2019) and UNCTAD, (2020)

Sudan's economy expanded moderately, in Fiscal Year 2019, the real GDP expanded at a rate of 1.8 percent, after all parties reached a peace accord. Although private spending continued to shrink, albeit at a reduced rate, a rise in exports and higher government consumption resulted in a minor economic recovery in Fiscal Year 2019 (IMF, 2019). Private investment returned to some extent in the average period between 2016 and 2017 as the economy continued the current recovery and rebuilding route. On the supply side, the agricultural and service sectors improved modestly, while industrial development was boosted by oil sector activity. Overall, crude oil export was a primary source of development in the near and an intermediate tenure, with oil field repair and restart continuing. However, a less optimistic view has developed as the peace accord falters, with growth in the fiscal year 2019 falling below 0.3 percent due to lack of expansion in the non-oil industries (UNCTAD, 2019).

Table 1. 1: Sudan: Key Economic Indicators (% change)

	2015	2016	2017	2018	2019	2020	2021 (projections)
GDP at constant market	-10.8	-11.2	-6.9	-3.5	1.8	3.4	4.8
Private consumption	-26.0	-16.0	-15.0	-7.5	-0.5	-0.5	3.9
Government expenditure	1.4	3.0	3.0	4.0	5.0	7.5	5.0
Gross fixed capital	2.0	0.0	3.0	4.0	4.5	5.0	5.5
investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in Inventory (%)	-40.0	-44.0	-20.0	-10.0	5.0	7.5	10.0
Exports	-41.0	-17.0	-10.0	3.2	5.1	5.4	5.5
Imports							
GDP at factor prices	10.9	-11	-6.7	-3.6	1.7	3.4	4.8
Agriculture	2.5	-15.0	-10.0	-5.0	0.5	2.5	2.5
Manufacturing	-23.3	-20.5	-7.0	-1.5	3.3	4.8	6.2
Service sector	2.3	4.2	6.1	0.0	-1.5	6.0	6.0
CPI	34.0	41.0	70.0	81.9	112.3	145.0	180.0
Current account balance (%)	-3.8	-7.5	-12.5	-11.7	-9.1	-11.1	-6.6
Fiscal balance (%)	-50.8	-8.5	-3.8	-3.1	-4.1	-10.4	-7.1
Poverty rate ($)	65.5	82.3	86.5	88.7	89.5	74.6	
Poverty rate ($)	85.4	94.5	96.8	97.7	97.9	92.2	
Poverty rate ($)	92.9						

Sources: Central Bureau of Statistics estimates (2020)

1.2 Statement of the problem

The impact of inflation on economic growth has drawn several studies which do not agree on this relationship, some studies support the linear relationship as positive, while other studies have found a nonlinear relationship. Inflation rates over a particular level, according to most studies, are bad to economic development, that is to say; inflation rates that are moderate or lower than the threshold have a positive effect on economic growth or have no effect at all. Sudan's recent price volatility has been a source of concern because high overall prices indicate substantial inflation. As a result, the country's inflation rate jumped to 18.96 percent in April from 18.30

percent in March 2020 (MoFEP, 2020). According to a World Bank assessment from 2014, Sudan's macroeconomic situation was unstable, and since then, a large and the general price level has been steadily rising and has been a frequent feature of the country's macroeconomic status. Sudan experienced inflation for a 12-month moving average between 2016 and 2020, with total inflation of 25.3 percent in 2016 following the depreciation of the Sudanese pound and in 2020, the GDP was 36.4 percent, with a comparable double-digit GDP growth rate of 11.2 percent in 2016 and 27.08 percent in 2020. Sudan's embryonic economic recovery, backed by the 2019 transition to democracy after civil uprising that toppled the government headed by Umar Al Basir, rising oil prices, and the resumption of oil production in some oil field in South Sudan, was thwarted once more in 2020 by locust invasions, floods, and the COVID–19 outbreaks (IMF, 2020).

Yabu & Kessy (2015) and Kimani & Mutuku (2013) showed an adverse link among inflation and GDP in Kenya; however, Wambui (2013) and Wanjiku (2005) revealed a positive link. Fundamentally, this causality is described by the nominal shocks have which have a real impact since nominal prices fluctuate, it causes upsurge in the average percentage of inflation induces companies to adjust prices more often to keep up with the increasing price level and therefore, the link remains contentious both hypothetical and empirical literature (Wanjiku, 2005).

Sudan's steady macroeconomic history, particularly in the single digits, for example, the total rate of inflation fell to about 40.1 percent in December 2018 from 123 percent in July 2018. However, beginning in 2018, following the five-year Sudan economic growth plan of the Growth and Transformation Plan (GTP), the monetary policy tried to maintain inflation below 5% because it is believed that inflation rates more than 5% are harmful to the economy (MoFEP,2018). As a result, the problem persisted in the country since the two macroeconomic factors were not thoroughly examined to resolve this link. The link among inflation and economic growth is still hotly debated, equally theoretically and then empirically. Furthermore, the threshold points of inflation that turns out to be discouraging growth of the economy still has no conclusion and rely on the growth condition of a given state; thus, such a gap inspired this study to provide policy implications regarding the target of inflation that the central bank of Sudan should focus on, and thus, this study tried to fill the knowledge gap using annually disaggregated data from Sudan's post-socialist regimes.

1.3 Research Questions

This paper aimed to response to the resulting study questions:

i. What is the threshold level of inflation in Sudan?
ii. What is the impact of inflation on Sudan’s economic growth?

1.4 The Objectives of the Study

The key objective of the paper was to investigate the relationship between inflation and economic growth in Sudan. The specific objectives were to:

i. Determine the threshold level of inflation in Sudan
ii. Estimate the impact of inflation on Sudan's economy
iii. Provide policy implications of the findings

1.5 Significance of the Research

The study is crucial since it will provide findings on the effect of inflation on economic growth of Sudan given that the Sudanese economy has been exhibiting double-digit economic growth combined with a high rate of inflation that has plagued the country for several years since its independence in 1956 (CBS, 2020).

Therefore, this will provide policy implication which will aid policy making in Sudan especially, the Sudan Central bank and Ministry of Finance to develop policies that aims at alleviating the effects of inflation on the economy.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

There are significant number of literatures on the inflation-economic growth nexus, with many scholars and writers writing on the impact of inflation on economic growth. This chapter addressed numerous theories that explain economic growth, as well as some empirical research on the issue.

2.1 Theoretical review

The section looks at different growth concepts like neoclassical, endogenous and the monetary growth theories that explain the economic growth.

2.1.1 Neo- Classical Theory

This focus on well-adjusted factors of production that is say, capital, labor, and technology to most important factors for economic stability. Furthermore, economic stability required temporary equilibrium to work adequately, a relative capital size and well-integrated labor and technology must also be in place (Nyadera, 2018).

Neoclassical growth theory used the production which comprise of three factors as below:

Y = AF (K, L) where Y is GDP of a given country, K mean the share of capital in the model, L mean the share of labor force in an economy and A is the level of technology in the country.

The capital accrued by a given state is very vital to the growth of an economy and so does labor and technology in achieving economic stability though, both unskilled labor and technology diminishes as time goes by while technology does not.

Mundell's (1963) thesis that economic growth and inflation are connected underpins the Neo-classical theory. According to Mundell, any change in an inflationary outlook has an influence on prosperity. Therefore, rising inflation deplete means by sinking the rate of return. People save to purchase more assets, according to Mundell, and consequently, asset values increase as demand grows, driving interest rates to fall. The more savings is accessible, however, the bigger the quantity of capital accumulation and, therefore, the quicker the pace of development.

This theory says that consumers put off present utilization through capital investment or saving capital (Ripsman, Taliaferro & Lobell, 2016). Again, it says as persons move away from money and toward capital, the capital stock goes up, which makes the steady state go up as well. People think that the economy is adjusting or changing, so the increase in output is only temporary. The term "lazy dog effect" refers to how inflation affects the growth of capital and the economy. It happens when returns on capital reduces, which makes both capital accumulation and economic growth go up and people think that inflation makes the economy grow faster because it causes people to save more money.

Recent models, however, have demonstrated that economic growth nexus inflation may have a bidirectional connection. Inflation, according to Stockman (1991), lead to a decrease of the steady state since it erodes the purchasing power of individuals to get consumer goods, hence end up reducing their spending and lowering the steady state level. Inflation also has a negative impact on labor returns, causing people to spend their spare time instead of their money.

The marginal rate of return on labor falls as inflation rises, and both the steady state and capital returns decline. According to Schweller (2014), neoclassical model provides a broader kind of theoretical implication concerning the linkage among economic growth nexus inflation and according to the Stockman Effect, increasing prices causes production to decline.

2.1.2 Endogenous Growth Theory

It says that factors like new technologies and scale of operations or mobility of capital, which are part of the production function, control economic growth, not outside factors. The endogenous conceptual framework is focused on a completely multiple linear regression with wealth creation as the response variable and ranging from business or currency devaluation like the explanatory parameters (Haslag, 1995). The biggest disparity in among internal growth theories and indeed the neoclassical model that under the analytical framework, as accumulation of capital grows, capital payments and financial to go down instead of going down to negative values. The model says that externalities influence how capital is used, while scale of operation has such an effect on how things are made (Akcigit & Ates, 2021).

Even though taxes are thought to hurt investment returns on new investments, the theory says that economic growth is affected by the returns on capital, wages, and the salaries and people will be

more likely to choose leisure over work if taxes are high, and taxes on capital would slow down economic growth. There has been a lot of talk about how inflation affects economic growth and according to the study a pessimistic relationship amid inflation and employment causes negative effect on the GDP and that inflation has two effects on growth: it reduces the marginal income tax rate of productivity levels and the rate at which capital is added (Gomme, 1993). According to Gomme (1993), lowering prices will have little influence on economy. According to Haslag (1995), inflationary effects are frequently manifested as a drop in deposits, that can harm the savings, and so does the capital accumulation as well as economic growth.

2.1.3 Monetarism Theory

Milton Friedman came up with the word "Monetarism," which is based on the idea of long-term supply. Friedman says that long-term supply factors connect money circulation to growth (Gomme, 1993). Theory of money especially quantity theorem, for example, shows a link that exist among CPI and GDP by comparing the money circulation to the amount of money spent by the economy and hence, Friedman says that the equation can be written like this:

$$\mathbf{MV = PY}$$

M represent stock of money in circulation, V represent velocity of circulation, P is the price, and Y is the output and when using the above equation, Hence the rate of inflation is written below.

$$\mathbf{p = v + m – y}$$

P is the rate of inflation; money velocity is represented by V and m is the stock of money and y is the output.

Friedman reasoned about equation rises the speed and quantity of currency larger than present pace of expansion of the economy aggravated the problem. The study went on to add that the influence of price increase on the expansion of the economy is determined predicting the rate or not. In anticipation of predicted inflation, consumers adjust their purchasing habits and battle for pay increases, resulting in inflation rising in lockstep with wage increases (Gomme, 1993). When this occurs, a rise in inflation has no impact on employment or growth, which is recognized as monetary impartiality. Thus, prices increase is not deemed damaging since money growth drives

long-term prices rather than growth, according to the monetarism approach, and inflation occurs when the money supply surpasses the pace of the output.

2.2 Empirical review

2.2.1 Threshold level of inflation

Frimpong and Oteng-Abayie (2010) found that inflation slowed economic growth in Ghana by 11 percent and that was between 1960 and 2008, but that wasn't enough to pass the significance test. After taking out the growth rates of the aggregate labor force and money supply, which the OLS models failed to capture and hence came up with a strong 11 percent inflation threshold level with near coefficients. They also found that inflation is still a big deal even at lower threshold value and as a result, the study concluded by emphasizing the necessity to broaden the area of research to find evidence supporting lower threshold levels. To me, the weakness of this finding is that it did not give additional evidence of threshold effect and thus failed to examine the responsiveness of the estimated coefficients over the entire sample period.

In Rwanda, Rutayisire (2021) looked at the cut points in the bond linking inflation nexus growth. The study found very low levels of inflation don't hurt the growth of economy, but higher levels do. According to the research, the rate of inflation is expected to be 14.97%. In the research on inflation nexus economic growth, Sattarov (2011) looked at the link among price increase and economic expansion as well as the threshold of inflation in Finland. The study used time series from 1980 to 2010 and in the long-term, it showed economic growth and price increase are linked definitely, and the level that Firms are comfortable with is 4%, however, to my own view this study failed to distinguished the conditions in which firms in developed and developing countries are comfortable with that rate, for example 4 percent inflation rate would be harmful to economic growth in developed nation since it would discourage investment than it would be in developing countries.

Furthermore, Niyizurugero, (2021) investigated inflation dynamics and economic growth in Rwanda and this research relied on time series information. According to the results, a 1 percent transformation in inflation increased economic growth by 0.03 percent, while a 1 percent change in capital and currency markets increased economic growth by 0.04 percent and -0.21 percent,

including both. The study also suggested that Rwandese policymakers aim to maintain rising prices at the basic price possible to achieve and promote growth.

Mubarik (2005) was using historical data from 1973 to 2000 to determine Pakistan's inflation threshold, and the research employed Ordinary least squares (OLS), two stage least squares (2SLS), and Granger causality tests, with the results indicating that Pakistan's inflation threshold was 9%, and1 there was a one-way link between inflation and economic growth.

Khan and Senhadji (2001) reviewed if there are inflationary levels above which inflation has an adverse effect on economic growth. Using unbalanced panel data from 1960 to 1998 for 140 industrialized and developing countries and conditional least squares, the researchers discovered that the amount of inflation that slows economic expansion is between 1% and 3% in rich countries and 11% to 12% in least developed countries. The study's findings, however, are not applicable in the real world today because most developing countries are now aiming for a lower level of inflation below 5% and thus did not consider other factors in this regard.

Khan and Senhadji's (2001) work were expanded by Bick et al. (2009), who created a panel of 124 advanced and emerging economies from 1950 to 2004 and a threshold method to examine the connection among growth and inflation. They found the target rate for advance economies is about 2% and for developing economies it is about 17%. If inflation stays below 17 percent, it doesn't have much of an effect on economic growth. This doesn't show that inflation helps non-industrialized countries grow economically. Sarel (1996) used data of 87 countries from 1970 to 1990 to look for nonlinear influence of inflation on economic growth. Using Ordinary Least Squares (OLS), the researchers were able to figure out that the structural break of inflation was 8%. To me, the researchers failed to conceptualize on other shock which affects economies/countries differently. For example, natural disasters and internal conflicts can influence the association between these variables since investments will not take place in countries which are in most cases subject political turmoil.

Yabu and Kessy (2015) tested a positive inflationary level for development in Kenya, Tanzania, and Uganda. According to the study, "the credit-to-GDP ratio, economic openness, and FDI have a significant and beneficial impact on economic growth." According to Hasanov (2010), the relationship between economic growth and the price level in Azerbaijan was nonlinear, positive,

and dependent on fixed capital formation, with inflationary pressures on economic growth detected at levels lower than 13%. At levels above 13%, the link between economic growth and inflation is especially beneficial. This argument was supported by Umaru and Zubairu (2012), revealed that although expansion of economy generates high prices, it cannot stimulate growth. These findings to my own view, are not in line with how today's economies can react to economic shocks and how countries would keep inflation rate lower than 5% threshold because most countries be it developing or developed nations are aiming at threshold level of inflation which is lower than 13% to that effect.

2.2.2 The Impacts of Inflation on Economic Growth

Fischer (1993) investigated the correlation among rising prices and economic advancement utilizing cross-sectional and panel data sets from developing and developed countries. Fischer revealed an encouraging link between growth and inflation when inflation was low, but as inflation rose, the relationship deteriorated. Correspondingly, Barro (1995) examined the effect of price increase on investment and growth using panel data from 100 countries from 1960 to 1990, including instrumental variables (IV). Based on the report's results, price level has a important adverse effect on equally progress of economy and investment, and investment is the key platform in it influences the progress of economy; however, this is not true for me because many other factors are always in play through which inflation influences the expansion of the economy, such as unemployment, economic shocks, and other external factors.

Ghosh and Phillips (1998) examined data in 145 nations from 1960 to 1996 using OLS, 2SLS, and a decision tree to investigate whether there was a connection among inflation nexus economic progress and these parameters contain a statistically and economically important negative connection, with the two variables having an encouraging link when inflation is between 2-3 percent and below to assess the negative influence of price rises on the expansion of the economy. Harris et al. (2001) investigated the link among increasing prices and the progress of the economy effect hypothesis and made used of panel data from OECD and APEC countries, as well as an endogenous growth model and instrumental variables (IV).

Veni and Choudhury (2007), in contrast hand, conducted an econometric study on the Indian economy using time-series data collected annually from 1981 to 2004, examining the connection among price increase and the GDP. The Co-integration and Granger causality tests were used in

the study, and the two variables did not co-integrate, and there was no correlation between inflation and economic growth, indicating that the two are unrelated. Wai (1959) used a scatter plot, least squares, and weighted average to examine the relationship between inflation and economic progress in developing countries from 1938 to 1954. According to the study, there is no link between inflation and economic growth, so the findings are inconclusive. The weakness of these empirical studies, in my opinion, is that they failed to connect their analysis to known theories, which would have resulted in a conclusive finding on the relationship between the two variables. Second, country-specific conditions, data types, and time factors can all influence the relationship and thus the findings, which they failed to account for in their research.

The effect of price rises on Malaysian GDP growth was investigated by Akter and Smith (2021). The investigation used data from secondary sources and ranges from 1961 to 2019. The data was provided by World Development Indicators (WDI) and according to the VECM, the increasing prices is undesirably related to economic progress, and price level reduces GDP rapidly but increases it in the long run, according to the report.

Xiao (2009) investigated the connection among China’s inflation nexus economic development using data from 1978 to 2007. The research indicated a significant encouraging link among these parameters. To the research, price increase and economic growth have a two-way causal link. Varia Antui et al. (2013) investigated Ghana's economic development. Co-integration check and the Error Correction Model was used to do the analysis from 1980 to 2010 and based on this research, increase in prices and labor force all have a positive influence on expansion of the progress, even if labor force is statistically insignificant. However, this study failed to reveal the degree at which a rise in prices is conducive to promote expansion of the economy in the country especially in developing countries where economies are affected by other economic shocks like political turmoil.

Anidiobu et al. (2018) used Descriptive and Ordinary Least Squares methodologies to examine the impact of price increases on Nigeria's economic progress from 1986 to 2015. According to the findings of the study, inflation has a significant and negative relationship with Nigerian economic development, whereas the exchange rate and interest rates have a positive effect on the economy. Inflation and interest rates hampered Nigeria's economic development, which had a long-term negative impact. IIdris and Suleiman (2019) examined the effects of inflation on

Nigeria's economic progress from 1980 to 2017. The study's weakness is that it does not explain how exchange rates and interest rates affect economic development. The study did not provide the magnitude of the effect that these two variables had.

Boyd et al. (2001) used statistical data from 1960 to 1995 to conduct a cross-sectional analysis. The study looked at the influence of inflation on economic progress by considering parameters including trade volume and capital market. According to the study's results, a property rate of inflation relates to little domestic lending to the personal sector with a non-linear link among inflation and money supply. The established results demonstrated that the implications of the interaction between inflation and the square measure of the economic process are restricted for a purpose of lowering the rate of inflation. There exists the association among the economic process, investment and inflation, which was identified. Inflation variance has a pessimistic influence on economic progress in developing Nations, but there is no evidence that it has an impact on developed countries. Jha and Dang (2011) examined the effects of inflation fluctuations and economic progress on both developing and developed economies using annual historical data. The weakness of Boyd et al. (2001) is that it restricted the square measure of economic growth which was not considering the purpose of degree of freedom among the variables of study thus gave a wrong conclusion regarding how inflation changes base on the level of a Nation, be it developed or developing country.

Kasidi and Mwakanemela (2013) examined the impact of inflation on economic expansion in Tanzania using data over the period, and the research found that inflation has an adverse effect on the economy in the short run, but there is no long-term link between macroeconomic factors in Tanzania. Tadele (2014) investigated the impact of inflation on economic growth in Ethiopia and Uganda using annual time series data from 1990 to 2012. According to the findings, Ethiopia's GDP and inflation rate are higher than Uganda's, owing to a large positive bi-directional feedback relationship between inflation and economic advancement. The study, however, revealed only a one-way negative relationship between growth and inflation in Uganda, and it recommended that both countries implement a stabilization program to address inflationary conditions.

Sahadudheen (2012) investigated the factors that affect inflation in India. Increases in GDP or broad money have a long-run favorable influence on inflation, according to the study. A rise in either rate of interst or the exchange rate have significance effect. Inflation, according to Seleteng

(2015), has had a negative impact on regional economic development. The Mundell-Tobin effect has been countered by inflation, which has stifled much-needed economic development in the region. The study emphasizes the significance of an institutional framework that promotes a stable macroeconomic environment.

According to Wambui (2013), taxation and government expenditure enhance Kenya's GDP level, according to many independent relationships. Different degrees of inflation had varying effects on GDP, i.e., some levels of inflation enhance GDP while others reduce GDP. Taxes, inflation, government spending, and economic growth all have a linear relationship, according to the study. In World Bank research, the equations were re-estimated to separate the effects of inflation and real interest rates in a financially restrained economy. World Bank, 1993) used data from 20 countries to show how the real interest rate and inflation rate affect the growth rate of GNP. But when money was tight and nominal interest rates stayed the same, the positive relationship between real interest rates and growth was a sign that inflation and growth were going in the wrong direction. When inflation was considered, the real interest rate coefficient was no longer statistically important, but the negative coefficient on the inflation rate stayed.

According to Mwase (2006), inflation that was unexpectedly large reduced the real value of financial assets, and increased the risk involved with holding them. High inflation rates were also volatile, and the accompanying negative and unstable real interest rates discouraged domestic financial savings. Low-to-moderate inflation encourages financial savings, especially at consistent rates. However, conditions can never be the same for developed and developing nations, developing can have allowance of 17 percent inflation threshold while, developed nations consider a 2 percent inflation as the best threshold.

Kryeziu and Durguti (2019) looked at how inflation affects economic growth in the Euro zone and researchers utilized yearly panel data with a total of 257 observations from 1997 to 2017. The inquiry and results were obtained utilizing a multivariate linear regression model using least squares regression. Furthermore, more analysis was conducted to investigate whether inflation had a significant influence on an economic progress as an independent variable. The results of the tests clearly show that serial correlation and heteroskedasticity are unrelated in the model and inflation has important effect on the pace of economic progress in the euro region.

The uneven effect of increase prices on progress of Vietnam's economy was explored by NGOC (2020) using evidence from a nonlinear ARDL technique. Long-term evidence suggests inflation to have a negative and imbalanced influence on economic progress. The influence of currency value on economic progress was encouraging in both short and long term. Therefore, a rise in the inflation rate has a higher effect in the long term than a reduction. This disparity has a significant impact, and high inflation will devastate economic activity. Consequently, the research offers empirical data for policymakers to use in developing monetary policies and controlling inflation to promote long-term economic development.

Chibwe, (2015) investigated the correlation among Zambian inflation and economic growth (1980-2011). The analysis later applied a time series data, which included both pre and post estimation test by applying VAR. To investigate the relationship, expansion in the natural log of inflation measured CPI and growth in real GDP and because correlation does not exist, thus no link in the long run.

In Ghana, Kankpeyeng, Maham and Abubakar (2021) examined the effect of rise in prices on economic expansion. Information for study was extracted from WDI (1986 to 2018). For analysis, the study adopted vector autoregressive (VAR) models. The study findings established that the inflation rate, physical capital, and supply of money meaningfully affect progress of GDP during the study period, whereas government spending adversely and significantly affects the progress of GDP. Mbonimpa (2019) investigated the effect of prices on economic growth in Burundi (1980-2014). The study used secondary data from 1980 to 2014 to determine the role of the inflation and money supply in boosting Burundi's GDP however, no correlation in the long run.

Shibanda (2020) investigated the effect of rising prices on Tanzanian productivity expansion from 1995 to 2017. The findings indicated prices increase is critical to the expansion of the economy because results revealed all the parameters influence one another. Secondly, using several analysis tests like the correlation analysis and VAR, the hypothesis was tested that price increase affect economic expansion have positively

Yemane (2008) investigated the link among Ethiopian economic growth – inflation nexus. An assessment of the empirical evidence was obtained for the period 1971 to 2006 using yearly data sets on gross Domestic product as well as other variables, using the cointegration and error

correlation models. Aside from that, it delves deeply into a fascinating policy issue: what level of inflation is appropriate for the economy.

In Kenya, Akinsola and Odhiambo (2017) examined the effect of inflation on economic development, with resulting indicating that the effect varies by nation and throughout time, according to the study. According to the study, the conclusions of these studies can be also influenced by State condition and features, the availability of information, technique applied, it then indicated clear evidence of an adverse connection among the parameters, specifically in advance nations. But much discussion over what threshold level is appropriate for growth. However, even it is true about this connection, some countries indeed have inadequate information regarding trucking major macroeconomic variable which can prove difficult in estimating the link.

Furthermore, Kigume (2011) investigated the connection among rising prices and Kenyan economic growth (1963-2003) and applying secondary data while adopting Philip's cure to do the analysis. To establish the connection among the variables, the OLS was used however, no connection among prices increase and the rate of progress of the economy, and research indicates a negative link among these parameters rapidly and a encouraging association in the extended run.

Moriyama (2008) revealed that adjustment in money circulation influence prices increase with 18- to 24-month lag when studying the inflation dynamic in Sudan applying a single equation model. This study however, failed to look at other distinct factors that can affect economic growth in Sudan because it only looked at money supply to influence inflation in Sudan.

Makuei (2016) studied the effects of rising prices on Sudanese economy (from 1980 to 2016) applying different econometric techniques such as unit root analysis, and finally simple regression. The results showed that the co-integration technique established a link among domestic inflation and economic expansion. According to the findings, inflation has an adverse influence on Sudan's economy and there was no co-integration among the main parameters in the Sudanese economy, according to the study. The study's weakness is that it failed to establish a long-run connection between these two variables.

2.3 Overview of Literature

The link among price increase and economic expansion is still debatable and this comes from the perspective that most economists keep asking on having stable prices while maintaining economic growth at a sustainable level. Meanwhile most empirical literature reviewed shows encouraging outcomes (Mundell, 1963; Tobin, 1965), adverse (Stockman, 1981), or impartial (Sidrauski, 1967). Other studies backing the linear correlation as positive, while others have found a nonlinear link among price increase and expansion.

The absence of agreement among the previous studies was, therefore, a good justification that more research was needed in this area. Furthermore, the review looked at several studies from global and regional perspective though there were few studies on inflation-economic growth nexus locally, the study by Moriyama (2008) only focused on inflation dynamic in Sudan but, failed to explained the degree of impact that rise in prices has on expansion of the economy and this was the gap as the current research would reveal and make conclusion on the relationship which may be similar with either of revealed relations in the literature by answering the main question on ; what is the impact of inflation on economic growth of Sudan.

CHAPTER THREE
METHODOLOGY

3.0 Introduction

The research paper used different approaches to determine the impact inflation has on economic growth: a case study of Sudan was explained in this chapter. It contains the study's conceptual framework, empirical model specification, diagnostic tests, and the source of data.

3.1 Conceptual Framework

The model used in this study demonstrates how independent variables such as inflation (as measured by annual CPI), rate of exchange (as assessed by yearly currency rate seen between Sudanese Pound and the United States dollar (SDG/USD), gross capital formation (as calculated by annual interest rate), export and foreign direct investment (as measured by gross national inflows) influence the dependence variable, economic growth (GDP growth rate) (GNI).

Inflation is expected to harm economic growth because rising rates of inflation result in increased price levels, that also reduce firm profits. Gross capital formation can affect the expansion of the economy in either a negatively or positively because when interest rates are high, investors borrow less, discouraging investment and thus economic growth, and when interest rates are low, the opposite is true. As a result, the rate of exchange is closely linked to the economy because entrepreneurs invest in foreign currency with the expectation that it will appreciate relative to other currencies, and foreign direct investment and net export are expected to boost economic growth.

In the conceptual framework, inflation and deflator are both measured by (CPI) each of which is the reverse of another. These two variables have great impact on the GDP but of all, inflation affect the GDP negatively.

The rate of exchange and gross capital formation have effect on the inflation, and this is because when Sudanese pound losses value, the prices will increase and this in turn lead to decrease in GDP. Secondly, foreign direct investment and net export relate in a sense that, when investment is taking place, production will be high, and prices locally will drop which in turn increases export of and thus in turn increases the GDP.

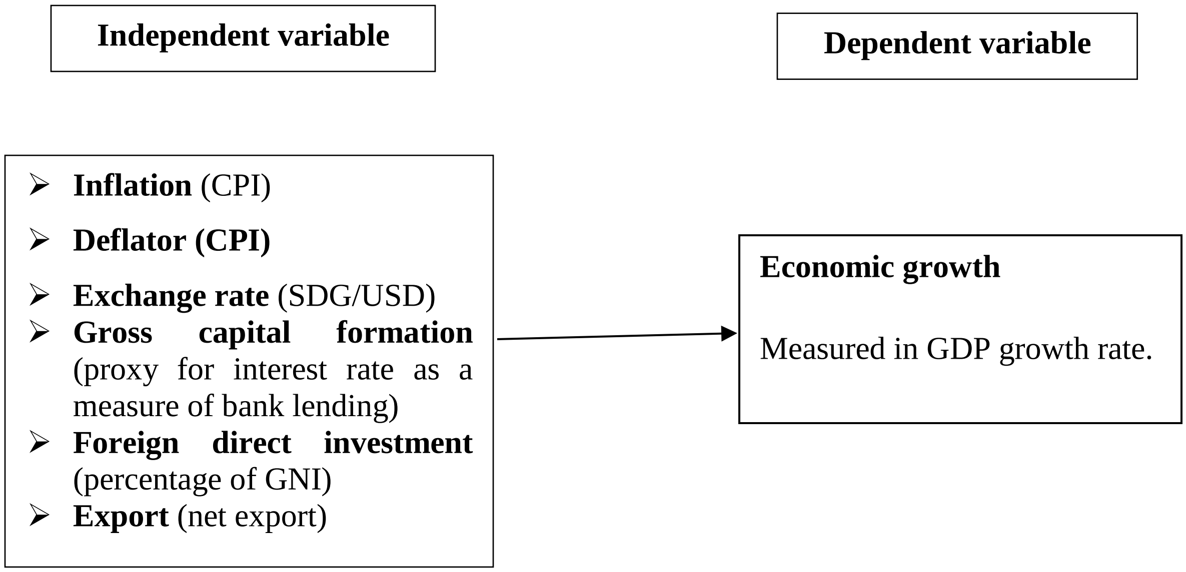


Figure 3. 1: Conceptual Framework

3.2 Model Specification

The production function was written in standard notation as follows and at the later included inflation and other variables as inputs alongside labor and domestic capital.

$$Y = f(L, K, A) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1a)$$

from here, Y is the output, L is the labor input , K is the capital input and A is the technology and the production function was further being written in Cobb Douglas production as below.

$$Y = AL^{\beta}K^{\alpha} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1b)$$

Equation (1b) was therefore modified in the following expression describing how the determinants of the growth rate of real GDP was obtained:

$$y = \alpha + \beta l + \delta k + \theta l + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Again, when transforming these factors of production, it yields equation 2 as seen above. Furthermore, the population growth rate was typically substituted for change in labor input.

Following the example of Karras (2006), this analysis considered the proportion of inflation as measured by CPI as another factor that can affect Sudan's economic growth, in addition to foreign direct investment and from the above model, the empirical model is specified as follows:

$$GDP_t = \beta_0 + \beta_1 INF_t + \beta_2 DEF + \beta_3 ExC_t + \beta_4 FDI_t + \beta_5 GCF_t + \beta_6 EXP_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where GDP is the rate of economic growth, ExC is the exchange rate, INF is the rate of inflation, DEF is the deflator that will capture the decrease in general price level, GCF is gross capital formation as a measure of real interest rate, and EXP is exports.

The estimated model parameters are denoted by β ′s, also known as the coefficients and it also accounts for additional parameters that can also affect economic expansion but not accounted for in the model, and for the estimation of Sudan's inflationary threshold, a modified version of the Khan and Senhadji (2001) model was used.

$$GDP_t = \beta_0 + \beta_1 INF_t + \beta_2 (INF_t - K) + \beta_3 EXC_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

GDPt denotes the GDP growth rate, INFt is inflation rate, K the constant used to estimate the threshold level of inflation, EXCt the exchange rate, and is the error term.

To reduce the effect of outliers and get the elasticity of model coefficients, some variables like GDP, inflation deflator and net export in this paper were changed to natural log as follows:

$$\ln GDP_t = \alpha_0 + \alpha_1 InINF_t + \alpha_2 InDEF + \alpha_3 ExC + \alpha_4 GCF + \alpha_5 lnNEXP + \alpha_6 FDI + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (5)$$

GDP stand for GDP growth rate in Sudan, InINF is a natural log of inflation and DEF is the deflator which are both measured by CPI, ExC is an exchange rate which is measure in US dollar terms, GCF is a gross capital formation which is a measure of real interest rate, lnEXP is a natural log of export, FDI is foreign direct investment, ε_t is the error term and α_0= intercept, while α_1 to $\alpha_6$are parameter estimates of the explanatory variables

3.3 Variable Description and Measurement.

The regression coefficient is the growth rate estimated by GDP, inflation indicated by annual consumer index as a percentage of GNP, inflation rate, and deflator, which are introduced as control variables in the model, and inflation is likely to have an adverse influence on Sudan's economic progress. The natural log on some variables was introduced to cater for change in the coefficients.

Table 3. 1: Definition and measurement of the variables.

Variables	Variable description	Unit of measurement	Expected relationship	Literature source
Gross domestic product (GDP)	GDP is a dependent variable in this study measured by growth rate	rate		Barro (1995)
Inflation rate (INF)	The annual consumer price index is used to estimate inflation (CPI) which is the focus of this study.	rate	Negative	Barro (1995)
Exchange rate (ExC)	The Sudanese Pound to US dollar conversion rate is denoted by ExC.	rate	positive	Havi et al. (2013)
Deflator (DEF)	DEF is the deflator which captures the decrease in general price level while the purchasing power increases. It is also measured by consumer price index (CPI).	rate	positive	Barro (1995)
Gross capital formation	GC is measured by annual interest rate	rate	Negative/positive	Idrisand Suleiman (2019

Foreign Direct investment (FDI)	FDI is measured by total value of investments in both capital and financial that come from abroad to Sudan.	rate	positive	Anidiobu et al. (2018)
Net Export (NEXP)	Sudan's total change in trade value is represented by net export (NEXP) and it is the difference between total exports and import.	rate	positive	Tadele (2014)

3.4 Diagnostic Tests

3.4.1 Pre- estimation tests

Stationarity test

Augmented Dickey-Fuller (ADF) to check for stationarity was used and this used equation (6a), where the null hypothesis for each of the two tests is unit root if ($\delta = 0$), whereas an alternative hypothesis is ($\boldsymbol{\delta \neq 1}$), indicating that variables are stationary, and the following expression was used in the analysis:

The research based its decision on the critical values of the Tau statistic in comparison with the former. The procedure for Augmented Dickey-Fuller (ADF) test were as below in equation (6a):

$$\boldsymbol{\Delta Y_t = \alpha_0 + \alpha 1_t + \delta Y_{t-1} + \sum_{j=1}^{n} \delta j \Delta y_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6a)}$$

The study used ADF to overcome the issue of potential autocorrelation in the error terms when testing the unit root by including the dependent variable's lagged difference and it was applied as follows:

$$\boldsymbol{\Delta Yt = \omega + \beta\,(t - T/2) + (\rho - 1)\,Yt\text{-}1 + \delta Yt\text{-}1 + \varepsilon t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6b)}$$

Chow test,

This paper used Chow test to test for potential structural break in the series and this would allow detecting whether a particular time lag causes a break in the coefficients in the regression on another lag.

Chow = $(RSS_p-(RSS_1+ RSS_2))/k/ (RSS_1 +RSS_2)/(N_1+N_2-2k)$

The null hypothesis will be no break and if the F-value is < 0.05, then the study would fail the null in favor of alternative hypothesis that the break exist

Testing for Multicollinearity,

The Variance inflation factor (VIF) was used in this paper to determine whether any independent variable was correlated with one or more of the other explanatory variables in the regression model. If this problem was not detected, the statistical significance of the independent variable would be underestimated.

If the VIF value is 1, it indicates that there was no link among the independent parameter and any other explanatory parameters in the model.

Second, a VIF value between 1 and 5 indicates moderate correlation and no major corrective measure was required. However, if the VIF value was greater than 5, the model has a high level of multicollinearity and thus the coefficients are poorly estimated, putting the P-values in doubt.

3.4.2 Post estimation Tests

Autocorrelation Test

The Durbin-Watson test was used in the study to test for autocorrelation in time series because it helps reduced underestimation of standard errors in the series.

Its hypothesis was that null hypothesis would be Ho = there was no first order correlation in the series.

H1 = First order autocorrelation exists in the series as an alternative hypothesis.

The test statistic values would range from 0 to 4, with a test value of 2 indicating that there will be no autocorrelation in the series.

When it falls between 0 and 2, the series has positive autocorrelation, and when it falls between >2 and 4, the series has negative autocorrelation.

Ramsey's RESET test

To overcome variable measurement errors in the regression model, this paper used Ramsey's RESET test to determine whether regression analysis was appropriate and whether the link among the dependent and the independent parameters was linear or non-linear.

The null hypothesis was that t = 0, implying that no variables were left out of the model and that the power of the fitted value has no relationship that would clearly explain the dependent variable in this case. The alternative hypothesis was that t0 indicated an omitted variables problem in the model.

3.5 Data Source

The paper used time series data from 1990 to 2020, a period of 30 years and the data came from the World Development Indicator (WDI) and the World Bank.

CHAPTER FOUR
DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter] focus on descriptive statistics, empirical regression results, unit root for stationarity, post estimation test are presented, analyzed and discussed**.**

4.2 Descriptive Statistics

The descriptive information is shown in table 4.1, on selected parameters from 1990 to 2020. The summary of common data include means, maximum and minimum values as well as standard deviation of each series after some variables have been transformed into logarithmic form. The descriptive statistic revealed that average logarithm value of growth domestic product (lnGDP) is 0.644 with standard deviation of 0.321 while the data range from -0.283 to 1.062, inflation (LnINFL) was measured by CPI and range from 0.287 to 2.177 respectively, the mean is 1.435 and standard deviation of 0.469 while the average value of logarithm of exchange rate (InEXCR)is 0.333 with standard deviation of 0.219, and the average logarithm value of gross capital formation (InGCF) stood at -1.005 with standard deviation of 30.498. In a similar glance of the descriptive statistics, the average value of foreign direct investment (InFDI) and that of net export (InEXP) variables are 2.884 with standard deviation of 6.369 and 0.714 with standard deviation of 0.552 respectively.

Table 4. 1: Descriptive statistics for variables

	Obs	Mean	Std. Dev	Minimum	Maximum
LnGDP	31	0.644	0.321	-0.283	1.062
LnINFL	31	1.435	0.469	0.287	2.177
LnDef	31	2.532	0.953	0.261	4.306
EXCR	31	0.333	0.219	0.131	1.005
GCF	31	-1.005	30.498	-60.000	92.958
FDI	31	2.884	6.369	-15.397	19.612
LnNEXP	31	0.714	0.552	-0.361	1.338

4.3 Unit root test

The stationary check was applied in this study to establish the order of integration of each variable. Table 4.2 indicate outcomes of ADF unit root, which was applied in this paper to check stationarity and from these results all parameters became stationary at first difference.

Table 4. 2: Augmented Dickey-Fuller Stationary Test Results.

Variables	**Test Statistics at level**	**Test Statistics at difference**	**Critical values at difference**		
			1%	**5%**	**10%**
LnGDP	-1.137	-7.599	-2.654	-1.950	-1.602
LnINFL	-0.320	-7.370	-2.652	-1.950	-1.602
InDef	11.953	-0.742	-2.652	-1.950	-1.602
EXCR	-2.290	-6.505	-2.652	-1.950	-1.602
GCF	-2.457	-5.874	-2.652	-1.950	-1.602
FDI	-2.997	-6.312	-2.652	-1.950	-1.602
LnNEXP	-0.834	-5.310	-2.652	-1.950	-1.602

Note: at 1%, critical values for all the variables were 2.654, at 5% critical values were 1.950 and at 10% critical values were 1.602.

4.4 Correlation test among the variables in the model

The matrix in table 4.3 confirmed that correlation do not exist among the variables as seen in the table below**.**

InGDP and InINFL have weak and negative correlation which is given by -0.176, on the same note InGDP has weak negative correlation with EXCR, and InNEXP (-0.296, 0.023). InGDP has weak and positive correlation with InDef while positively correlated with GCF and FDI (0.471 and 0.635 respectively).

Inflation is negatively correlated with InDef, InNEXP and FDI (-0.248, -0.494 and -0.111) while positively correlated with EXCR and GCF (0.130 and 0.105 respectively).

InDef is negatively correlated with EXCR, GCF InNEXP and FDI as seen in the table as well as EXCR which negatively correlated with GCF, InNEXP and FDI while GCF has positive correlation with InNEXP and FDI as well as InNEXP which has positive correlation with FDI.

Table 4.3 Correlation results

	LnGDP	InINFL	InDef	EXCR	GCF	InNEXP	FDI
LnGDP	1.000						
LnINFL	-0.176	1.000					
InDef	0.092	-0.248	1.000				
EXCR	-0.296	0.130	-0.188	1.000			
GCF	0.471	0.105	-0.354	-0.503	1.000		
LnNEXP	-0.023	-0.494	-0.368	-0.156	0.243	1.000	
FDI	0.635	-0.111	-0.234	-0.439	0.645	0.136	1.000

4.5 Chow test,

This paper used Chow test to test for potential structural break in the series and this was to detect whether a particular time lag causes a break in the coefficients in the regression on another lag.

From the finding, the P- value is 0.083 which is less than 0.1 which is 10% level of confidence and thus, the study confirmed the null hypothesis was that no break since the F-value was less than 10% (0.1) hence the study accepted the null.

Table 4.4: Chow test results

F (1, 23)	=	3.29
	Prob>F =	0.083

4.6 Autocorrelation analysis

The Breusch-Godfrey was used in the study to check for autocorrelation in time series because it reduces underestimation of series standard errors. *So,* when p-value is larger than 0.05, acceptance occurs, and rejection occurs when the p-value is much less than 0.05. the paper accepts the null hypothesis that the residuals of this regression model do not have serial correlation or autocorrelation because the p-value is greater than 0.05.

Table 4. 5: Autocorrelation Test Results

Lags(p)	Chi2	df	Prob>chi2
1	0.204	1	0.651

H0: no serial correlation

Empirical Regression results

Threshold level of inflation

After receiving satisfactory diagnostic test results on the variables, they were used to sufficiently provide answers to the study's main question and the linear regression model was used to estimate at what point inflation affects Sudan's economic growth. The regression results are shown in the tables (4.6 and 4.7).

Table 4.6 Empirical Regression results for the threshold level of inflation

LnGDP	***Coef.***	***Std.Err.***	***t***	***p>/t/***	***[95% Conf.***	***Interval]***
LnInfl	-0.137	0.175	-0.780	0.443	-0.499	0.226
D (InINF-K) Above 5%	-0.074	0.157	-0.470	0.642	-0.398	0.250
InDefl	0.001	0.000	2.720	0.012	0.000	0.000
EXCR	0.393	0.002	1.560	0.133	-0.129	0.915
GCF	0.002	0.010	1.150	0.262	-0.002	0.007
FDI	0.037	0.126	3.640	0.001	0.016	0.058
LnNEXP	0.036	0.184	0.280	0.780	-0.225	0.296
_cons	0.533	0.284	1.880	0.073	-0.054	1.122
Model Summary						
R-squared	0.618					
F (6, 24)	5.320					
Prob>F	0.001					
Adj R-squared	0.502					
Root MSE	0.226					
observation	31.000					

As shown below, the paper applied a regression analysis to assess the impact of the inflation threshold, which is represented by D (INFt-K), and it is the degree of responsiveness to Gross domestic product to adjustments in the general price level. The results of the regression equation are shown in equation below:

$$\mathbf{LnGDP_t = 0.533 - 0.137\ ln INFL_t - 0.074(InINF_t\text{-}K) + 0.001DEF_t + 0.393EXCR_t + 0.037FDI_t + 0.036NEXP_t}$$

When result for threshold which is given by D(INFt-K) and again looking at $\boldsymbol{\beta}_1$ which is coefficient of inflation and indicate the impact of InINFL on InGDP of Sudan when the rate of inflation threshold is above inflation threshold.

From the model analysis, $\boldsymbol{\beta}_1 + \boldsymbol{\beta}_2$ (-0.137-0.074 =-0.211) clearly indicate the degree of effect of inflation on economic growth above the threshold and in which the threshold level of inflation becomes insignificant, but the coefficient on the threshold becomes significant and negative at 1 percent level when determining the threshold and level of effect on inflation and thus, the threshold coefficient is -7.4.

For the inflation rate is such an important macroeconomic variable that affect GDP changes, the Gross domestic product elasticity coefficient to the rate of inflation is inelastic and this is because the estimated coefficient was so low, the results revealed that GDP is inelastic to inflation (7.4 point).

The thresholds were also not statistically significant at the 5% level according to these findings, the study concluded Sudan's GDP is inelastic in response to changes in inflation by 7.4 point. Furthermore, $R^2 = 0.50$ is quite low, implying that changes in overall price levels account for roughly 50% of GDP responsiveness.

The Impact of Inflation on Economic Growth

Table 4.7 Regression results on the log of GDP and inflation plus other variables.

Model Results

LnGDP	***Coef.***	***Std.Err.***	***t***	***p>/t/***	***[95% Conf.***	***Interval]***
LnInfl	-0.200	0.110	-1.810	0.082	-0.429	0.028
InDefl	0.001	0.000	2.810	0.010	0.000	0.001
EXCR	0.392	0.248	1.580	0.1270	-0.120	0.904
GCF	0.002	0.002	1.200	0.243	-0.002	0.007
FDI	0.037	0.010	3.700	0.001	0.016	0.058
LnNEXP	0.046	0.122	0.380	0.711	-0.206	0.298
_cons	0.581	0.261	2.220	0.036	0.042	1.120
Model Summary						
R-squared	0.614					
F (6, 24)	6.380					
Prob>F	0.000					
No of Obs	31.000					
Adj R-squared	0.518					
Root MSE	0.223					

$$LnGDP = 0.580 - 0.200LnINFLt + 0.001Def_t + 0.392EXCR_t + 0.025GCF_t + 0.037FDI_t + 0.046NEXP_t$$

As per Table 4.7. The results show that a 1 percent increase in inflation (INF) in Sudan decreases InGDP expansion by 20% while other factors remain constant. Except for net export and gross capital formation (a proxy for interest and degree of openness), all other variables are significant and positive in comparison to GDP.

The research also found the rate of exchange to have a positive but minor effect on Sudan's GDP growth (r=0.392, p=0.127). According to the study, gross capital formation (GCF) has insignificant

effect on Sudanese GDP progress (r=0.025, p=0.243). The study also shows FDI to have a significant and positive effect on Sudan's GDP growth (r=0.037, p=0.001) and finally, the study found that net exports have important but insignificant impact on Sudanese GDP increase (r=0.046, p=0.711).

On determining the link among economic growth and inflation, the paper used linear regression equation as illustrated in table 4.7, and according to the estimated model, as inflation rises by 1 percent, economic contraction (GDP) falls by 1 percent and with R^2 = .518, which imply that inflation account for 52% of changes in economic growth (GDP) while the remaining 48 percent variance is unexplained by the model due to the fact that, in relation to inflation, other macroeconomic factors have an influence on GDP, which means that inflation affect the growth of GDP in the Republic of Sudan and, as a result, lead to adverse effect on the expansion of Sudanese' economy since it can account for a significant share of changes in GDP.

These findings support theories that explain the link among these parameters just as other scholars like (Barro, 1995), who used data over the period for 100 countries from 1960 to 1990 to study connection among price increase and economic expansion and investment, using instrumental variables (IV). The findings were that rising prices induces adverse influence on both expansion and investment, with investment being the primary channel.

Table 4.8: Model Results on the effect among the variables

LnGDP	***Coef.***	***Std.Err.***	***t***	***p>/t/***	***[95% Conf.***	***Interval]***
LnInfl	-0.102	0.123	-0.800	0.432	-0.367	0.163
InDefl	0.000	0.000	1.760	0.092	0.000	0.000
EXCR	0.429	0.244	1.760	0.092	-0.076	0.935
GCF	0.002	0.002	1.170	0.255	-0.001	0.007
FDI	0.042	0.162	1.250	0.224	-0.133	0.536
LnNEXP	0.202	0.010	4.040	0.001	0.020	0.063
LnInflDEF	0.000	0.000	-1.430	0.160	-0.000	0.000
_cons	0.581	0.356	0.640	0.531	-0.509	0.963
Model Summary						
R-squared	0.646					

F (6, 24)	6.000					
Prob>F	0.000					
No of Obs	31.000					
Adj R-squared	0.538					
Root MSE	0.218					

Whenever the link between two variables is consistent and affect another variable, this is referred to as interaction. As a result, the interaction variable is LnInfl*Defl which is now the difference in the slope of the inflation and deflator. The presence of the term shows effect independent variable on the response parameter which varies with the other predictor variable's value. By including this term in the analysis and multiplies LnInfl and Def which now give the new regression equation will now look like this:

$LnGDP = 0.227 - 0.102LnINFLt + 0.000Def_t + 0.429EXCR_t + 0.002GCF_t + 0.042FDI_t + 0.202LnNEXP_t - 0.000LnInfl*Defl_t.$

The effect of interaction terms on the link among inflation and economic in Sudan is very minimal, as indicated by (-0.000), and the reason is that interaction means it depends on the value of the third variable, which in this case is LnInfl*Defl. The interaction term is statistically significant (p = 0.001), and R_2 is significantly higher with it than without it (0.538 versus 0.518). As a result, this paper concludes that the interaction term does not have significant impact on the relationship among inflation and the economic growth to the regression equation's predictive ability and according to the findings, a 1% increase in the interaction variable (LnInfl*Defl) in Sudan diminishes expansion of the economy (LnGDPt) by 0.009% though all other variables remain constant.

4.8 Post estimation Tests

Testing for Multicollinearity,

The Variance inflation factor (VIF) was used in this paper to determine whether any independent variable was correlated with one or more of the other descriptive parameters in the regression model. If this problem was not detected, the statistical significance of the independent variable would be underestimated. Now based on the finding, VIF value is 1 between 1 and 5 meaning that there is moderate correlation, and no major corrective measure was required.

Table 4. 9: **Multicollinearity Test Results**

VIF		
Variables	**VIF**	**1/VIF**
FDIGNI	2.300	0.435
GCF	2.240	0.445
NEXP	2.110	0.473
LNFL	1.990	0.503
EXCR	1.710	0.586
Defl	1.660	0.602
Mean VIF	2.000	

Ramsey's RESET test (ovtest)

To overcome variable misspecification in the regression model, this paper used Ramsey's RESET test to determine whether the regression model was appropriate and whether the link among economic growth, which was the regression coefficient, and the predictor variables was linear or non-linear.

Based on the finding from running Ramsey RESET test by means of controlling standards error of LnGDP, the study found that F=0, in which null hypothesis hold and no variables were omitted in the entire model. Again, the value has no relationship that would clearly explain the dependent variable in this situation. On the other hand, it failed to accept the alternation hypothesis since t≠0 and the model has no omitted variables problem.

Table 4. 10: Ramsey's RESET test Results

Ramsey RESET test with powers of the fitted InGDP
H0 values: There are no variables missing from the model.
Prob>F = 0.434, F (3, 26) = 0.940

4.6 Discussion of Findings

The finding implies that 52% of the changes in economic expansion (GDP) has indeed been described by inflation, and because inflation has been discussed to have a significant impact to a change in GDP, thus, inflation has a greater effect on GDP of Sudan, and that having a high rate of inflation could have an adverse effect on the expansion of economy of Sudan since it would reduce the purchasing power of Sudanese consumers.

As a result, the negative effect link among inflation and economic growth as seen in regression model has an impact on the Sudanese economy, and the opposite is true. The findings are consistent with those of Tadele (2014), who investigated how inflation affected economic growth in Ethiopia and Uganda between 1990 and 2012 and found a strong positive feedback correlation among natural log of economic growth and the inflation.

The findings are also consistent with those of Niyizurugero (2021), who investigated the factors such as inflation and economic growth in Rwanda and observed that a 1 percent change in inflation increased economic growth by 0.03 percent, whereas a 1 percent change in investment and exchange rates increased it by 0.4 percent and -0.21 percent, respectively, and Mbonimpa (2019), who found that there was no long-term correlation among macroeconomic factors in Burundi.

In addition, the paper determined that increase in prices represented by (INFL) does have a significant and adverse impact on Sudan's 1 percent GDP increase. According to the findings, a 1 percent increase in Sudan's inflation (INF) causes a 20% decrease in GDP growth. The findings are also consistent with those of Kigume (2011), who studied the link among increasing prices on expansion of Kenya's economy from 1963 to 2003 and revealed both immediate and lasting beneficial connection.

The results supported those of Makuei (2016), who investigated the effects of rising price on the expansion of the economy in Sudan and concluded that it causes an adverse influence on expansion of the economy. This paper also found no correlation among inflation and the expansion of the South Sudanese economy during the research period, lending support to Kankpeyeng, Maham, and Abubakar (2021), who revealed that the amount of money in circulation and other indicators all have encouraging and important influence on GDP growth.

The paper also revealed that the currency value has a positive and minor effect on Sudan's GDP growth (r=0.392, p=0.127), contradicting Karahan's (2020) discovery of a strong relation between exchange rates and GDP. According to the study, GCF has small and positive impact on Sudan's GDP growth (r=0.025, p=0.243). These results also support Nweke et al. (2017), who revealed capital production had a minimal and positive effects on Nigerian economy over the course of the study.

According to the study, FDI has a positive and important impact on Sudan's GDP growth (r=0.037, p=0.001). The findings support Gachunga's (2019) claim that investment from abroad in the utilities and services sector has a positive and important effect on Kenyan's economy.

Njeru (2013) revealed a significant link among overseas direct trade and Kenyan economic expansion. Finally, the research revealed exports have a small but significant and positive impact on Sudan's GDP growth (r=0.046, p=0.711). However, the result contradicts those of Maina

(2015), who established that increased export markets lead to increased investment opportunities, technological advancements, and improved imported goods, all of which contribute to helpful and important to the expansion of the economy. The findings also support Ndoen and Amtiran's (2020) contention that value of exports has a positive and significant effect on the extent of the expansion of the economy, the case of Indonesian between 2010 and 2018.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This section looked at the summary of results as of previous section; also derived policy implication then has briefly explained the scope and limitation. This chapter also offered recommendation to the decision makers as well as policy makers and has highlighted the areas for further study.

5.2 Summary of the Findings

Primarily, the main aim of the paper was to investigate the impact of rising prices on Sudanese economy, and yearly information from 1990 to 2020 were applied, as well as linear regression to study the effect of predicators on the dependent; the stationary check was performed

Both model's variables were becoming stationary after first difference, according to the unit root results. Based on the regression analysis, inflation has an adverse impact on Sudan's economy and this revealed that inflation was detrimental to Sudan's economic expansion from 1990 to 2020, which is consistent with previous research such as (Fisher (1993), Barro (1995), Harris et al. (2007)), Wai (1959), Xiao (2007), Varia Antui et al. (2013), Sahadudheen (2012, Ghosh and Phillips (1998), Veni and Choudhury (1998), Veni and Choudhury (1998), (2007). The extent of sensitivity of changes in GDP as a consequence of changes in inflation is inflexible, according to the study, as a consequence of the recent decline in buying power of the Sudanese pound, which was caused by the reduction of subsidies in Sudan. The study also found that the rate of exchange as well as interest rate represented by GCF, have a beneficial but unimportant result on Sudanese GDP expansion. International direct investment, according to the study, has a favorable and significant effect on Sudanese GDP growth, whereas exports have a beneficial but insignificant effect on Sudanese GDP expansion.

5.3 Conclusion

The findings from the analysis have answered the main objective of this paper which was to examine the impact of inflation on economic growth of Sudan, it is now clear from the analysis that inflation has negative and significance effect on Sudanese economy. From the empirical results, the threshold level of inflation in Sudan was between 4% to 5%, above this threshold, the impact of inflation become negative and significance on Sudanese economy. Secondly, Other independent variables like FDI, EXCR, GCF, and NEXP have positive link with economic growth of Sudan and therefore, has some implications on the economy of Sudan if appropriate measures are not taken in this regard.

From the finding, inflation have negative and significant impact on economic growth of Sudan, Foreign direction investment has positive and significance impact on Sudanese economy, while interest rate, gross capital formation, exchange rate and net export all have a positive and insignificance impact on economic growth of Sudan. These, therefore, have major policy implication for all the stakeholders including policymakers and other associates, and thus, focus on monitoring price increase is as essential condition to promote the expansion of the economy.

Inflation, according to the findings, was responsible for about 20 percent of the decrease in GDP, implying that a 1 percent increase in inflation would lead to a 20 percent reduction in the overall GDP in Sudan and thus, any adjustment in the overall level of prices has a massive effect on Sudan's GDP.

5.4 Recommendations

From the findings, inflation has negative link with economic growth, therefore, focus for future consideration should be on the current rates of inflation as it negatively affects economic growth of Sudan by having adverse impact on stock of capital and thus discourage investment and hence does the aggregate demand.

There is also a need for Sudan government to redirect its focus on stimulating the productive sectors then, execute economic policies which assists in keeping rates of inflation low in the country to improve growth in the economy.

Furthermore, apart from reducing inflation rate, government should now consider stimulating foreign direct investment, increase production to increase net export. Central bank of Sudan

should now aim at stimulating economic growth by encouraging investment, promote agricultural production as this is the source of export and employment and regulate interest rate.

This paper also proposes to Sudanese government to develop inflation-control policies through the ministry of finance and economic planning, as well as some of the viable policies, which should include increasing revenue base while reducing government expenditure other relevance policies.

This research paper again, commends strategy makers in Sudan to develop strategies geared towards augmenting the capital formation which could enhance economic growth. This is due to positive link among the capital formation and economic expansion which can be increased by reinstituting the investment tax credits.

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