Modelling the Sources and Impact of Macroeconomic Fluctuations in Sudan

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ABSTRACT

Like many developing countries, Sudan has experienced different episodes of political and economic instability throughout its history. While it was a relatively good time during 1960s, Sudan has undergone significant fluctuations during the successive decades. This include oil price shock during 1970s, the civil war and drought in 1980s, regime change and economic policy change "liberalization" in1990s, oil boom over early 2000s and the situation has worsened over the last few years after the secession of the South Sudan in July 9, 2011. This secession has contributed to create severe macroeconomic imbalances and deteriorating considerably the economic conditions in Sudan. It resulted in losing some three-quarters of its oil production, half of its fiscal revenues, and about two-thirds of its international payment capacity. It has also driven the trade balance from substantial surplus to a large deficit. In response to these various turbulent events, authorities in Sudan adopted various policy choices to maintain macroeconomic stability, usually in the form of economic policy measures. However, the policies adopted have not been quite effective in stabilizing the economy. The economy is currently experiencing high inflation rate, unstable exchange rate, large external and internal deficits, low growth rate, high unemployment, and sever poverty.

To adjust to this new economic reality, strong policy responses are required if the economy is to be put onto a sustainable growth path in the future. It is therefore seems timely for policymakers in Sudan to question what has gone wrong and what has been forgotten in an attempt to put it right in their future policy priorities. Toward that end, the current study aims to add value in supporting the country's policy responses to mitigate the negative consequences of these turbulent events. This study focuses on modeling the sources and impact of macroeconomic fluctuations in Sudan by considering a set of major macroeconomic variables including: real output, price level, real exchange rate, and money supply as domestic forces and world oil prices and real output for Arab countries to represent the external forces. It also investigates the impact of different domestic and external shocks on the performance of the Sudanese stock market.

In terms of methodology, the study applies the structural vector autoregression (SVAR hereafter) methodology to look at the dynamic interrelationships between key macroeconomic aggregates and it also uses a VAR(1)-GARCH(1,1) model to see how the Sudanese stock market responds to changes in fundamental economic forces. The estimation results of a SVAR model lead to the conclusion that the shocks in crude oil price and output for the Arab countries (external shocks) are less likely to explain the movement of domestic macroeconomic variables than shocks to domestic variables. For instance, external factors account for approximately 21% of the real output dynamics in the 12th time horizon. Additionally, the results show that fluctuations in world oil prices account for more domestic fluctuations than that related to movements in the real output of the Arab countries. As for domestic fluctuations, empirical results suggest that apart from their own shocks, much of the real output fluctuations can be explained by the shocks in price and real exchange rate. Consistent with turbulent macroeconomic environment in Sudan during the past few years, the study also shows that KSE has experienced higher levels of fluctuations especially in the post-secession period and that the KSE fluctuations are greatly attributed to oil shocks and exchange rate fluctuations. Based on these findings, the study presents many policy implications pertinent to policy makers, authorities and future researchers.

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CHAPTER 1

1. INTRODUCTION AND OVERVIEW

"Interest in business cycles is itself subject to a wavelike movement, waxing during and after periods of turbulence and depression, waning in periods of substantial stability and continuing growth" (Victor Zarnowitz, 1992, p. 20)

1.1 Background
One of the major goals of macroeconomic policy that has been receiving increasing attention in the central banks and policy making institutions worldwide is to achieve high and stable levels of economic growth. Macroeconomists and policymakers everywhere have been entrusted to find ways for sustainable economic growth in order to improve the nation's prosperity. However, history has frequently shown that long run economic growth has never been stable; instead it tends to experience some fluctuating episodes relative to its long-term time trend and typically this involves irregular and unpredictable movements between periods of relatively rapid economic growth (an expansion or boom), and periods of relative stagnation or decline (a contraction or recession). This feature of fluctuations[1] in an economy is widely known as the "business cycle[2]" or "economic cycle". In actual economies, this behavior seems to be characterized by at least two broad regularities[3] as explained by Long and Plosser (1983). First, measured as deviations from general time trend, the ups and downs movements in individual economic variables exhibit a considerable amount of persistence. Given that a certain variable is currently above (below) its time trend value, it tends to stay above (below) the trend for some time[4]. Second, most important, measures of various economic activities tend to move together. At times when one economic aggregate is above (below) its time trend, others tend also to be above (below) their trends[5].

Why do world's economies go through cycles of economic contraction and expansion? To what extent do different types of internal and external shocks play a role in driving business cycle fluctuations? What are the main transmission mechanisms through which these shocks are propagated between different economies? What, if anything, can be done to reduce the length and severity of these fluctuations? These kinds of questions are all very critical for a better understanding of how well an overall economy is performing and of course, this involves issues related to decisions of various agents in the economy. For instance, van Dijk (2004) indicates that the consumption and saving decisions of private individuals; investment, production and

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[1]To study fluctuations of "aggregate economic variables" around their trend or "long-term growth paths" requires a formal procedure to divide any variable into two components: a trend and a deviation from trend called the "cycle".

[2]A full business cycle is identified as a sequence of four phases: contraction, trough, expansion, and peak, whereas the time span between, for example, two peaks, varies from time to time, so do the magnitude of peaks or troughs.

[3]Most countries in the world economy exhibit well defined empirical regularities not only in domestic indicators of economic activity, but also in key international indicators (Mendoza, 1991).

[4]This is meaningful restriction only to the extent that deviations from trend form a stationary, zero-mean process.

[5]Robert Lucas (1977) argues that these co-movement properties reflect the central role that aggregate shocks play in driving business cycle fluctuations.

sales decisions of the industrial sector; and monetary and fiscal policy decisions[6] of the banking and government sector are all based on forecasts of future developments of economic variables which depend, to a large extent, on the state of the business cycle. Special attention to this set of questions has also been paid by business cycle theorists who want to know what kind of shocks to incorporate into their models based on the fact that further empirical research in the field should prove to be critical in the development of business cycle literature.

From standpoints of theoretical debate, different schools of thought and many economists offer a wide range of theoretical models which share some common properties to look at the nature, sources and propagation mechanisms of business cycle fluctuations[7]. One of this is the fact that there is always a major driving force behind these fluctuations, some sort of shock or disturbance that causes the cycle. The latter may be volatile market expectations about future sales and profits according to the Keynesian Business Cycle Theory; fluctuations in monetary growth rate as illustrated by the Monetarists Theory; unanticipated fluctuations in aggregate demand according to New Classical Theory; some kind of nominal price/wage rigidities according New Keynesian Theory; and random shocks to total factor productivity that result from technological change according to the Real Business Cycle Theory. These theories have made significant contributions to a better understanding of the salient characteristics of the observed pervasive and persistent nonseasonal fluctuations of the economy. Indeed, they have undergone tremendous developments over time in line with the improvements in econometric and statistical methods since the pioneering works on the statistical testing of business cycles conducted by Jan Tinbergen (1939)[8] and the empirical analysis done by Burns and Mitchell (1946)[9].

More generally, business cycle theoretical models vary in terms of their choice of shocks, that is, which shocks are most important in disturbing an aggregate economic activity and their propagation mechanisms, that is, the economic structure. In this regard, various kinds of shocks have been historically documented and the current business cycle literature distinguishes between nominal and real shocks, demand and supply shocks, domestic and external shocks, country specific and global shocks, etc. For example, some business cycle studies report that external shocks, such as terms of trade shocks, oil price shocks, interest rate fluctuations, stock markets crashes, climate shocks and natural disaster represent main sources to the business cycle fluctuations (see, e.g., Kose and Riezman, 2001; Broda, 2004; Edwards, 2006; Calderon and Levy-

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[6]For example, empirical evidences on the relative magnitudes of various factors can for example, guide policy-makers in designing appropriate policy responses to external shocks, and deciding whether or not it is a good idea to try to insulate the domestic economy from them.

[7]It has long been observed that many countries experience similar fluctuations in macroeconomic aggregates and that these fluctuations exhibit substantial synchronization across countries. These observations date back at least to the work of the National Bureau of Economic Research, on the construction of business cycle chronologies for several nations, in the early 1920s (Gregory et al. 1997).

[8]In fact, Tinbergen's large scale macro-dynamic model in 1939 is widely acknowledged as the first major econometric endeavour to model business cycle fluctuations.

[9]Today a wide range of econometric techniques are available. these include the multi-equations vector autoregression (VAR) methodology pioneered by Sims in 1980; the structural VAR approach suggested by Sims (1986), Shapiro and Watson (1988), Blannchard and Quah (1989), and a new generation of large dimensional models: the "generalized" or "approximate" dynamic factor models introduced by Forni et al. (2000), Stock and Watson (2002a, 2002b) and recently proposed for structural economic analysis by Stock and Watson, (2005) and Forni et al., (2009).

Yeyati, 2009; Sosa and Cashin, 2009; Shioji and Uchino, 2011; Hiroshi Morita, 2013, among others). In contrast, some others reveal that internal shocks, such as domestic supply shocks, monetary policy shocks, investment-specific technology shocks[10], weak institutions and political instability have larger impact relative to that of external shocks in driving business cycle dynamics (see, e.g., Hoffmaister et al, 1997, 2001; Dejong et al., 2000; Aisen et al., 2006; Fisher, 2006; Hirata et al., 2007; Justiniano and Primiceri, 2008; Klomp and de Haan, 2009; Allegret et al., 2012, among others). On the other hand, business cycle theory has highlighted several channels through which these shocks transmit across countries such as: international trade, financial integration, and industrial structure. Understanding these transmission mechanisms provide useful information for policy purposes (see, e.g., Clark and van Wincoop, 2001; Baxter and Kouparitsas, 2005; Imbs, 2006; Rana, 2007; Inklaar et al., 2008; Flood and Rose , 2010; Erden and Ozkan, 2014, among others).

It is evident that the major driving forces behind business cycle fluctuations have significant impacts on the long-term economic growth and related variables such as productivity, employment and price levels and therefore impacted the standard of living. To counteract the length and severity of these kinds of shocks, strong macroeconomic policy responses are needed. Toward that end, the current study represents an attempt to look empirically at the impact of both internal and external shocks in the Sudanese economy so that relevant macroeconomic policies for enhancing sustainable growth can be envisioned.

1.2 Motivation, Problem Statement and Research Questions
The need to understand how well (or how badly) an overall economy is doing has long been one of the major preoccupations in both theoretical and empirical macroeconomic research, with special focus on analyzing the cyclical behavior of key macroeconomic aggregates. Recently, a great deal of empirical research has again started to focus on business cycle phenomenon, especially in developed economies, given the fact that the world's economies have become increasingly integrated [11] . However, debates concerning the dominant driving forces behind business cycle fluctuations and their propagation mechanisms do not completely come to a conclusion. Notwithstanding the growing body of evidences documenting the stylized facts of business cycle fluctuations, little attention has been given in developing countries[12] whose economies are especially vulnerable to fluctuations due to many factors including: large external shocks, volatile macroeconomic policies, political instability, poorly developed insurance and financial markets, and weak institutions [13] among others. Existing empirical literature has generally agreed on a consensus view that business cycles in developing countries are quite different from the ones observed in developed countries

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[10]Technology shocks refer broadly to exogenous "changes in production functions or, more generally, the production possibilities of profit centers" (Hansen and Prescott, 1993).
[11]Of course, this kind of economic integration has resulted in deeper synchronization of business cycles between individual countries, since economic links serve as a channel for transmission of shocks between countries (Tayebi and Zamani (2013).
[12]Agénor et al., (2000) provided two reasons to account for this. First, limitations on data quality and frequency could be constraining factors in some cases. Second, developing countries tend to be prone to sudden crises and marked gyrations in macroeconomic variables, often making it difficult to discern any type of "cycle" or economic regularities.
[13]For example, Kose and Riezman (1999) showed that a highly and unstable domestic macroeconomic environment is one of the primary reasons for the poor growth of African countries.

in the sense that they are generally characterized by low magnitude and more volatile. Moreover, it has become a stylized fact that economic activity in developed countries, as measured by world output and world real interest rate, has a positive influence in generating macroeconomic fluctuations in most developing countries (Agenor et al., 2000; Rand and Tarp, 2002; Neumeyer and Perri, 2005; Aguar and Gopinath, 2007). There is no doubt that more attention is needed to document the stylized facts regarding macroeconomic fluctuations in developing countries. This will be useful at least in two aspects. First, to examine whether similar empirical regularities are observed across countries at different levels of income (Agenor et al., 2000). Second, this type of analysis may have important policy implications in the design of stabilization and adjustment programs (Agenor and Montiel, 1996).

Motivated by the importance of modelling business cycle fluctuations in policy making environment, the present study tries to look at the possible impacts of these kinds of fluctuations in the performance of Sudan economy where the design of macroeconomic stabilization policies remains a critically important policy objective for a long period of time. A close examination of the behavior of Sudan economy from the time of independence from Britain in 1956 to date reveals that it has experienced significant swings in aggregate economic activity. While it was a relatively good time during 1950's and 1960s, Sudan economy has undergone significant fluctuations during the successive decades.

During the 1950's the Sudanese economy grew at an increasing rate though at a low levels, inflation was not a problem; the exchange rate of the Sudanese pound was fixed at about one Sudanese pond to 3.53 United States dollars; and both the balance of payments and government budgets were generally in good shape. It could also be claimed that there was full employment since the great majority of the people practiced subsistence agriculture in the rural areas, and therefore there was no open unemployment (Bior, 2000). This behavior of the economy continued during the 1960's but at a much lower rate. Again as in the previous decade, inflation and exchange rate were stable. But the balance of payments and government budgets recorded some deficits.

During the successive decades, Sudan economy started to experience an economic slowdown as results of different economic and political upheavals. For instance, in the 1970's and 1980's Sudan had been hit hardly by severe drought and famine and in 1983 with outbreak of the renewal of the civil war between the North and South[14]. Additionally, several economic problems started to pop up such as high inflation rates[15], large swings in the growth rate[16], high external debts, deficits in the balance of payments and government budgets, high residence of poverty and unemployment. This of course was in line with the increasing oil prices in the early 1970s, as a result of the world oil crisis.

Over the last two decades, Sudan economy has experienced many ups and downs. In

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[14] In fact, Sudan had been embroiled in a devastating civil war in the southern regions since 1955, with exception of an 11-year peace period during 1972-1983.

[15] According to World Bank (2009), Sudan was in economic turmoil during most of the 1970s and 1980s when double-digit inflation was a common occurrence, and there were large swings in the growth rate.

[16] During 1970–90 the real GDP growth rate fell below –5 percent in six years (1972, 1978, 1979, 1984, 1985, and 1990) and exceeded 10 percent in four years (1974, 1975, 1976, and1987) (The World Bank, 2009).

the early 1990s, real GDP grew at an annual average rate of 5 percent, and the growth has been relatively stable[17] compared to the sharp output swings experienced during 1970s and 1980s (IMF, 1999). By the end of 1999s, Sudan began exporting crude oil with production increased dramatically during the late 2000s. Since that time, the economic performance of the country has improved significantly[18] with positive and high economic growth. For nearly a decade, the economy boomed on the back of increases in oil production, high oil prices, and significant inflows of foreign direct investment. Accordingly, the Sudanese economy has shifted from a low income economy into a lower medium income economy according to World Bank classification. Notwithstanding these remarkable improvements in the overall economy, high oil dependence had sparked a wide range of problems. For example, it led to greater export concentration undermining long-run economic diversification[19] and raised the possibilities of a 'Dutch Disease[20]'.

The situation has worsened in more recent years after the secession of the South Sudan in July 9, 2011 which has contributed to create severe macroeconomic imbalances and deteriorating considerably the economic conditions in Sudan. In the aftermath of the South Sudan's secession, the Sudan economy has lost some three-quarters of its oil production, half of its fiscal revenues, and about two-thirds of its international payment capacity. It has also driven the trade balance from substantial surplus to a large deficit. In fact, even after the secession of Southern Sudan, Sudan still endures political instability and conflicts[21] along with the resulting economic disruption.

In response to these various turbulent events, authorities in Sudan adopted various policy choices to maintain macroeconomic stability, usually in the form of economic policy measures. For example, the government has been (i) pursuing a three-year Economic Program for Stabilization and Sustained Growth (EPSSG 2012-2014) with objectives to maintain fiscal and external sustainability, boost inclusive growth, and gradually reduce unemployment, (ii) working with the IMF since 1997 to date to implement macroeconomic reforms, including a managed float of the exchange rate, (iii) implementing an Interim Poverty Reduction Strategy Paper (I-PRSP) in 2012 to strengthening governance and the institutional capacity of the public sector; reintegrating internally displaced persons (IDPs) and other displaced populations; developing human resources; and promoting economic growth and employment creation. However, the policies adopted have not been quite effective in stabilizing the economy. The economy is currently experiencing high inflation rate, unstable exchange rate, large external and internal deficits, low growth rate, high unemployment, and sever poverty.

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[17] This stability attributed to some extent to relatively favourable weather conditions and to the economic liberalization policies that sustained growth and fostered greater economic diversification.

[18] According to the World Bank (2009), the size of Sudan economy, measured by gross domestic product, has grown fivefold—from $10 billion in 1999 to $53 billion in 2008. Per capita income has increased from $334 to $532 in constant dollar terms over the same time period, in contrast to being range-bound between $200-300 since the 1960s.

[19] Kabashi (2012) showed that the share of non-oil exports in total exports has declined by about 82 percentage points over the last decade and the share of agricultural exports dropped from about 50% in 1996 to less than 1% for 2010.

[20] Dutch disease refers to the case where a resource boom in an economy leads to a real exchangeappreciation and to the crowding out of the tradable manufacturing sector.

[21] There are currently several crises happening in Sudan, including those in Darfur, *Abyei*, South Kordofan and Blue Nile and Eastern Sudan; as well as with South Sudan.

To adjust to this new economic reality, strong policy responses are required if the economy is to be put onto a sustainable growth path in the future. It is therefore seems timely for the policymakers in Sudan to question what has gone wrong and what has been forgotten in an attempt to put it right in their future policy priorities. Without any doubt looking at empirical evidences which addressing many macroeconomic issues would be an ideal tool for them to consider. One of these evidences can be done by empirical identification of the sources of macroeconomic fluctuations and modeling their possible impacts. This of course will help them to effectively design economic policies to maintain macroeconomic stability for better living conditions. The study is therefore hopes to contribute to the existing body of empirical literature in this area by addressing the following research questions:

- To what extent do macroeconomic fluctuations in Sudan driven by global or regional shocks or by events that are more specific to the country?
- What has been the impact of quantifying macroeconomic fluctuations on macroeconomic policy environment in Sudan?

A natural way to answer these questions is to incorporate some kind of econometric modeling to look at the dynamics of the major macroeconomic aggregates in the economy. To that end, the current study examines the degree to which economic fluctuations in Sudan can be explained by internal and external shocks and investigate which shocks play an important role.

1.3 Objectives of the study
The main objective of this study is to identify the sources and impact of macroeconomic fluctuations in the Sudan by considering a set of major macroeconomic variables including: real output, price level, real exchange rate, and money supply as domestic forces and world oil prices and real output for Arab countries to represent the external forces. Then, the specific objectives can be set as follows:

- To understand the nature and source of different types shocks (domestic as well as external) that cause macroeconomic variables to deviate from their long run equilibrium growth paths;
- To investigate the impacts of different domestic and external shocks on the performance of the Sudanese stock market; and
- To suggest some policy recommendations for an effective management of macroeconomic fluctuations in Sudan.

To address the first objective of the study, a system of variables containing output growth (GDP), price level (CPI), money supply (MS), real exchange rate (RER), the price of Brent crude oil (Brent) and GDP for Arab countries (ARAB) is analyzed by applying the structural vector autoregression[22](SVAR hereafter) methodology proposed by Shapiro and Watson (1988), Blannchard and Quah (1989), and King et al. (1991). To look at the patterns of macroeconomic aggregates, the dataset is divided into two sub-periods; the first representing the functioning of the economy without oil, while the second period represents when the economy is heavily dependent on oil. The main focus here is to examine the impulse response functions (IRFs), that is what happens to

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[22]An advantage of this approach is that it identifies different types of shocks of a given economy by making long-term restrictions based on macroeconomic theory.

the path of the key macroeconomic aggregates when some shocks occur in the economy as well as the variance decomposition (VDCs), that is proportion of the total variations of a given variable due to itself and all other endogenous variables in the system.

And, to address the second objective, a VAR(1)-GARCH(1,1) model proposed by Ling and McAleer (2003) is employed. Here, the study tries to see how the Sudanese stock market (the Khartoum Stock Exchange, KSE) responds to changes in fundamental economic forces? In particular, the study focuses on the fluctuations of inflation rate and exchange rate as key domestic forces and world oil price as an external force. To look at the impact of the secession of South Sudan, the study uses a sub-period analysis by splitting the whole sample period into two sub-periods (before and after the secession).

1.4 Significance of the study

It may be worthwhile to note at this juncture that the turbulent events that have pervaded the Sudanese economy since its independence in 1956 have posed considerable challenges to policy makers in the central bank and other national policy institutions. Subjecting the economy to these types of events means that a thorough understanding and evaluating of the impact of different internal and external shocks on the performance of economy is of utmost importance, as the consequences of these shocks push millions of people into abject poverty and deprivation. There is no doubt that it can be seen as a prerequisite condition in the process of designing appropriate stabilization policies required to achieve such macroeconomic goals as long-term economic growth, full employment and price stability.

This kind of empirical research could be useful for different agents in the economy in many aspects. First, it gives an insight into how well Sudanese economy is doing and to some extent to make reliable predictions concerning macroeconomic performance in Sudan. Second, it can be used as the basis for the decision-making process surrounding macroeconomic policies; policy makers can rely on such empirical work when appropriate stabilization policies have to be formulated and to examine an effectiveness of monetary, fiscal and exchange rate policies on the overall economy. Third, it can provide very usefully information for the government authorities and policy makers in the central bank of Sudan and the Ministry of Finance and National Economy in their attempts to build their own macroeconometric model for the purpose of policy analysis and forecasting.

1.5 Organization of the study

The presentation of the study is organized in terms of six chapters in which the general introduction, theoretical framework, methodology and data, empirical research, and conclusions and recommendations are provided, notably, corresponding to the objectives of the study. As such, the organization of the study can be summarized as follows: Chapter 1 briefly provides an introduction to the problem statement, the objectives, and the other related structure of the study. It provides a general view of how the study can be conducted in both empirical and theoretical themes.

The theoretical background and empirical literature are presented in chapter 2. This chapter starts with a historical dimension and basic facts on business cycle

phenomenon. Different business cycles theories are also discussed here, this include: Keynesian Business Cycle Theory; Monetarists Business Cycle Theory; New Classical Theory of Business Cycle; New Keynesian Theory of Business Cycle; and Real Business Cycle Theory. This section ends up with the empirical literature concerning the application of different business cycle models for specific countries. Chapter 3 provides a detailed overview of the Sudanese economy to establish a clear understanding of the structure and performance of the economy with an emphasis on macroeconomic policy environment before and after the secession of South Sudan in 2011.

In chapter 4, the structural analysis of macroeconomic fluctuations in Sudan is presented. The chapter starts with the description of the SVAR model. Then the identification restriction of the structural VAR is specified. The patterns of macroeconomic aggregates, the empirical results of the SVAR contemporaneous coefficients, impulse response functions (IRFs) and forecast error variance decomposition (FEVD) will be provided in the last part of this chapter.

Chapter 5 of the study addresses the question: How the Sudanese stock market (the Khartoum Stock Exchange, KSE) responds to changes in fundamental economic forces? It investigates the responses of KSE to fluctuations in exchange rate, inflation and crude oil price. In the first part of this chapter the motivation and significance is provided. Then it presents the theoretical considerations and provides some empirical literature along with the empirical framework. Empirical results are provided in the last part of the chapter.

Finally, chapter 6 concludes by summarizing the main findings, drawing conclusions and deriving some policy implications for an effective macroeconomic management. This section ends up with a brief discussion on the direction for future research.

CHAPTER 2

2. THEORTICAL BACKGROUND AND EMPIRICAL LITERATURE

2.1 Introduction

One of the most challenging issues in applied macroeconomic research is to understand fluctuations of aggregate economic activities. Business cycle theory attempts to explain why macroeconomic variables fluctuate around their long-term growth paths and how policymakers should respond to these cyclical fluctuations. Although, many economists have devoted years to address this issue, the answers to these questions remain highly controversial. The main objectives of this chapter are: (i) to highlight major business stylized facts of key macroeconomic aggregates for developed as well as developing countries; (ii) to briefly review business cycle theories; and (iii) to show how previous authors make use of these theoretical models for specific economies in both developed and developing countries.

2.2 Business Cycle Stylized Facts and Theories

2.2.1 Understanding Business Cycles

The concept of business cycles has its origins as a distinct phenomenon in the observation of significant indicators that describe the economic process. This process is not constant and is characterized by cumulative upward and downward movements in which observers claim to discern certain regularities. Whatever the truth of the matter,

> *"... business cycles are considered to be an independent phenomenon which needs explaining" (Heubes, 1991, p. 28)*

This phenomenon is not new. Ever since the end of seventeenth century, business cycles have been used as a way of describing the "ups and downs of business" (Vosgerau, 1984). It was Juglar who described the economic cycle as "a recurring, if not necessary uniform pattern of business cycle" for the first time in 1860 (Vosgerau, 1978).

In the late nineteenth and early twentieth centuries, eminent economists were concerned with theoretical explanation of business cycles; Cassel, Hawtrey, Hayek, Robertson, Schumpeter, Spiethoff, and Wicksell were a few among them (Haberler (1937/1941) provides a brilliant survey of their theoretical achievements). In the first half of the twentieth century, the US National Bureau of Economic Research (NBER) initiated a systematic investigation of the statistical regularities of observed business cycles (see Burns and Mitchell, 1946). Keynes's (1936/1973) General Theory of Employment, Interest and Money shifted the problem of fluctuations in aggregate output to the centre of economic interest. Soon after the publication of the General Theory, the first mathematical business cycle models were developed by Hicks, Kalecki, Metzler, Samuelson, and others. Ever since, the explanation of business cycles has been at the centre of economic theorizing. Since that time, a four-phase scheme has been used to describe fluctuations in business cycles: an upturn ends at an upper turning point (boom), followed by a downturn which leads to a lower turning point (recession). Then the upturn starts again.

In macroeconomic literature, business cycle is widely recognized as the periodic

fluctuations of aggregate economic activity. More specifically, as highlighted by McDermott and Scott (1999) and Harding and Pagan (2005), there are two distinct methodologies for describing business cycles. The first one is the classical definition of business cycles which was followed by the economic discipline, was provided by Arthur F. Burns and Wesley C. Mitchell (1946), and is the one adopted by the National Bureau of Economic Research (NBER). According to them, business cycles are:

"... type of fluctuation found in the aggregate economic activity [23] of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; in duration, business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar characteristics with amplitudes approximating their own."(Burns and Mitchell 1946, p. 3)

According to this definition, it is very clear that business cycle is consisting of four phases that inevitably evolve from one into another: prosperity, crisis, depression, and revival. This view is expressed perhaps most clearly by Mitchell ([1923] 1951, p. 46), who showed that these phases are linked by a causal relation: prosperity produces conditions which lead to crises, crises run into depressions and depressions after a time produce conditions which lead to new revival.

The second one is the econometrical definition of business cycles. The emergence of this definition is largely caused by the growing importance of econometrics tools in the economic literature. It was proposed by Lucas in 1977[24]. According to Lucas, business cycles are:

"...movements about trend in gross national product"(Lucas, 1977, p. 87)

According to this definition, the movements are typically irregular in period and in amplitude; regularities are only observed "in the co-movements among different aggregative time series". The difference with Burns and Mitchell (1946) definition is that Lucas proposes the centrality of the product, and emphasizes the importance of analyzing the characteristics of the comovement of the rest of the aggregate variables with respect to it.

Although being termed cycles, fluctuations in aggregate economic activity do not follow a mechanical or predictable periodic pattern. For example, Korotayev and Tsirel (2010) identified four different types of business cycles, ranging from the shortest to longest is; the Kitchin cycle (1923) – averaging 40 months. This type of cycle concerns fluctuations in inventories and the flow of information between decision makers and is generated by market information asymmetries. This cycle is up for discussion with inventory management and information flows being improved considerably through the technological age. The Juglar cycle (1862) – identified as lasting 7-11 years, is an investment cycle that observes investments into fixed capital and not just changes in levels. The Kuznets swing (1930) – lasts 15 to 25 years, and is a wave of demographic

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[23] Although real GDP may be the single variable that most closely measures aggregate economic activity, Burns and Mitchell also thought it important to look at other indicators of activity, such as employment and financial market variables.

[24] Kydland and Prescott (1990) complete Lucas conceptualization, defining the trend of a variable as that which results from applying the Hodrick Prescott filter to the raw data.

changes and infrastructural investments. Finally, the Kondratiev wave (1925) – lasting 50 to 60 years, captures fluctuations in wages, interest rates and raw material prices.

2.2.2 The Stylized Facts of Business Cycles

In applied macroeconomic literature, business cycle stylized fact[25] are empirical regularities which characterizing the behavior of major macroeconomic aggregates[26] such as outputs, prices, employment, consumption and investment. These regularities may not be rigorously exact always and everywhere, but they capture some important features in the economies we observe and it has been one of the major areas of research in quantitative macroeconomic analysis. According to Canova (1998), the compilation of stylized facts of the business cycle is important for two reasons. First, stylized facts provide a coarse summary of the complex co-movements existing among macroeconomic aggregates, allow a rough calculation of the magnitude of the fluctuations in economic variables and may guide in selection of leading indicators for economic activity. Second, stylized facts provide a set of empirical regularities which can be used by macroeconomists as a benchmark to examine the validity of numerical versions of theoretical business cycle models.

Business cycle stylized facts were first documented at length in the early NBER chronologies pioneered by Mitchell (1913, 1923, 1927 and Burns and Mitchell (1946). Since that time, considerable attention has been given to document business cycle stylized facts for both developed and developing countries[27].

The economist Robert Lucas in his seminal paper "Understanding Business Cycles" emphasized the idea of business cycles regularities as a set of common facts in the form of correlation coefficients and standard deviations, in addition to an idea that business cycles are all alike. He noted that business cycles are not distinguished by regularity of timing. It is not the case, for example, that the path of (detrended) GDP resembles a sine wave, rising and falling at regular and predictable intervals. Rather, business cycles are distinguished by the fact that different macroeconomic variables move together over time. If a variable rises when GDP rises, and vice versa, we say that it is procyclical; variables that move in the opposite direction to GDP are said to be countercyclical.

Among the principal stylized facts noted by Lucas were the following: (i) Output movements across broadly defined sectors of the economy move together[28], (ii) Production of producer and consumer durables exhibits much greater amplitude than does the production of nondurables, (iii) Production and prices of agricultural goods and natural resources have lower than average conformity, (iv) Business profits show high conformity and much greater amplitude than other series, (v) Prices generally are procyclical, (vi) Short-term interest rates are procyclical; long-term rates slightly so, and (vii) Monetary aggregates and velocity measures are procyclical.

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[25]First labeled "stylized facts" by Nicholas Kaldor (1957).

[26]In fact, most countries in the world economy exhibit well-defined empirical regularities not only in domestic indicators of economic activity, but also in key international indicators (see e.g., Backusand Kehoe1989).

[27] Establishing the "stylized facts" associated with a set of time series is widely considered a crucial step in applied macroeconomic research (see e.g. Blanchard and Fischer, 1989).

[28] In Mitchell's terminology, they exhibit high conformity; in modern time series language, they have high coherence).

Considerable attention has been devoted to documents business cycle stylized facts after Lucas seminal work for advanced industrial economies (see for example, Kydland and Prescott, 1990; Backus and Kehoe, 1992; Stock and Watson, 1999; King and Rebelo, 1999) as well as for developing and emerging market economies (Agenor et al., 2000; Rand and Tarp, 2002; Male, 2010, Neumeyer and Perri, 2005; Aguiar and Gopinath, 2007; Uribe and Yue, 2006, Mendoza 2010 and Ghate et al., 2013. For example, the major empirical regularities of business cycles for the industrialized counties an documented by Male (2010) include: (i) persistent real output and real exchange rate fluctuations, (ii) consumption, investment, employment, inflation and money velocity all generally procyclical, (iii) government expenditures typically acyclical, and (iv) a remarkably stable relationship between output, consumption and inflation29. According to Neumeyer and Perri, 2005; Aguiar and Gopinath, 2007; Uribe and Yue, 2006 and Mendoza 2010), major features of business cycles in emerging market economies can be summarized as follows (i) consumption is more volatile than output with a relative volatility larger than one; (ii) real interest rates tend to be countercyclical, very volatile and lead the cycle, and (iii) net exports are strongly counter-cyclical. For the developing countries on the other hand, the major stylized facts as documented by Agénor et al. (2000) are as follows: (i) there is a great output fluctuations in developing countries, but on the average these fluctuations are considerably more volatile than typically observed in industrial countries, (ii) Industrial country business cycle fluctuations has a significant effect on developing country business cycle fluctuations, (iii) government expenditure is mostly counter-cyclical, which yields a counter-cyclical fiscal impulse as government revenue was found to be mostly a-cyclical, (iv) real wage deviations appear to be significantly pro-cyclical, (v) no consistent relationship between output fluctuations and deviations for inflation or for the price level, (vi) Monetary aggregates are broadly procyclical while the velocity of broad money was found to be mostly anti-cyclical. (vii) Finally, cyclical movements in the terms of trade are positively correlated with output fluctuations.

2.2.3 Business Cycle Theories[30]

One of the most critical challenges facing macroeconomic policy makers today is the need to understand why do world's economies go through cycles of recession and recovery, or boom and bust. Different schools of macroeconomic thought offer differing views to answer this question. Of course, providing a detailed historical overview of all business cycle theories is beyond the scope of this study[31]. Nevertheless, some important elements behind the development of business cycle theory will be presented in this subsection with an emphasis on the two claims of these theories of what shocks are most important in disturbing the economy and what economic structure is necessary for propagating these shocks. This subsection briefly provides a compact exposition of business cycle theory since Keynes[32]. It puts the main theories- Keynesian economics, monetarism, new classical economics, the real business cycle theory, and new Keynesian economics- in a historical perspective by presenting them

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[29] For more details see Male (2010).

[30] This subsection has benefited from the overview of business cycle theory given in Arnold (2002).

[31] For me details see, for example, Mullineux (1984, 1990), Zarnowitz (1992, Chapter 2), or Arnold (2002).

[32] Although there are significant differences between the various schools of thought, the work of Keynes remains a central point of reference because, as Vercelli (1991) argues, all the schools define themselves in relation to the ideas originally put forward by Keynes in his General Theory, either as a development of some version of his thought or as a restoration of some version of pre-Keynesian classical thought.

in the chronological order of their appearance and highlighting their differences and commonalities. These theories try to explain what the business cycle is, how it works, and why the things that happen in the economy happen.

The development of *Keynesian economics* began in 1936 with the publication of the *General Theory*, which challenged the classical presumption that aggregate output is determined, in normal times, by the supply of factors of the production. Keynesian economics emphasizes the role aggregate demand plays in the determination of aggregate production and the role the government[33] can play in creating additional demand in circumstances of low output due to lack of aggregate demand. There are well-known classical models of Keynesian business cycle theory such as the multiplier-accelerator model of Samuelson (1939), the Hicks-Fleming-Mundell model[34] (Hicks's (1937) IS-LM model for the closed economy and Fleming (1962) and Mundell's (1961, 1963) classic open economy version of the IS-LM model), an endogenous business cycle model by Kaldor (1940), a non-linear accelerator model by Goodwin (1951), a simple growth cycle model by Goodwin (1967)[35]. Keynesian economics became the predominant school of macroeconomic thought and remained in this position until the late 1960s.

In the 1960s, growing discomfort with the Keynesian neglect of supply-side factors a rose. M. Friedman initiated the monetarist counter-revolution, which brought the supply side back to the fore. The monetarist critique of Keynesian economics gave rise to a widely shared macroeconomic consensus in the late 1960s: the average rate of aggregate production is determined by supply side factors[36]. The interplay between aggregate supply (a monetarist Phillips curve) and aggregate demand (the Keynesian IS-LM system) causes fluctuations in aggregate production around the average level. This macroeconomic consensus assigns to the government a much less important role than does the original Keynesian theory.

In the early 1970s, under the head of Lucas, new classical economics appeared on the scene. New classical economics popularized the use of rational expectations in macroeconomics. It shows that the effectiveness of government policies is strongly dependent on the way in which expectations are formed. The new classical policy ineffectiveness proposition asserts that only unanticipated demand policies affect aggregate economic activity.

During 1980s, business cycle theory witnessed tremendous development when Finn Kydland and Edward Prescott (1982) and John Long and Charles Plosser (1983)

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[33] The Keynesian models assign to the government an important role in the stabilization of the economy via fiscal and monetary policies, the relevant options being described by the Phillips curve.

[34] Much of this model is discussed in more detail in Arnold (2002).

[35] However, these models may not be regarded as appropriately formulating Keynes' own vision, because ad-hoc hypotheses regarding investment decisions such as the accelerator principle or particular investment functions are used to formulate firms' investment behavior in these models in spite of the fact that Keynes stressed the forward-looking aspect of firms' investment decisions and the role of long-term expectation (Tanaka,

[36] The monetarists, including their leading proponent, Nobel Laureate Friedman, believe that there is no need for demand management. At any rate, fiscal and monetary policies are regarded as ineffective means of stabilizing the economy. In the long run, demand management is deemed to be futile because supply-side factors, which were, by and large, ignored by the Keynesian, determine the natural rates of aggregate output and employment- there is no permanent unemployment-inflation tradeoff. in the short run, activist policy is likely to add to, rather than reduce, the volatility of the economic system because of long and variable data lags, recognition lags, legislative lags, implementation lags, and effectiveness lags (see Arnold 2002: 26 and Mishkin 1998:680)

initiated the development of the real business cycle (RBC) theory. Since then, RBC theory provided the main reference framework for the analysis of macroeconomic fluctuations and to a large extent became the core of macroeconomic theory. The RBC approach to business cycle readopts the classical view that output determination is a supply-side phenomenon. It demonstrates that, given exogenous variations in total factor productivity, calibrated versions of pure supply-side modes without any market imperfections are capable of generating output movements and co-movements of other macro variables that resemble closely the observed time series. The RBC theory thus interprets observed output fluctuations as the optimal outcome of firms' and households' optimizing behavior under rational expectations, given exogenous variations in total factor productivity and, therefore, denies the need for any kind of effort to stabilize the economy. From a methodological standpoint, RBC theory firmly established the use of dynamic stochastic general equilibrium (DSGE) models as a central tool for macroeconomic analysis and forecasting. The first-order conditions of intertemporal problems facing consumers and firms replaced the behavioral equations describing aggregate variables. Ad hoc assumptions on the formation of expectations gave way to rational expectations. In addition, RBC economists stressed the importance of the quantitative aspects of modelling, as reflected in the central role given to the calibration, simulation, and evaluation of their models (Galí, 2008)

The fifth school of macroeconomic thought, new Keynesian economics, encompasses a heterogeneous set of models developed since the 1970s. Broadly speaking, new Keynesian economics is concerned with deriving Keynesian-style propositions from RBC-style models with rational expectations and optimizing behavior. Attention is focused on the explanation of nominal and real rigidities, on the role of firms' balance sheets in business cycles, and on the impact of extrinsic uncertainty on economic activity. Leading proponents of the new Keynesian approach are Bernanke, Blanchard, Mankiw, and Stiglitz.

2.3 Review of Empirical Literature

From an empirical standpoint of view, the statistical analyses of business cycles were first analyzed by the National Bureau of Economic Research during 1920s under the leadership of Wesley Clair Mitchell. Another significant contribution was also made by Burns and Michell in their extensive examination of economic activity in the United States in 1947. Burns and Michell found that the empirical regularities of economic fluctuations lay not in the length of cycle or its amplitude, but rather in the patterns of comovement and relative amplitude of economic variables. Since then, business cycle modelling has undergone major developments in line with the changing economic paradigms, improvements in computational capacity, new developments in econometric methods, new macroeconomic theories and advances in the quality and availability of the required data, which have led to richer and more complex models. Although Burns and Mitchell identified nine distinct phases of the business cycle and emphasized co-movements of the disaggregated series across sectors of the economy, some later economists concentrated on the analysis of a single series, most commonly real gross domestic product (GDP), the unemployment rate, or the index of industrial production to analyze business-cycle fluctuations. More generally, empirical business cycle literature tries to address issues like, identifying the driving forces behind these fluctuations and evaluating the degree of business cycle co-movements and associations using different country samples. Many econometric techniques have been

employed for that purpose. these include a Markov switching approach (see, e.g., Hamilton, 1983; Artis et al., 2004; Girardin, 2005; Dufrénot and Keddad, 2014); a dynamic factor model (see, e.g., Stock and Watson, 1989, 1991, 2003;) a cointegration techniques (see, e.g., Sato and Zhang, 2006), the Bayesian state-space based approach (see, e.g., Lee and Azali, 2012), vector autoregression (VAR) model (see, e.g., Kawai and Takagi, 2009; Shioji and Uchino, 2011), a dynamic stochastic general equilibrium model (see, e.g.,) sign-restricted VAR model (see, e.g., Braun and Shioji, 2007; Pappa, 2009)

For example, considerable empirical research indicate that large fluctuations in energy prices (mostly in the form of oil prices) have greater impact on business cycle fluctuations (see, e.g., Hamilton, 1983, 2003, 2011; Mork, 1994; Lee et al., 1995; Brown and Yücel, 2002; Balke et al., 2010; Kilian, 2010; Kim and Loungani, 1992; Ben-Arfa, N., 2012; Tiwari, 2012; Yilmazkuday, 2014).

Several studies focused on the relationship between business cycle fluctuations and banking system behavior, for example, Demirgüç-Kunt and Detragiache (2000) find strong relationship between macroeconomic conditions; especially economic growth and bank soundness; Ayuso et al., (2004), Estrella, 2004, and Saadaoui (2014) show a negative co-movement between capital buffers and business cycles. Bikker and Metzemakers (2005), Stolz and Wedow (2011) Shim (2013), among others indicate that a countercyclical behavior of banks leading to a negative and significant co-movements between bank capital buffers and credit risk with business cycle fluctuations.

Pallage and Robe (2001) indicate that in half of developing countries and in most African economies there is a high positive correlation between the cyclical component of foreign aid receipts and that of domestic output

Some empirical studies have drawn attention to the importance of the natural disasters[37] (such as droughts, floods, storms, and earthquakes) on the macro economy (see, e.g., Benson, and Clay, 2004; Narayan, 2001; Rasmussen, 2004; Selcuk and Yeldan, 2001; Skidmore and Toya 2002, 2007).

Most of these studies argue that natural disasters have a substantial impact on the economy, primarily through the destruction of capital stock [38] which leads to pronounced slowdowns in production. For instance, Rasmussen (2004) finds that natural disasters lead to a median reduction of 2.2% in the same-year real Gross Domestic Product (GDP) growth rate in the Caribbean. In the same line, Raddatz (2007) for a panel data for 109 low income countries showed that climatic and humanitarian disasters result in declines in real per capita GDP of 2% and 4%, respectively.

There is an ample literature that has been devoted to investigate shock propagation mechanisms in different economies and their effects on cyclical behavior given the fact that the global economy has become a more complex dynamical system, whose cyclical fluctuations can mainly be characterized by simultaneous recessions or expansions of major economies. One active branch of this literature addresses the question of whether there exists a global or world business cycle[39], that is, to distinguish the effects of

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[37]Major disasters include: the December 2004 tsunami in the Indian Ocean, the Pakistani Kashmir earthquake of October 2005 and cyclone Nargis that hit Myanmar in May 2008.

[38]For example, Burton and Hicks (2005) estimated that Hurricane Katrina in August 2005 generated commercial structure damage of $21 billion, commercial equipment damage of $36 billion, and residential structure and content damage of almost $75 billion.

[39]The presence of a world or global business cycle means that business cycles move together closely because of

country specific shocks, common shocks and spillover of business cycles between different economies. Some of this literature relies on a single measure of aggregate activity, such as output, while some other works employ multiple indicators, including output, consumption and investment, in order to provide more reliable estimates of global business cycles. However, the empirical literature remains inconclusive. For instance, Baxter and Kouparitsas (2005), Köse et al. (2003, 2008), Otto et al. (2001), Flood and Rose (2010) and Xi et al. (2014) find evidence that there has been a higher degree of synchronization of business cycle fluctuations among the group of industrial economies and among the group of emerging market economies during the last few decades. Similarly, Artis et al. (2011) find evidence of a secular increase in international business cycle synchronization across advanced and emerging market economies. to justify this synchronous phenomenon, Kaminsky and Reinhart (2000) and Imbs (2010) show that the international financial linkages between these countries were directly responsible for the international transmission of these fluctuations. Moreover, Chow and Kim (2003), Socorro Gochoco-Bautista (2008), Lee and Azali (2012) and Dufrénot, Keddad (2014) find that domestic outputs of East Asian countries are strongly influenced by country-specific shocks. For the same region Sato and Zhang (2006) find that some pair-countries in the region share both long run and short-run synchronous movements of the real outputs. Furthermore, Faia (2007) concludes that similar financial structures, closer trade and exchange rate stability among countries have significant impact on synchronized business cycles. More recently, Konstantakopoulou and Tsionas (2014) show that there are two distinct cycles in the OECD countries during the period 1960-2010: the Euro-area cycle, which includes the business cycles of Germany, France, Italy, Netherlands, Austria and Belgium, and the world cycle, which consists of the business cycles of the United States, Canada and the United Kingdom. In contrast, some others argue the opposite, for example, Heathcote and Perri (2004) for developed countries and Doyle and Faust (2005) for the G-7 countries provide evidence that there is a decline in the linkage between business cycles of the US and industrialized countries. Similarly, Kalemli-Ozcan et al. (2013) find that financial integration leads to less synchronized business cycles.

However, even if a clear understanding of the sources of business cycle fluctuations is commonly regarded as an important input for effective macroeconomic policy analysis and forecasting, empirical literature mostly concentrates on industrialized and to some extent on emerging countries, leaving most of the developing economies outside the analysis. There has also been a growing interest in understanding the sources and impacts of macroeconomic fluctuations in developing countries whose economies are especially vulnerable to fluctuations due to many socio-economic and political factors as explained section one. Generally, most developing countries on average exhibit more macroeconomic volatility than typically observed in developed economies (see, e.g., Agénor et al., 2000, Hnatkovska and Loayza, 2004). For African economies particularly, empirical literature suggests that highly unstable domestic macroeconomic environment is one of the primary reasons for the poor growth performance. For instance, Sachs and Warner (1996) and Rodrik (1998) use a variety of growth regressions to study the determinants of economic performance, and conclude that macroeconomic stability is an important factor for the long-run growth in Africa. Mendoza (1995) and Kose and Riezman (1999) find that terms of trade shocks explain

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transmission channels and/or common shocks.

roughly half of the aggregate output fluctuations in developing countries where the major economic sectors relied mainly on imported goods as factors of production. In a similar analysis, Hoffmaister et al. (1998) use the role of terms of trade, world output, domestic supply, fiscal policy, and nominal policy shocks to analyze the sources of macroeconomic fluctuations in Sub-Saharan Africa. Their results indicate that domestic shocks play a major role in accounting for aggregate output fluctuations. In line with these considerations, new research work on business cycle phenomenon emerged after the recent global financial crisis for example, Kalemli-Ozcan et al. (2013) show that prior to 2007, financial integration had a negative effect on international business cycle co-movement, but after 2007, it had a positive effect.

Understanding the performance of the Sudanese economy has long been a major preoccupation for both academics and policymakers. Although the sources of macroeconomic fluctuations and their potential impacts have still not been tackled in a comprehensive macroeconomic model (to the best of author's knowledge), some interesting studies and considerable empirical literature have emerged to evaluate the overall level of economic activity usually in terms of single driving forces and to suggest some policy options consistent with the turbulent macroeconomic environment in Sudan, especially after the secession of the South Sudan in 2011. One strand of the literature has focused exclusively on analyzing the behavior of exchange rate and evaluates its impact on the economy. For example, Elbadawi (1992) studied the macroeconomics of multiple exchange rates and black market for foreign exchange in Sudan to understand the determinants of the black market premium-both the short run asset market determinants and the longer run trade oriented influences- and how the presence of such market might have interfered with macroeconomic management of the economy. He argued that controlling inflation becomes more difficult under high-premium regimes and that higher premiums hurt official exports, tax revenue from foreign trade, and also tends to accelerate capital flight. He concluded that successful exchange rate unification and subsequent integration of the parallel market into Sudan's regular economy will require deep fiscal reform and liberalization of trade and exchange rate policies tailored to the pace of macroeconomic reform. In a similar study, Gerling (2012) indicated that the persistent of real effective exchange rate (REER) overvaluation pressures, multiple parallel exchange rates, and administrative restrictions on access to foreign exchange over the past few years provide risky environment to Sudan's external competitiveness. He suggested that undoing them would help (i) restore competitiveness and current account sustainability; (ii) reduce dead-weight loss ensuing from the use of informal channels by encouraging financial inflows (incl. remittances) through official channels; (iii) foster the credibility of the exchange rate system and its resilience to adverse exogenous shocks by accumulating international reserves; and (iv) remove the adverse impact of uncertainty relating to the exchange rate and foreign exchange regime on investment and diversified economic growth. In slightly different perspective, some authors concentrated on exchange rate volatility and its dependency with a set of macroeconomic variables. For instance, Arabi (2012) showed a simultaneous feedback between exchange rate and uncertainty and the response of the exchange rate to news about general price level, money stock, and current account by estimating the leverage effect in EGARCH framework. He argued that higher volatility of exchange rate during the last few decades mainly resulted from inconsistent economic policies adopted by consecutive governments who failed to realize the realistic exchange rate of the Sudanese pound. In a framework of a bivariate vector autoregressive-generalized autoregressive conditional

heteroscedasticity model, Abdalla (2013) showed that the shocks originating from the exchange rate market lead to increase volatility of stock market returns.

Another strand of the empirical literature has investigated the potential role financial institutions in the aggregate economic activity. Looking at the trend of financial development and intermediation in Sudan since the full adoption of Islam banking principles in 1990, Elhiraika (1998) provided evidence of a decline, in either real or relative magnitudes, in all key indicators of banking performance. He argued that the activities of Islamic banks in the country are constrained by the highly unstable macroeconomic environment in general and repressive monetary and credit policy in particular. In a framework of autoregressive distributed lag, Mohammed (2004) investigates the impact of financial development on economic performance in Sudan over the period 1970- 2004. The results overwhelmingly indicate a weak relationship between financial development indicators and real output as a results of inefficient allocation of resources by banks, along with the absence of an appropriate investment climate required to foster significant private investment and promote growth in the long run, and to the poor quality of credit disbursal of the banking sector in Sudan. By using insurance premiums, total claims, total investment as proxies of insurance activity in Sudan, Abdalla (2013) documented a very weak statistical significant for only total insurance premiums in relation to economic growth, other insurance variables have no significant impact on economic growth. He concluded that the weak impact of insurance sector on economic growth can be attributed, to some extent, to low levels of total premiums of the market. Based on a cross sectional data of seven banks and the telecommunication company, Arabi (2014) tested the validity of capital asset pricing model (CAPM), the arbitrage pricing theory (APT), and the three factor model of Fama and French for the Khartoum Stock Exchange (KSE). He illustrated that the effects of bad news on the conditional variance are almost double as good news in the market but without significant reaction of stock returns to the news regarding macroeconomic variables. Investors can only make use of the number of assets (cash-flow pattern), market capitalization, and risk free assets (GMC) as the main sources of their investment decisions.

Some other researchers have concentrated on the impact of bilateral trade and foreign direct investment. In a simple macroeconomic model, Hassan (1999) analyzed the macroeconomic effects of the 1980s liberalization, foreign capital inflows and reform policies on the Sudanese economy. The model's estimates validated the prevailing belief that the economy performed poorly during liberalization and showed that the contribution of foreign capital to investment, growth, and industrialization was very limited. Arabi and Ibrahim (2012) explained the bilateral trade patterns between Sudan and 16 Arab countries over the period 1990-2009 by using augmented gravity model. Although their estimates of population variable, GDPs of Arab countries and distance elasticity were compatible with priori theoretical explanations, the estimated coefficient of Sudan income has unexpected sign. They explained the later result by four possibilities: trade -barriers, home-market effect, lower level of inter- industry trade, and government policies.

The chronic political instability and conflicts has motivated some researchers to incorporate their impact. For example, Onour (2013) designed a macroeconomic model to mimic small open economies enduring political uncertainty arising from country splitting into two independent parts. He indicated that the stabilization of foreign exchange rates at the post-secession era depends on political stability in the country, which will impact foreign currency inflows to the country. The model predicted that if

political unrest continues after the split of the country, then foreign currency reserves at the Central Banks of either country will dwindle over time, which may lead to domestic currency depreciation in terms of hard currencies. In a similar study, Nour (2013) showed that natural disasters, civil wars, and government instability, and the external political and economic pressures are the main sources of macroeconomics policies stability during the period 1970-2005. Additionally, the model predicted that an expanding budget deficit and declining Central Bank reserves will eventually force the government to abandon a fixed exchange rate system in favor of a more flexible exchange rate system that resulting in further acceleration of both the domestic inflation rate and the domestic money growth rate.

Some other empirical works investigated the importance of the migrant's remittances as source of financing economic growth and foreign exchange in Sudan economy with a focus of investigating the role of macroeconomic environment in attracting migrants' remittances. For example, Elbadawi (1994) investigated the impact of exchange rate premium on remittances transferred by expatriate Sudanese working abroad during the period 1970-1990. He found that the black market exchange rate premium is a significant factor affecting the flow of migrant remittance through the official channels. He argued that an increase in exchange premium led to many deleterious effects, such as the reduction in the official exports and acceleration of the capital flight as well as the diversion of workers' remittances from the official market of the exchange rate. He concluded that improving the macroeconomic environment in terms of a credible exchange rate and trade reform is necessary condition for the realization of the full potential from the migrant's remittances. In the same track, Ebaidalla and Edriess (2012) investigated the role of macroeconomic policy variables in influencing the flow of migrant's remittances into the Sudanese economy. They found that inflation rate and black market exchange rate premium exert a negative and statistically significant effect on the remittance flow in both the short-run and long-run. Additionally, foreign income and trade openness have a positive impact on attracting the immigrants' remittances through official channels. They concluded that in the short run, the cut of government expenditure is the most effective policy since the problem of inflation and market premium is believed resulted from unproductive expenditure made by the government during the last few years.

Additionally, high and accelerating inflation and their impact has long been a major preoccupation to some researchers. Abdel-Rahman (1998) studied the determinants of the inflation in Sudan during 1970-1994 by incorporating inflation's characteristics in a framework allowing for structural regime shifts and ARCH effects within some conventional formulations directed towards discrimination between alternative inflation theories within the context of a Less Developed Country(LDC). Results obtained generally validate the conjecture that the inflation witnessed in Sudan is really a hybrid of monetary demand, structural supply and expectational origins and while the problem was predominantly one of a fiscal deficit, other factors played significant roles e.g. inflationary inertia and the various structural factors which impacted the economy during that period. In particular, the wide sweeping stabilization and structural adjustment programs of 1979 and after unleashed forces that thwarted the authorities' ability to harness inflation. Abdel-Rahman also argued that the budget deficits were not kept within limits the economy could absorb and in turn they ignited new inertia to the already existing inflationary forces this coupled with the altogether different phenomenon which emerged since 1992 where inflationary finance through seigniorage became a formal policy tool of the government. By analyzing inflation in Sudan during

the last few years, Abdoun (2012) underscored that its key determinants are reserve money, the exchange rate, fiscal monetization, and wage policy. While fiscal policy seems to have a limited direct effect, its indirect impact through the government's wage policy, and its presumed impact on national wages and the monetization of the budget deficit, are substantial. He also illustrated that inflation in Sudan is also characterized by a domestic cost dynamic largely influenced by the external environment, which underscores the open nature of Sudan's economy. According to Abdoun, reining inflation will require a fruitful and close cooperation between the central bank and the ministry of finance given the fact that two out of the three key determinants of inflation in Sudan (money supply and exchange rate) are under the control of the central bank, while the third (wage policy) is the responsibility of the ministry of finance. He also emphasized the need to enhance the role of the central bank by, among other measures, increasing its independence.

Some other driving forces like employment, Fiscal decentralization, Private capital formation, and the impact of oil have also been debated. Badawi (2006) suggested that public sector investment had a negative crowding out impact on private investment over the period 1969-1998 and that the devaluation policy contributed to discouraging private sector capital expansion. Dridi (2012) analyzed growth-employment nexus in Sudan over the past three decades. He pointed out that although Sudan's growth performance improved gradually in the past two decades, but could not provide enough jobs for a rapidly growing labor force, especially for youth and women. a heavy reliance on the oil sector, with insufficient investment devoted to the rest of the economy, an underdeveloped private sector, and a mismatch between education and skill levels among the unemployed and labor market demand are the main factors behind this weak relationship. Looking ahead, Dridi illustrated that an effective strategy would need to aim at fostering productivity gains and higher private-sector investment as the basis for growth and employment, and would therefore need to place emphasis on several factors, including: (i) accelerating the implementation of the reform program that would improve the business environment and allow the private sector to expand; (ii) removing existing rigidities in the labor market; (iii) strengthening and restructuring the educational and vocational training systems, with the objective of alleviating mismatches between workers' skill and education levels and job openings; and (iv) reforming labor market regulations so as to increase mobility and flexibility. By reviewing the current state of intergovernmental fiscal arrangements in Sudan, Flamini (2012) indicated that fiscal institutions are weak, social service delivery is inadequate and fiscal decentralization has so far been ineffective in reducing inequality and widespread poverty. He presented a set of policy options to inform fiscal adjustment efforts and improve the overall approach to fiscal federalism, these include: (i) building capacity at the sub-national level to meet administrative and institutional requirements; (ii) improving the transparency and predictability of central transfers to the states; (iii) strengthening fiscal institutions and budget credibility at the state level; (iv) improving project management and social delivery to advance poverty reduction; (v) refocusing central transfers toward the poorest states to reduce disparities across states; and (vi) improving the capacity of states to mobilize own revenues to reduce vertical imbalances and improve fiscal responsibility. Suliman (2012) examined the impact of oil boom on the Sudanese economy and articulates Sudan's underlying political economy issues. The results show that, the contribution of oil to real growth has been strong; however, the impacts on technological innovations are insignificant. Dutch Disease and fiscal linkages are the main mechanisms that transmitted the negative

effects of the boom. Specifically, the resultant misalignments of real effective exchange rate have caused an overall loss of competitiveness measured by the negative contribution to total factor productivity; also oil dependence has led to greater export concentration undermining long-run economic diversification.

Finally, in a prominent study, Alamir et al., (2014) analyzed the consequences of the secession of South Sudan on macroeconomic management in Sudan. They illustrated that Sudan has failed to manage and spend oil resources to build an economic foundation for a diversified, inclusive and sustainable growth. They argued that inefficient macroeconomic management, lack of inclusive economic policies, lack of implementation of development plans, and long internal conflicts hindered the country to effectively utilize its resources. Notwithstanding the declining economic activity during the last few years, the authors showed that Sudan has immense potentials to become an emerging economy, by reaching sustainably high growth rates through using agricultural resources and exploration of minerals, but good governance of the revenues from agriculture, agro-industries and from minerals is also a necessary precondition for this to happen.

CHAPTER 3

3. THE SUDANESE ECONOMY: AN OVERVIEW

3.1 Introduction

Despite the fact that Sudan is a country endowed with huge economic potential in terms of natural resources, it is classified as least developed, lower medium-income and food-deficit country. It is a country that has been undergoing tremendous fluctuations since its independence in 1956 which have created profound negative impacts on the country's development. Being mired in a heavy debt burden, international sanctions, Sudan is still searching for its way to become a strong and prosperous economy. The main objective of this section is to present the background of the Sudanese economy and its structure. The section also highlights the story of macroeconomic management in Sudan since its independence in 1956. The section concludes with the performance of key economic variables and institutions.

3.2 Some Facts about Sudan

Being the third largest country in Africa (after Algeria and Democratic Republic of Congo) and the sixteenth largest in the world, Sudan has a total area of 1,861,484 square kilometers[40] with population estimated at about 34 million[41] with the annual population growth rate of roughly 2.8% per year (UNDP, 2014). It shares international boundaries with Egypt to the north, the Red Sea, Eritrea and Ethiopia to the east, South Sudan to the south, the Central African Republic to the southwest, Chad to the west and Libya to the northwest. The River Nile traverses the country from South to North while the Red Sea washes about 550 miles of eastern coast making Sudan a bridge between Africa and the Middle East.

Because of its vast area, the country embraces many climatic and ecological zones[42] which include stretches of tropical forests, marshlands, mountains in the southern and central parts to savannah, stone and sand deserts, and mountains in the north, east, and west. Sudan is endowed with considerable natural resources including large and rich agricultural land as well as mineral resources. The white and Blue Nile Rivers, along with their main tributaries, are the major sources of irrigation and sustenance in the predominantly agrarian economy. However, when it comes to look at the global scale of the country's development, World Bank and the United Nations classification classified Sudan amongst the poor and low income country. According to UNDP, Sudan's Human Development Index (HDI) remains low with the value of 0.473 for the 2013 positioning the country at 166 out of 187 countries and territories[43]. Sudan also has wide and deep swaths of poverty and stark inequality between regions[44]. Poverty

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[40]Given Sudan's size compared to its total population, much of the country is unoccupied or very sparsely populated.
[41]The large majority of whom (about 70 per cent according to the 1993 census) live in rural areas.
[42] Diversity is also reflected in its people; and as a result, the country is multi–cultural, multi-ethnic, multi-lingual and multi religious.
[43]The prospects for Sudan meeting MDGs by 2015 are also bleak and its progress compared to that achieved by its neighbors and Sub-Saharan Africa average lags behind on many fronts (World Bank, 2013).
[44]According to the World Bank (2014), the main determinants of poverty in Sudan include: (i) sustained and multiple conflicts, which undermine opportunities for economic and social development, which in turn feeds back into grievance driving fresh conflict; (ii) a lack of economic diversification as reflected in the over-dependence on oil which has resulted in a neglect of agriculture and livestock sectors; (iii) unequal distribution of fiscal resources and unequal access to natural resources, especially between the center and the periphery; and (iv) governance

estimates set the average rate of poverty incidence at 46.5%[45] (National Baseline Household Survey 2009), indicating that some 15 million people are poor. Additionally, Sudan is considered as a heavily indebted country[46] to external creditors and has been in non-accrual status with the World Bank since 1994[47]. At the end of 2012, Sudan's external debt stock stood at US$41.7 billion in nominal terms, about 85% of which was in arrears (The World Bank, 2013).

In the political arena, one stylized fact about Sudan is that the political context is characterized by a long history of instability. Sudan has been plagued by chronic internal conflicts[48] and civil wars[49] involving northern and southern regions[50] since its independence in 1956[51], culminating in the secession of South Sudan on 9 July 2011. The secession of South Sudan has contributed to creating severe macroeconomic imbalances and deteriorating considerably the economic conditions in Sudan. It resulted in losing some three-quarters of its oil production, half of its fiscal revenues, and about two-thirds of its international payment capacity. It has also driven the trade balance from substantial surplus to a large deficit (IMF, 2012).

Additionally, regimes in Sudan have been changing since 1956, this including three civilian parliamentary regimes (1956-58; 1965-69; 1986-89) and three military ones (1958-64; 1969-85; 1989-present). Of course, such military–civilian regime cycles have posed serious challenges to the process of social and economic development in the country given the fact that each regime seems determined to introduce its own programme for economic development.

3.3 The Structure of the Sudanese Economy

Over the past few years, the structure of the Sudanese economy has been changing from an agriculture-based economy towards a highly oil-dependent one which in turn has marginalized agriculture. In fact, Sudan just like many other less developed sub-Saharan countries has an economy widely characterized by a high share of agriculture[52] and service sectors in GDP and employment and a small share of industry. In the

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failures as reflected in an inadequate policy framework and incentives for private sector investment.

[45] According to the Sudan's Interim Poverty Reduction Strategy Paper (IPRSP), the incidence poverty in Sudan varies significantly between urban and rural areas, with 57.6 percent of the population living in rural areas below the poverty line compared to 26.5 percent of the urban population. it also varies significantly by states, form 69.4 percent in Northern Darfur state to 26 percent in Khartoum state.

[46] Sudan's debt problems can be traced back to the 1960s when the country embarked on large-scale industrialization, financed in part by foreign borrowing on non-concessional terms, and accompanied by government heavy regulation of the economy (IMF, 2013).

[47] However, the country is eligible for debt relief under the Highly Indebted Poor Countries Initiative but it must come to an amicable understanding with South Sudan and its main creditors (World Bank, 2013).

[48] The onset and continuation of the civil wars and conflicts in Sudan can be traced to a complex of cultural and historical factors, as well as to developments of the post-independence period.

[49] The first civil war erupted in the South of the country in August 1955, shortly before independence between the forces of the central government and the "Anyanya Movement". The war intensified after independence of the country when the promise to grant a "Federal System of government" to the South of the country was denied by the ruling elites in Khartoum.

[50] The financial costs of the wars, coupled with international repercussions, have severely affected the nation's economic development.

[51] Prior to independence in 1956, Sudan was ruled by the Anglo-Egyptian condominium which had been established in 1899 following the overthrow of the Mahdist rule.

[52] Sudan grows a variety of crops that include cereals (wheat, sorghum, millet, corn and rice), oil –seeds (sesame, groundnuts and sunflowers), beans, chickpeas, and lentils. Others include cotton, sisal hemp and fodder crops. Horticultural crops include vegetables (onions, tomatoes, okra, egg-plant, potatoes, water-melon, cucumber), tropical and equatorial fruits. Aromatic and medical herbs are also grown. Forest wood products are also to be found and harvested in abundance.

immediate aftermath of independence in 1956, the agricultural sector was dominated the Sudanese economy, where it contributed about 61% of GDP (Brown, 1992). Since that time, the sector has been playing a pivotal role in the Sudan's economy until the exploitation and exportation of oil by the end of 1990s. In the late 1990s(before oil production), agriculture sector provides employment for about 80 percent of the country's labor force and its industry contributes about 40 percent of the country's GDP, over 90 percent the exports and foreign cash earnings[53], and in addition it produces over 90 percent of the national food requirements (IMF, 1999). Additionally, agriculture also drives activity in service sectors such as transportation, agro-industries, and commerce that account for a large proportion of the rest of the economy. Agriculture is the source of virtually all Sudan's exports, and therefore the key determinant of balance of payments developments.

Traditionally, agricultural sector in Sudan is generally divided into two sub-sectors: irrigated and rainfed agriculture[54] with rainfed production sub-divided into two further categories-traditional and mechanized[55]. The irrigated[56] sub-sector plays a very important role[57] in the country's agricultural production. It is mostly concentrated in partially sponsored governmental schemes along the banks of the Nile River and its tributaries covering an area of about 4 million acres[58], comprising schemes such as the Gezira, the Rahad, Khashm El Girba, El Suki, and the Tokar and Gash Deltas. The main irrigated crops[59] are cotton, wheat, groundnuts, sorghum and sugar cane and horticultural vegetables. The mechanized rain-fed agriculture covers 6 million acres of the central clay plains and is concentrated in Gadaref, Blue Nile, Upper Nile, White Nile, Sinnar, and Southern Kordofan states. Finally, the traditional rain-fed sub-sector[60] covers 9 million acres and considered the largest sub-sector[61]. Besides being the main source of the nation's livestock[62], this sub-sector produces sorghum, millet, grounds, sesame, gum arabic, cotton in clay soils, and other minor crops. Out of the country's total production, this sector contributes 90% of the millet, 48% of groundnuts, 28% of the sesame, 11% of the sorghum, and almost all of the gum Arabic (Abdalla et al, 2001).Within the vast agriculture land, Sudan also has abundant livestock sector with production almost entirely based on traditional pastoral system. Livestock export has become increasingly important part of the economy. Many animals, particularly camels and sheep, are exported to Egypt, Saudi Arabia, and other Arab countries.

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[53]Historically, agriculture sector generated the bulk of Sudan's foreign exchange earnings through a diversified basket of exports which can be broadly classified into three categories that includes field crops exports, animal and forest exports. The major field crops include sorghum, millet, cotton, sesame and ground nut, while animal exports include sheep, camels and cattle, and, gum arabic represents the major forest exports (Elgali et al., 2004).

[54]The rainfed agriculture covers the largest proportion of cultivated land in the country. It is generally characterized by small farm size, labor-intensive techniques employing hand tools, low input levels and poor yields.

[55]Each of these sub-sectors produces food and cash crops both for local consumption and export.

[56]In fact, Sudan has the largest irrigated area in Sub-Saharan Africa and the second largest in the whole of Africa, after Egypt (Critchley and Gowing, 2012).

[57]Irrigated agriculture has become more and more important over the last few decades as a result of drought and rainfall variability and uncertainty.

[58]One acre is equal to 0.42 hectares.

[59]Other crops grown under irrigated agriculture are fodder, sunflower, maize, potatoes, roots and tubers and rice.

[60]During the last ten years, this sub-sector has occupied an average of 60% of the total cultivated land and employed about 65% of the agricultural population.

[61]Although there is some rain-fed traditional farming in every state, the system is most prevalent in the States of Kordofan, Darfur, Sinnar, and the Blue and White Niles.

[62]Livestock production also has vast potential in Sudan, and many animals, particularly camels and sheep, are exported to Egypt, Saudi Arabia, and other Arab countries.

The second important sector in the Sudanese economy is the services sector which consists of sub sectors that have evolved in different magnitudes during the past decades in response to the increased demand for services from the emerging oil and oil related industries. This include financial services, construction, transportation, communications, trade and the public services such as, education, health and other social services.

Unlike, the significant contributions of agriculture and services sectors, industrial sector of Sudan is accounting for only a small share to GDP and workforce[63]. The main industrial activities of Sudan include manufacturing, construction, mining and electricity and water. The sector primarily comprises industries that process agricultural products, particularly sugar, textiles, oilseeds, flour and footwear. Due to the entry of petroleum revenues since 1999, recent years witnessed an increasing role of industrial sector. Meanwhile, the government has given a great attention to the development of industrial infrastructure, including new roads and transportation means and activation of telecommunication services and power energy. Figure 3.1 provides the contributions of these sectors in GDP throughout the period 1960-2013 and Table 3.1 shows the recent developments and prospects over the period 2010-2013.

Figure 3.1: Sectoral contributions to real GDP, 1960-2013 (% of GDP)
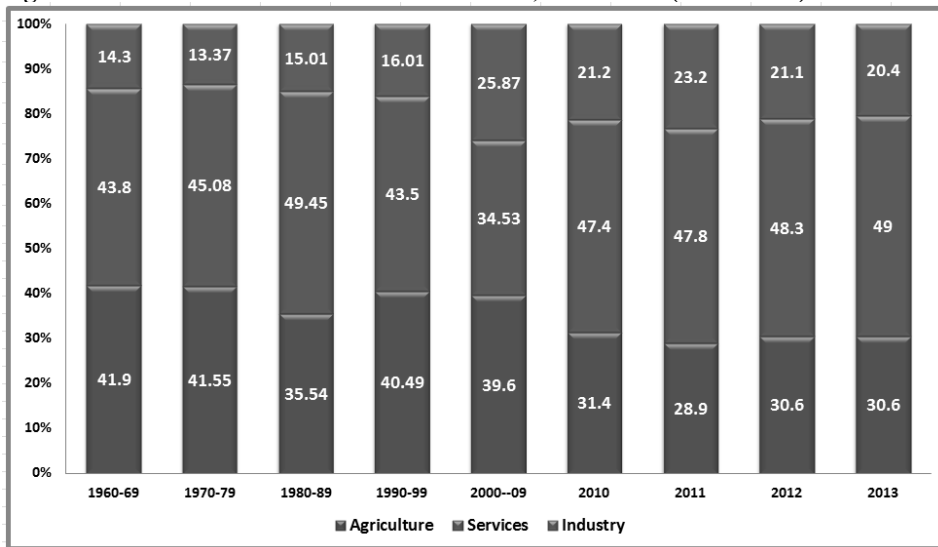
Source: Author's compilation based on World Bank Database and Central Bank of Sudan (annual report, various issues).

The dominant position of agriculture sector continued until in end of 1990s when Sudan began exporting crude oil[64] and since then the country has become increasingly dependent on oil for exports and revenues to the extent that the economy has turned into an oil dependent economy. Oil exports increased from zero level in 1998 to reach

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[63]The small size of the country's industrial sector is a result of chronic problems, including lack of skilled labor force, raw materials, and investments.

[64]In fact, oil was discovered in Sudan in the mid-1970s, but production did not start until 1999. The pioneer companies Chevron and Shell were forced to bow out in 1984, after the outbreak of the civil war.

US$ 276 million in 1999[65] accounting for 35.3% of overall export earnings. In 2005, oil exports reached US$ 3.097 billion accounting for 86.7% of total exports. For the whole period (1999-2010), the contribution of crude oil to national exports was on average 82.3% (Suliman, 2012). This was mainly a result of the rise in global aggregate demand driven by rapidly growing Asian countries, mainly China and India. With the increased oil production, high oil prices, and the significant inflows of foreign direct investment, the economy of Sudan boomed for nearly a decade. During this period, Sudanese economy has also become more integrated with rest of the world- its trade to GDP ratio has increased from 25 per cent in 2000 to 44 percent in 2008, and the country has emerged as one of the highest recipients of foreign direct investment in Africa (World Bank, 2010). Oil windfalls also contributed significantly in a massive expansion of its road network and electricity generation, development in telecommunications.

Table3. 1: Sectoral contribution to real GDP, 2010-2013 (% of GDP)

Sector	2010	2011	2012	2013
Agriculture, Forests, Animal Resources and Fisheries	**31.3**	**28.9**	**30.6**	**30.6**
Industry	**21.1**	**23.2**	**24.4**	**21.1**
oil	7.5	6.7	2.2	2.9
Mining and quarrying	0.3	0.2	0.6	0.6
Processing and Handcraft	10.9	13.7	15.0	15.0
Electricity and Water	2.4	2.6	2.7	2.6
Services	**47.3**	**47.7**	**49.0**	**48.3**
Building and Construction	3.4	3.3	3.4	3.4
Wholesale and Retail Trade, Hotels and Restaurants	7.8	8.9	8.9	8.8
Transport and Communications	9.9	10.4	10.9	10.8
Finance, Insurance, Real Estate and Other services	11.5	12.2	12.4	12.3
Community and other Social Services	1.4	1.1	1.3	1.2
Financial intermediation service	-1.7	-1.9	-2.0	-1.9
Government Services	12.9	11.5	11.7	11.4
Non-profit private households services	0.7	0.7	0.8	0.8
Import Charges	1.4	1.5	1.6	1.6

Source: Author's compilation based on Central Bank of Sudan (annual report, various issues).

Notwithstanding these remarkable improvements in the overall economy, high oil dependence had sparked a wide range of problems. For example, it led to greater export concentration undermining long-run economic diversification and raised the possibilities of a 'Dutch Disease'. At this point, it is worth mentioning that the secession of South Sudan in July 2011 has inflicted a large permanent fiscal and external shock on Sudan. The later has been linked, to a large extent, to inefficient management of oil revenues which in turns led to the country's failure in diversifying the economy out of oil despite its rich natural resource endowment.

As a consequence of the secession, and subsequent permanent oil shock, Sudan's attention has shifted to other natural resources such as gold. Based on the fact that Sudan still has a relatively huge economic potential in terms of its endowment of natural resources, economic growth in Sudan is expected to be driven by natural

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[65]Prior to 1999, the shortage of oil products was a permanent handicap impeding the economy's development with all its negative implications especially on production and growth (Gadkarim, 2010).

resources (mainly oil and gold). In fact, Sudan is currently working to expand oil exploration efforts and at the same time looking to gold mining as a new source of foreign exchange earnings.

3.4 Macroeconomic Management Overview

As for macroeconomic management perspective, at the outset it is worth pointing out that Sudan has experienced major challenges in the social, economic and political spheres in the immediate aftermath of its independence in 1956 which generated strong pressures for policy makers to look for effective policy responses. Despite these challenges, however, a very limited interest has been given to prepare a national development plan to address these challenges. In fact, political instability and partisan intrigues were the main concern during that period. Most of attempts for improving the performance of Sudanese economy were either failed or terminated due to their failure or a government change.

The beginning of some interest in national development plan was marked by the formulation of the Ten-Year Plan of Economic and Social Development (TYP-ESD) for the period 1961-1970[66]. The key objectives of that plan[67] were: broadening the structure of the Sudanese economy; achieving an appropriate increase in real per capita income; achieving an appropriate increase in exports an import substitution; improvement of social services; and maintenance of stable price level. However, ambitious goals of this plan were not fully achieved due to, among others, the civil war in the southern part of the country and lack of sufficient capital. Even though, the economy during such period was stable and reported a positive growth rates, about 5% percent on average (Ali and Albadawi, 2004).

The second attempt was made by initiating a Five-Year Plan (FYP) for socio-economic development for the period 1971-1975. Based on a socialist orientation, the key objectives of this plan were to achieve, among other things, a 7.6% percent average annual GDP growth; increase agricultural production by 60.8%; increase livestock production by 75.5% and industrial production (mainly agro-industries) by 57.5 %; and develop productive cooperative societies as a basis for economic development. Due to political instability, the plan had fallen short of achieving its targets; the overall rate of growth recorded during the plan period was only 4%. The plan was supplemented with a five year interim program of action in 1972 with a change in sectoral targets giving more attention to transport and communications sectors, followed by the agriculture sector.

Again, during the late 1970s,Sudan economy started to experience a wide range of interdependent structural problems which created serious challenges for economic development efforts during that period. These include, among others, the imbalance between savings and consumption, the inefficiencies in production, the large deficit on external account, and the imbalance between public revenues and expenditures(World Bank, 1985).To address these challenges, the government has adopted a set of macroeconomic stabilization policies[68]. Beginning with 1978, the government adopted

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[66]This plan was originally a seven year program; the goals of the original plan have been extended by three years.

[67]The theory behind the plan was that most of the country's resources should be allocated at this stage to the productive side of the economy, which will provide a base for later development. Health and education will receive more attention later, after investment in land and water show productivity.

[68]In early 1970s, the dominant macroeconomic policy and development strategy was outward orientation. The focus was on the expansion of cotton production and other main export crops, and on the promotion of private sector

the first wave structural adjustment programs (SAPs)[69] with the assistance from the International Monetary Fund (IMF) and the World Bank (WB).The basic elements of these programmes generally involved: (i) Monetary restraint aimed at reducing the growth of absorption and the rate of inflation; (ii) Interest rate policies aimed at keeping real interest rates positive but low; (iii) Fiscal restraint to reduce the fiscal deficit to a sustainable level and thereby restrain aggregate demand pressures; (iv) exchange rate action to ensure a real exchange rate that improves international competitiveness and creates the incentive for expanding the production of international traded goods; (v) External financing policies to reduce the stock of external debt if it is perceived to be currently unsustainable, or to limit foreign borrowing if it is likely to become so in the future; (vi) Structural reform (such as financial sector reforms, producer pricing policies, trade liberalization, and tax reforms) to make the economy flexible and efficient(Arabi, 2012). However, the performance of Sudan's economy did not stabilize as it has been anticipated. For example, GDP growth rate was highly volatile and reported a negative average of -0.3 percent during the period of 1978-85 (Hag Elamin and El Mak, 1997); the foreign debts accumulated to more than $15 billion (Bior, 2000). During the period, a program which was known as the Economic Recovery Program (ECRP) was designed for the period 1978-85. The key policy actions were devaluation of Sudanese pound[70] and implementation of a tight demand management. The potential effects of these policies were, however, undermined by rising inflationary pressures, internal and external imbalances and escalated of foreign debts. Accordingly, the economy remained very weak with a persistent macroeconomic instability. The main obstacles for the SAP to achieve the desired outcomes in Sudan[71] were the approach of implementation and the uncertainty about the policy and the existence of the government itself (Denu, 2011).

In the early 1990s, the government initiated new programs to resolve the country's economic problems, culminating in the adjustment policies of the Three-Year Economic Salvation Program[72] (NESP) for the 1990/91-1992/93), which was merged into the ten-year Comprehensive National Strategy (CNS) for the period 1992/93-2002/03. These reform programs aimed at addressing the structural rigidities and stimulating the economy's potential through liberalizing the economy. In particular, the government reform efforts emphasized four aspects: restoring macroeconomic stability and combating runaway inflation through tough fiscal and monetary policies; emphasizing market-oriented economic activity, liberalization, abolition of controls and deregulation; limiting the role of the state through privatizing public-sector enterprises and extending the role of the private sector to all activities including health, education and utilities; and encouraging saving by reforming the banking sector and introducing new saving instruments(World Bank, 2003).

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investment, in terms of enactment of investment promotion acts in 1972 and 1974 (UNDP, 2005).

[69]As it has been common with all SAP in different countries, the main theme of the reform was the implementation of economic policy measures which aimed at eliminating price controls and restrictions on private economic activities. State owned enterprises (SOEs) were to be privatized. Regulations on prices were lifted. Exchange rate system was liberalized. Tariffs on imports were lifted. Subsides on articles of greater necessity were removed. The currency was devaluated to regain competitiveness of the Sudanese exports (Denu, 2011).

[70]During the period 1978/79-1984/85 the official exchange rate was devalued, on average by 14.5 percent per annum (Hag Elamin and El Mak 1997).

[71] Not surprisingly, this period was accompanied by the devastated events of drought and famine in 1983/84, political instability and prolonged of civil war in the south in 1983.

[72]Macroeconomic policies during this period were homegrown given that they were neither negotiated with nor supported by the IMF and the World Bank.

Since 1997, Sudan began to cooperate again with the IMF by implementing macroeconomic reforms[73] within the framework of a medium-term staff-monitored program (MTSMP). Two successful staff-monitored programs were implemented in 1997 and 1998[74]. These programs built upon the progress made in deregulating the economy during 1992–96, which included: streamlining investment procedures, initiating a public sector reform and privatization program, instituting major agricultural reforms, eliminating most of the non-targeted consumer subsidies, and made some progress in liberalizing the foreign trade and exchange regimes (IMF, 1999). While the economy responded positively to these reforms, macroeconomic imbalances persisted with high inflation caused by weak fiscal and monetary policies, and an inadequate exchange rate regime. The tightening and rebalancing of fiscal, monetary, and external policies, and the initiation and implementation of major structural reforms during 1997 and 1998 resulted in significant macro-economic stabilization and laid the foundation for sustained economic growth. Real GDP growth accelerated to about 6 percent on average in 1997 and 1998; annual average inflation declined from 133 percent in 1996 to 17 percent in 1998; rates of return on deposits became positive in real terms, and financial disintermediation was halted; the foreign exchange market was unified; private transfers from abroad increased; export volume growth was strong; and the current account deficit (on a cash basis and excluding public transfers and oil-pipeline related imports) declined from 7.6 percent of GDP in 1996 to 4.1 percent in 1998 (IMF, 1999).

Another important step made by the Sudanese government under the supervision of IMF was the implementation of a Medium-Term Financial Adjustment and Structural Reform Program (MTFASRP) for the period 1997-2011. The intentions of this macroeconomic management approach were restoring macroeconomic stability, creating a better environment for the private sector, addressing the post-conflict challenges (reconstruction and rehabilitation of the war-affected areas and the solving the issues of displaced population settlements), and implementing poverty reduction actions. Substantial fiscal policy measures, combined with monetary and exchange rate reforms as well as trade liberalization reforms, were undertaken over the period 1999-2011 (Alamir et al., 2014).

In the aftermath of the secession of South Sudan, the government tried to approve some comprehensive reform programs to address the deterioration of the country's economic and financial situation. A first attempt was made by formulating a three-Year Salvation Economic Program (2011-2013) with the key objective to reverse the trade deficit by actively promoting imports substitution and exports. The plan aimed to promote self-sufficiency by 2013 on a number of agricultural products such as wheat, sugar, and

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[73]As for Sudan's macroeconomic management institutions, four major institutions are effectively participating in macroeconomic policy formulation and implementation, namely: National Assembly, National Strategic Planning Council, Ministry of Finance and National Economy, and the Central Bank of Sudan. some other institutions also play role, like the President's Office, the ruling National Congress Party, the Council of Ministers, the State Council, Big Business, and other organizations like the Sudanese Businessman and Employers Federation, the Sudanese Workers and Trade Union Federation, and the Sudan Bank Union (Alamir et al, 2014).
[74] More recently, a new SMP is initiated for the year 2014. Consistent with the policies outlined in the emergency three-year strategy, this new program has two key objectives: (i) restoring macroeconomic stability while strengthening social safety; and (ii) developing the required reforms to revamp the economy and lay the groundwork for sustainable economic growth. If appropriately implemented, the SMP will allow for the strengthening of Sudan's cooperation with IMF on policies and payments, and may, in due course, support the authorities' request for arrears clearance and debt relief (IMF, 2014).

cooking oil, as well as increasing exports of cotton, processed meat, gum Arabic, and gold (World Bank, 2013).

Additionally, and with the view to addressing the aforementioned structural constraints and challenges, the Government of Sudan formulated an Interim Poverty Reduction Strategy Paper (I-PRSP) for the years 2011-2013 and a Five-Year National Development Plan [75] (FYNDP) for the period 2012-2016. Both programs seek to promote economic growth, build institutional capacity and strengthen governance and are, therefore, meant to be complementary and mutually reinforcing. The I-PRSP had four main pillars: (i) strengthening governance and institutional capacity; (ii) reintegration of IDPs; (iii) developing human resources; and, (iv) promotion of economic growth and employment creation. The NDP on the other hand, focuses on five priority areas: (i) governance and administration; (ii) building institutional capacity; (iii) economic growth and sustainable development; (iv) social development and culture; and, (v) consolidation of the value system.

3.5 Summary of performance of the Sudanese Economy

3.5.1 Output performance
Over the past five decades or so, the Sudanese economy has experienced different growth episodes (see Figure 3.2). Between early 1970s and early 1990s, there were large swings in the growth rate as results of different economics and political turbulences such as, for example, civil war, oil price hike shocks, macroeconomic policy changes and regime instability. However, for a decade starting 1999, Sudan started to enjoy macroeconomic stability and it was in its longest and strongest growth episode since independence, benefiting from the advent of oil in 1999. According to Suliman (2012), real GDP per capita grew on average by 4.5% between 1999 and 2010, compared with 0.6% in 1961-98 and per capita income increased by 61.7%, in constant 2000 US$, between 1999 and 2010 compared to 16.9% between 1960 and 1998. The World Bank also provided enormous estimates during this period. These include for example, (i) real economic growth averaged about 9% during 2005-2006, putting Sudan among the fastest growing economies in Africa (World Bank, 2008), (ii) the size of the economy measured by nominal gross national product, has grown fivefold—from $10 billion in 1999 to $53 billion in 2008, and (iii) per capita income, a summary measure of the living standard of average citizens, has increased from $334 to $532 (constant 2000 USD) over the same time period. This is in sharp contrast to the pre-oil period when real per capita income kept mostly within the $200-300 range during a four-decade period (Figure 3.3).

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[75]This plan has benefited from active and substantive United Nations support and inputs, takes account of the new situation resulting from recent major political and socioeconomic developments and replaces the National Development Plan 2007-2011.

Figure 3.2: Real GDP Growth 1961-2013
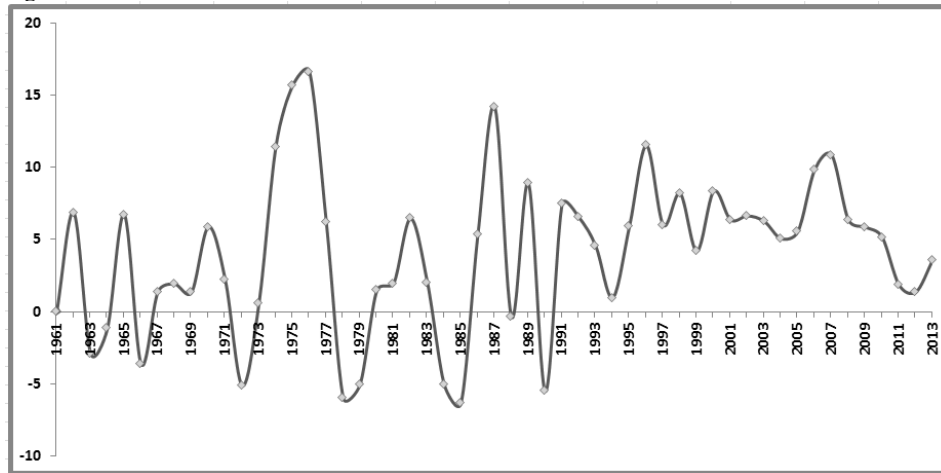
Figure 3.3: GDP per capita (constant 2000 USD)
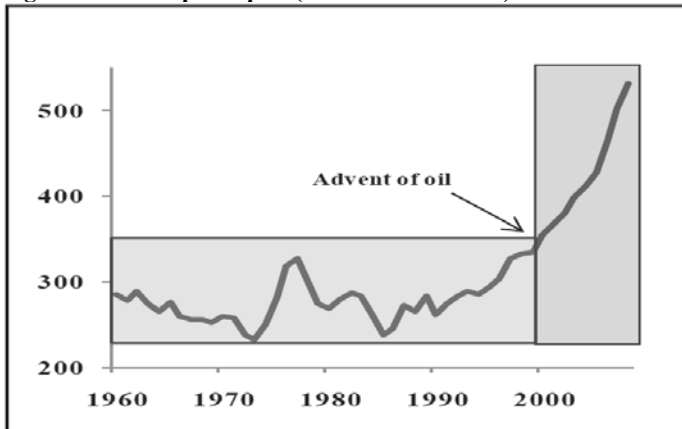
However, Sudan economy started again to experience a declining economic activity as a result of the negative oil shock after the secession of South Sudan in 2011. From 5.2% in 2010, the growth rate of real gross domestic product (GDP) registered at 1.9% and 1.4% in 2011 and 2012 respectively. More recently, the GDP growth rate registered at 3.6% in 2013, driven by agriculture and mining sectors as well as the inflows from oil transit fees and the Transitional Financial Agreement (TFA) with South Sudan. Figures 3.4 and 3.5 provide a full picture of real GDP growth rate in Sudan when it comes to be compared with economies in Africa and selected Arab countries.

Figure 3.4: Real GDP Growth for Sudan, Eastern Africa, and Africa 2004-2013
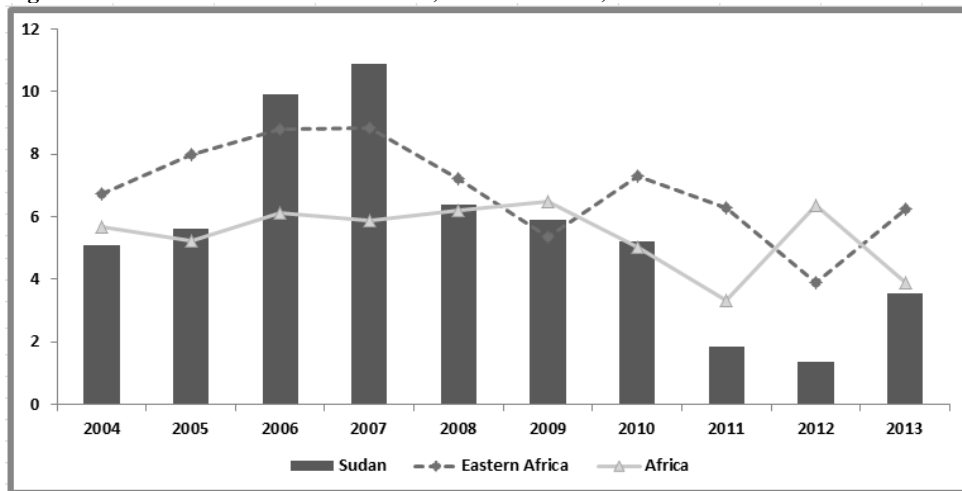
Figure 3.5: Real GDP Growth for Selected Arab Countries 2012-2013
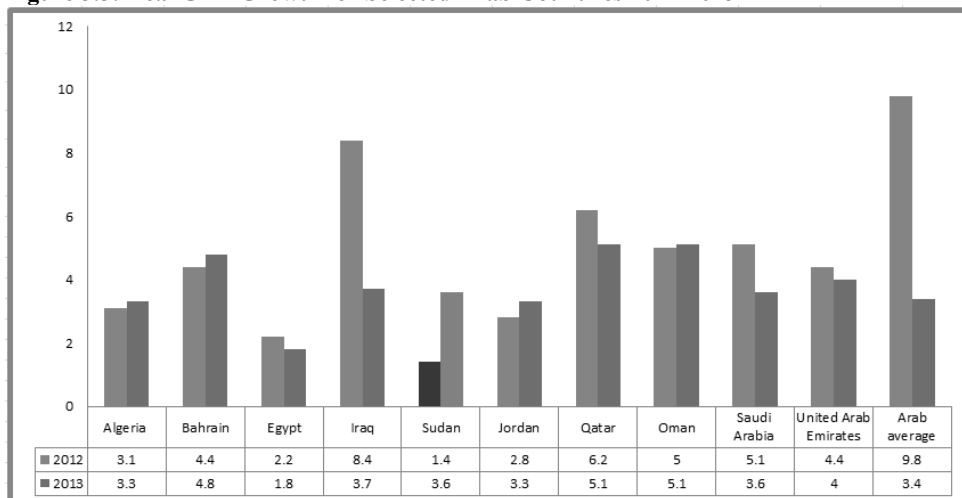
	Algeria	Bahrain	Egypt	Iraq	Sudan	Jordan	Qatar	Oman	Saudi Arabia	United Arab Emirates	Arab average
2012	3.1	4.4	2.2	8.4	1.4	2.8	6.2	5	5.1	4.4	9.8
2013	3.3	4.8	1.8	3.7	3.6	3.3	5.1	5.1	3.6	4	3.4

3.5.2 Developments in the Price Level and Money Supply

Throughout its history, Sudan experienced a series of simultaneous fluctuations in inflation rate and money supply with higher volatility seen at the early 1990s (see Figure 3.6). It is very clear that, as the growth rate of money supply is accelerating, there is a rapid rise of the inflation rate. Figure 3.6 distinguished three periods for inflation rate movements 1960-98, 1999-2010 and after 2011 where inflation averaged 34.3, 9.7 and 30.1 respectively. For the first period, Sudan economy experienced a

double-digit inflation for most of that period and this ending with hyperinflation by the early 1990s[76]. The advent of oil and the substantial progress made in maintaining price stabilization since 2000 were the main reasons for rates of inflation to be registered at single-digit levels during the second period. However, after the secession of South Sudan in 2011, Sudan started to struggle again from high and volatile inflation rate jumping significantly from 13.1 in 2010 to more than 40 in early 2014. Of course, various factors contributed to this acceleration and variability during this period, the predominant among these are the central bank financing of fiscal deficit and the government wage bill IMF (2012). Other factors such as decline in agricultural and industrial production; continuing high food price inflation; and the rising import cost of basic goods as a result of weakening local currency value are also considered. According to World Bank (2014), the recent double digit-inflation rate is expected to persist, due to the foreign exchange shortage, the monetization of the budget deficit and supply bottlenecks resulting from structural constraints on the private sector. A number of short-term policy measures to reduce inflation have been implemented recently, including the removal of import duties and administrative fees for cereals.

A closer look at the money supply growth rates on other side, it is very important to note that the expansion of money supply was reduced during the last few years due to a notable government borrowing reduction from the central bank (Alamir et al., 2014). According to available statistics, monetization and financial intermediation are weak in Sudan. In fact, broad money is only 26.3 percent of GDP, compared to 48 percent on average for LICs (see Figure 3.7), and the share of currency in broad money is very high (see Figure 3.8). Additionally, deposits are low at only 19 percent of GDP (Figure 3.9). As a result, domestic credit to the private sector is also low at only 12.1 percent of GDP versus the 32.6 percent LIC average at end-2012 (Figure 3.10). More information regarding monetary base is also provided in Figures 3.11 and 3.12. Figure 3.11 illustrates the components of the reserve money as a percentage of total reserve money by the end of December, 2013. While Figure 3.12 shows the money multiplier, the velocity of circulation and monetary depth during the period 2009-2013.

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[76]During hyper-inflation period in the 1990s, a strengthened programme focusing on macroeconomic and price stabilization was formulated for the period 1997-2001. the key objectives were: (i) restoring a stable macroeconomic environment and combating running inflation through a programme of enhanced revenue collection, expenditure control, and prudent monetary stance; (ii) Securing incentives for production and exports through measures emphasizing market oriented policies, deregulation, and abolition of controls; (iii) Adopting structural measures to limit the role of the state by privatizing public enterprises and extending the domain of the private sector to all activities, including education, health and utilities; and (iv) Encouraging savings by stabilizing the economy, introducing new saving instruments, and reforming the banking sector through prudential regulations.

Figure 3.6: Inflation Rate and Money Supply Growth (annual %) in Sudan (1960-2013)
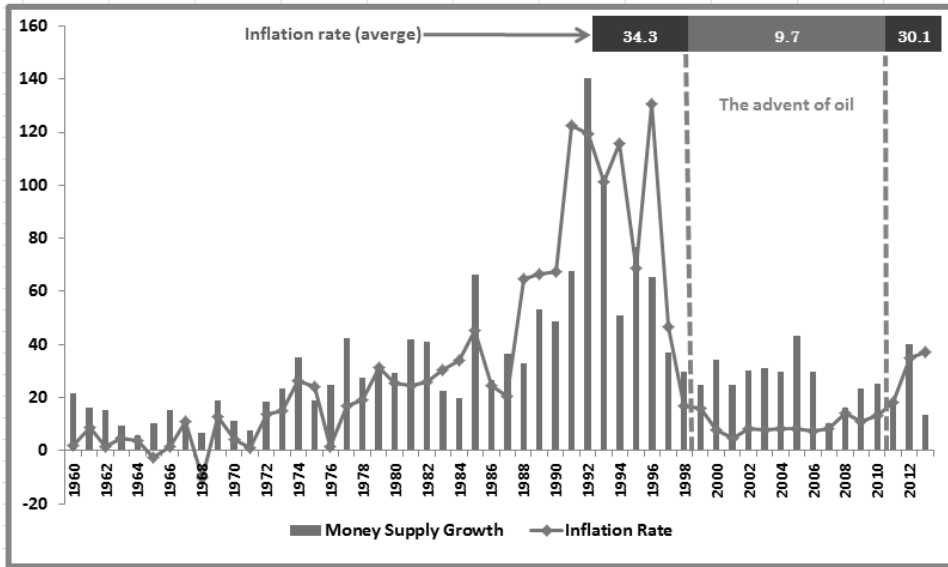
Source: Author's compilation based on Central Bank of Sudan (annual reports, various issues) and the World
Bank Database

**Figure 3.7: Broad Money: end-2012
(% of GDP)**
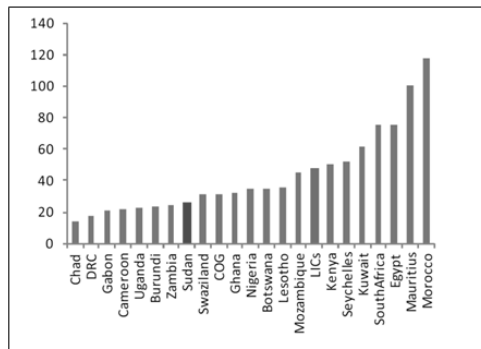
Source: IMF (2013).

**Figure 3.8: Currency outside Banks:
end-2012 (% of Broad Money)**
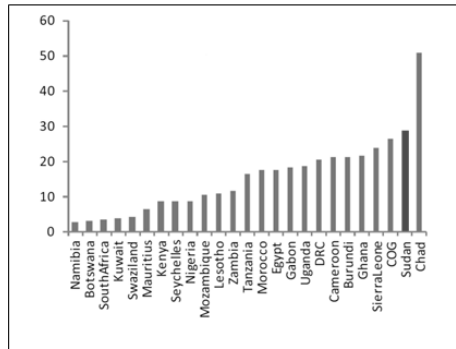
Source: IMF (2013).

Figure 3.9:Deposits:end-2012 (% of GDP)
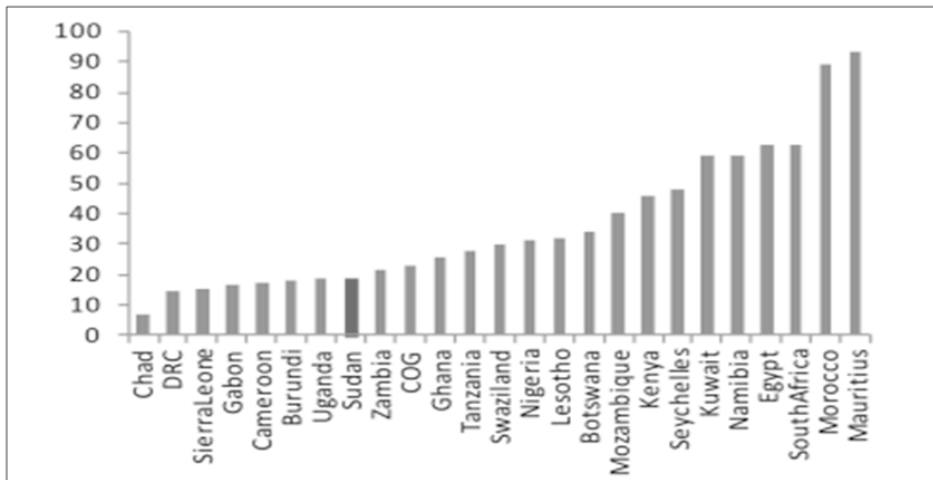
Source: IMF (2013).

Figure 3.10: Domestic credit to private sector:end-2012 (% of GDP)
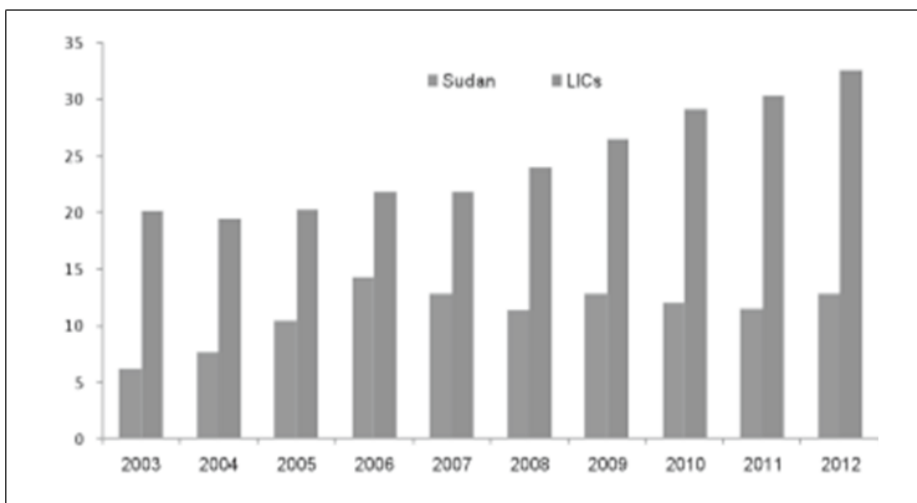
Source: IMF (2013).

Figure 3.11: Components of the reserve money: end-2013 (% total reserve money)
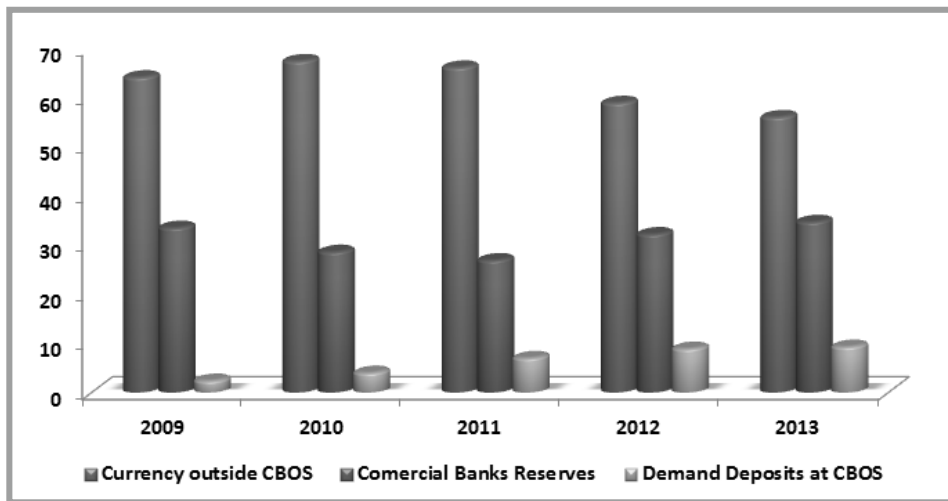
Source: Author's compilation based on Central Bank of Sudan (annual report, various issues)

Figure 3.12:Money multiplier, velocity of circulation and monetary depth 2009-2013
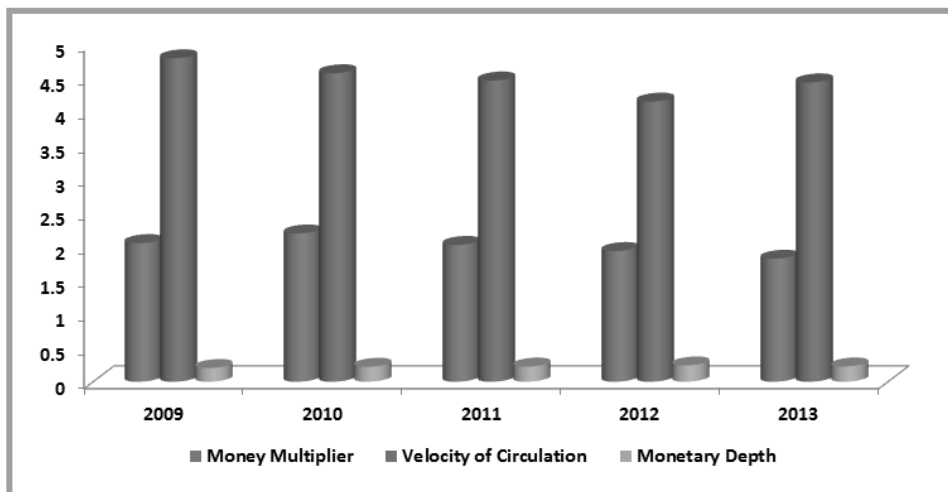
Source: Author's compilation based on Central Bank of Sudan (annual report, various issues)

3.5.3 Developments in exchange rate

Exchange rate system in Sudan has undergone a paradigm shift from a system of fixed exchange rate to floating one. After independence, the government adopted a fixed-exchange rate regime as part of the accession agreement to the IMF in July 1957. The entire 20-year period 1957-1978 witnessed remarkable stability of the Sudanese Pound under the peg (first to the Pound Sterling until 1971, and then to the U.S. Dollar) (UNDP, 2006). In September 1978, the government devalued the Sudanese pound for the first time by 43 percent, and introduced two rates i.e. the fixed (official) and floating (free) rate. This scenario continued up to February 1992 when Economic liberalization Policies (ELP) were introduced devaluating the official and free rate by 496 per cent, and 197 per cent respectively (Arabi, 2012). However, due to the drastic depreciation of the local currency and the subsequent increase in inflation, the floating system was abandoned in October 1993 and replaced by the dual exchange system. The formal rate was set at LS215/US$, while the parallel was set at LS300/US$. Thereafter, the exchange rate underwent continuous devaluations as set by the Central Bank of Sudan at LS300/$ and LS430/$ in 1994 and 1995, respectively. Therefore, managing the exchange rate during 1990-1995 was a difficult task for the government owing to the scarcity of foreign exchange and economic distortions (Ebaidalla, 2013). In 1998, a more comprehensive strategy for exchange-rate reform was introduced whereby the exchange rate was unified. The official exchange rate was replaced by a moving average of the market rates, and the Central Bank progressively implemented steps to strengthen the prudential regime and lift exchange controls (UNDP, 2006).

In recent years, exchange rate has fluctuated considerably. During the period of the managed floating exchange rate regime and the advent oil boom (1999-2010), the exchange rate was stable at an average rate of 2.5SDG/US$. However, after the secession of South Sudan, the loss of the main source of foreign exchange (oil revenue) and increasing uncertainty over the economic prospects have been putting significant depreciation pressure on the local currency and foreign exchange reserves have been dwindling. According to the World Bank (2012), the Sudanese pound has depreciated by around 50 percent in the parallel market since the secession further widening the gap with the official exchange rate. Figure3.13 shows the trend of exchange rate and its volatility over the period 2000-2013.

Figure 3.13: Exchange rate (**SDG/US$**) and its volatility 2000-2013
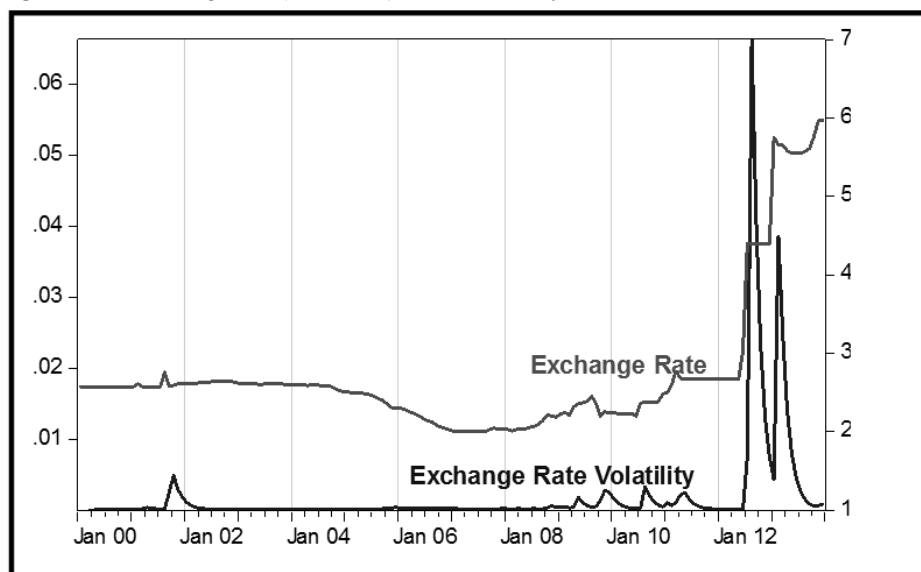
Source: Author's compilation based on Central Bank of Sudan database.
Note: The calculation of exchange rate volatility is based on estimating GARCH (1,1) process.

3.5.4 Sudanese Stock Market

The Sudanese stock market was established in 1995 with technical assistance provided by the Common Market for Eastern and Southern Africa (CoMESA)[77]. Securities traded in the market are ordinary shares and investment units[78]. Furthermore, a substantial number of mutual funds and Government Investment Certificates (GICs)[79] are also traded. Orders are handled through brokers during trading hours and share prices are quoted in Sudanese Pound (SDG). Trading in securities is taking place in two markets, the so called primary and secondary markets[80]. Although the market switched from manual to computer-based trading in January 2012, trading still occurs for only one hour (10:00 am to 11:00 am) and brokers must be physically present at the exchange (IMF, 2014).

As a part of the financial system of Sudan, the market operates on the basis of Islamic

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[77] Member states are: Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia and Zimbabwe.

[78] An investment unit is a proportional accounting share in the total net assets of an open end investment fund (Investment funds are the institutions of collective investment which serve as framework for collection of money funds. Collected money funds are then invested in various assets). The investment unit value is an indicator of how successful a fund is, and the changes of this value depend on the fluctuation of prices of securities and other property that the fund has invested in.

[79] Government investment certificates (GICs) are medium-term securities, based on various contracts financed by the Ministry of Finance of Sudan via the *istisna*, *murabaha* and *ijara* tools. Issuance of these *sukuk* is similar to the conventional securitization, where the Ministry of Finance acts as the originator. GICs are based on a limited *mudarabah*, which means that the raised money is invested solely in the projects stipulated in the original contract.

[80]The Primary Market deals with the trading of new securities. When a company issues securities for the first time (i.e. IPO), they are traded in the Primary Market through the help of issuing houses, dealing /brokerage firms, investment bankers and or underwriters. The acronym IPO stands for Initial Public Offering, which means the first time a company is offering securities to the general public for subscription. Once the securities (shares) of a company are in the hands of the general public, they can be traded in the Secondary Market to enhance liquidity amongst holders of such financial securities. Thus, the Secondary Market facilitates the buying and selling of securities that are already in the hands of the general public (investors).

Shariaa and is supervised and regulated by the Central Bank of Sudan[81]. The key feature of Islamic *Shariaa* practices in Khartoum Stock Exchange is that it is aimed to offer investment portfolios from common stocks of listed companies which ideally satisfy three basic criteria: (i) legitimate field of economic activity; (ii) interest-free dealings in both assets and liabilities, and (iii) the dominance of real assets. Thus, e.g., a company must not be engaged in the production of illegitimate goods like alcoholic drinks; it must not deal with interest rate financing as a means to leverage its capital structure through fixed debt liabilities, or generate interest income from investment securities; and since a company's shares represent equity rights in its assets, the latter should be real assets, not liquid money or receivable debt as they cannot be sold freely at a profit like real goods, real estate and machinery (Hassan and Lewis, 2007).

As consequences of these rules, the composition of assets traded at the KSE differs substantially from other stock markets. In particular, due to the regulations imposed by Islamic *Shariaa*[82] practices a separate class of investment vehicles on the KSE is provided by the so called Government *Musharakah*[83] Certificates (GMCs), which represent an Islamic equivalent to conventional bonds (also known as *Shahama* bonds). *Shahama* bonds offer a way for the government to borrow money in the domestic market instead of printing more banknotes. After one year, holders of GMCs can either liquidate them or extend their duration. These bonds are backed by the stocks of various companies owned by the Ministry of Finance. Consequently, they might be considered as asset-backed securities. The profitability of GMCs depends on the financial results of the companies in the underlying portfolio. It can reach up to 33 per cent per annum. Hence, the profit of GMCs is variable rather than fixed. The government issues these bonds on a quarterly basis and their placement on the market is done usually very fast- in just six days.

Despite its short history KSE has contributed a number of benefits to the investment climate in Sudan, among which, it promoted the auditing profession as one of the listing requirement of any company to submit audited accounts for the latest two years and every year after listing. And, also enhanced awareness in securities investment as manifested in the increasing number of the investment funds in the country (Onour, 2010).

When it comes to look at the market size, it is very important to point out that it is relatively small even compared to many stock markets in the Arab region; the number of listed companies is few and most stocks are infrequently traded, market capitalization and traded value are very low (See Table 3.2 and Figure3.14). Banks, communications and certificates sectors dominate the trading activity of the market in terms of trading volume and number of shares (see Tables 3.3 and 3.4). The market is currently listing 59 companies with a total market capitalization of SDG 11,758.06 (2,243.90 $US million) million (Arab Monetary Fund, 2014). Although, the amount of capitalization is very small, but it shows considerable increase, especially during the past few years (see Figure 3.15). The overall performance of the market is measured by the KSE index, which is a market capitalization-weighted index. In September 2003,

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[81] For more explanations about the ideas of Islamic banking see for example, Venardos (2010).
[82] For a detailed discussion of the Islamic Shariaa principles and its practices on stock exchange see for example, El-Gamal (2006) and Ayub (2007).
[83] Musharakah' is a word of Arabic origin which literally means sharing. In the context of business and trade it means a joint enterprise in which all the partners share the profit or loss of the joint venture. It is an ideal alternative to the interest-based financing with far reaching effects on both production and distribution (Usmani, 1998).

the KSE index was established and listed in the Arab Monetary Fund database. At the end of the first month the index closed at 961.74 points.

Despite its rapid growth in terms of market capitalization, KSE is characterized as highly concentrated market as only few companies constitute significant contribution of both capitalization and traded value around 90% of the total market capitalization. And, also can be regarded as an illiquid market as the shares of only few companies are tradable.

Table3. 2: Trading activity in selected Arab stock markets, End-2013

	Number of Shares Traded (In Million)	Daily average shares traded (Million)	Daily Average Value Traded (Million $U.S.)	Relative Market Capitalization (% of Total)	Stocks Traded Turnover Ratio (%)	Number of Listed Companies
Abu Dhabi Securities Market	17,044.68	304.369	131.0	9.68	7.05	66
Amman Stock Exchange	526.55	9.079	12.9	2.28	2.9	240
Bahrain Bourse	440.20	7.590	2.2	1.63	0.7	47
Saudi Stock exchange	10,993.02	180.213	1,287.4	41.28	16.8	163
Kuwait Stock Exchange	17,507.68	265.268	90.7	9.57	5.5	210
Casablanca Stock Exchange	94.15	1.569	44.5	4.89	4.8	75
Algeria Stock Exchange	0.034	0.0014	11.0	0.01	0.21	2
Tunis Stock Exchange	54.43	0.878	3.5	0.76	2.5	65
Dubai Financial Market	40,746.10	690.612	240.0	6.24	20	55
Damascus Securities Exchange	2.24	0.064	0.1	0.09	0.29	22
Khartoum Stock Exchange	**32.87**	**0.522**	**3.1**	**0.20**	**8.6**	**59**
Palestine Stock Exchange	91.58	1.607	2.5	0.29	4.4	49
Muscat Securities Market	1,735.10	29.408	26.4	3.25	4.2	131
Qatar Exchange	591.88	10.205	98.1	13.48	3.7	42
Beirut Stock Exchange	20.40	0.352	2.8	0.93	1.5	28
Egyptian Exchange	10,270.00	168.361	89.7	5.43	8.9	212

Source: Author's compilation based on Arab Monetary Fund database.

Figure 3.14: Trading Activity (USD million) in Selected Arab Stock Markets, End-2013
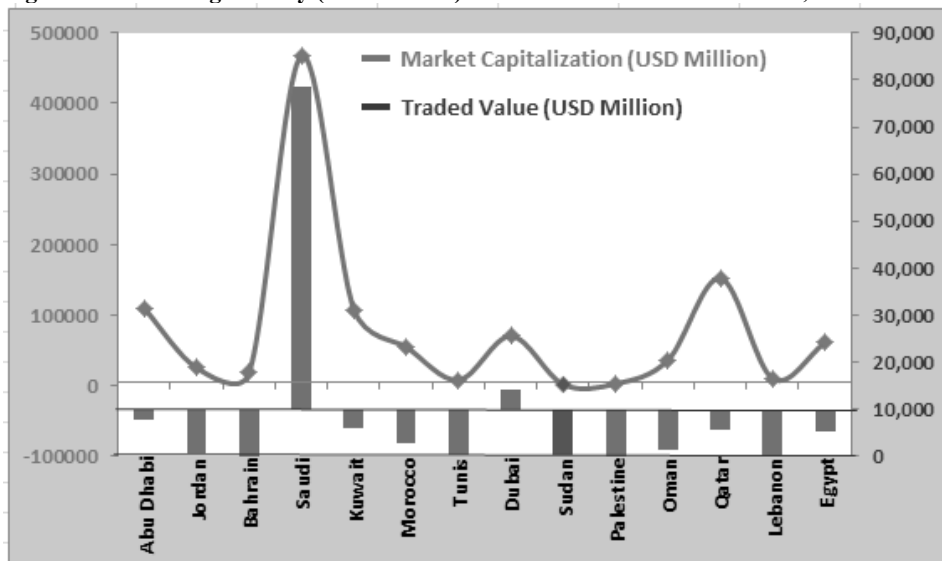
Source: Author's compilation based on Arab Monetary Fund database.

Figure 3.15: Market Capitalization (SDG million) for the KSE (2003-2013)
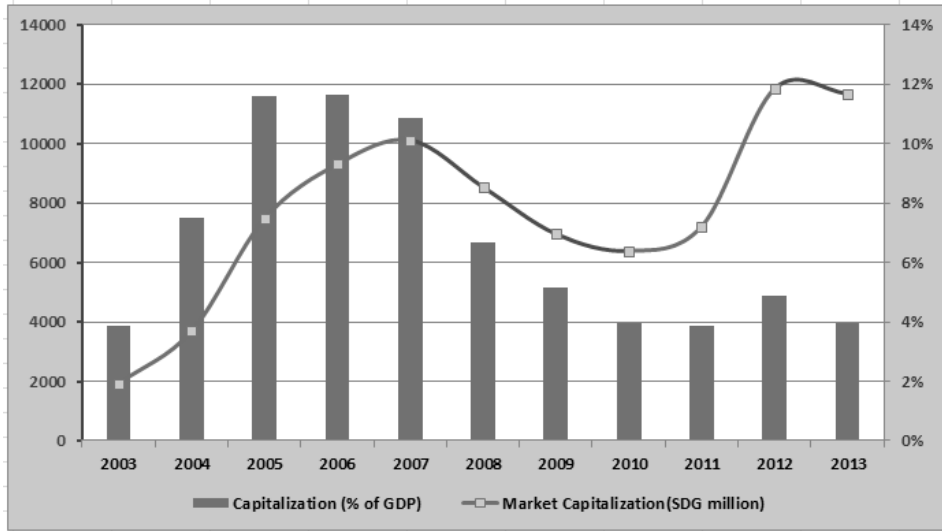
Source: Author's compilation based on Central Bank of Sudan (Annual report, various issues)

Table3. 3: No. of Shares (million) by Sectors (2002 –2013)

Years	Banks	Insurance	Commerce	Industry	Agriculture	Communication	Services	Funds	Certificates	Others
2002	1926.566	0.0067	2130.592	0.0164	0	0	0	0	0	3.0553
2003	8950.99	0.0004	790.228	0.0544	0	0	0	0	0	4.1844
2004	1506.397	0.0074	650.9387	21.6722	0	0	0	0.0308	0.1021	6.9789
2005	848.351	0.0021	848.0048	21.501	0	0	0	0.8458	0.3081	12.6575
2006	7146.345	0.0018	316.0161	28.0363	0	0	0	1.4334	1.4724	74.4771
2007	9283.037	8.0397	22.6046	2.056	0.0435	88.5736	1.9954	2.7172	2.0165	0.475
2008	195.7864	0.078	0.9087	1.0072	0.0679	78.1495	5.5248	4.9769	2.4211	0.0873
2009	85.0252	0.1689	1.48	39.3634	0	36.583	2.0034	4.2289	3.4177	0.089
2010	144.346	0.13389	0.2135	2.88556	0.00705	12.49552	1.36723	1.79111	4.0589	5.09979
2011	64.42859	1.39631	0.10922	13.6168	0.00008	21.84176	0.21574	7.33345	3.89207	4.90361
2012	165.1817	0.0942	0.0627	0.1313	0	5.8242	1.2666	5.7936	5.1166	0.0199
2013	12.5216	1.7148	0.066	0.0308	0	43.8405	5.7097	1.4473	6.9833	16.974
Period Average (%)	**84.90**	**0.03**	**13.33**	**0.36**	**0.0003%**	**0.80**	**0.05**	**0.09**	**0.08**	**0.36**

Source: Central Bank of Sudan (Annual report, various issues) and author's calculation.

Table 3.4: Volume Trading (SDG million) by Sectors (2002 –2013)

Years	Banks	Insurance	Commerce	Industry	Agriculture	Communication	Services	Funds	Certificates	Others
2002	13.594	0.023	9.123	0.005	0	0	0	10.754	108.853	106.703
2003	39.7	0.001	1.946	0.016	0	0	0	7.414	62.663	132.364
2004	7.805	0.004	39.29	38.958	0	0	0	2.767	113.702	245.197
2005	11.095	0.008	18.309	48.2	0	0	0	47.116	194.408	897.697
2006	91.4	0	22.3	57	0	0	0	120.2	799.9	977.3
2007	139.7	1.9	22	4	0.1	432.2	0.8	130.3	1068.5	0.1
2008	135.8	1.8	6.2	0.8	0.1	320.1	7.6	123.5	1283.2	0.04
2009	81.5	0.1	15.1	25.4	0	122.5	0.9	164.8	1836.3	0
2010	145.94	0.07	0.5	2	0.01	23.23	0.93	81.4	2157.93	10.31
2011	114.728	35.473	0.216	8.746	0.001	32.148	0.299	302.481	2059.139	9.394
2012	41.2	0.1	0.4	0.2	0	9.2	0.6	308.1	2713.7	0.03
2013	9.9	1.6	0.5	0.01	0	95.9	23.6	71.7	3679.7	2.4
Period Average (%)	**3.77**	**0.19**	**0.62**	**0.84**	**0.001**	**4.68**	**0.16**	**6.20**	**72.76**	**10.78**

Source: Central Bank of Sudan (Annual report, various issues) and author's calculation.

CHAPTER 4

4. A STRUCTURAL ANALYSIS OF MACROECONOMIC FLUCTUATIONS

4.1 Introduction

To investigate the dynamics and sources of macroeconomic fluctuations in Sudan, a system of variables[84] containing output growth (GDP), price level (CPI), money supply (MS), real exchange rate (RER), the price of Brent crude oil[85] (Brent) and GDP for Arab countries (ARAB) is analyzed by applying the structural vector autoregression (SVAR hereafter) methodology[86] proposed by Shapiro and Watson (1988), Blannchard and Quah (1989), and King et al. (1991)[87]. This econometric methodology involves an estimation of a vector autoregression (VAR) model for a particular set of variables. An advantage of this approach is that it identifies different types of shocks of a given economy by making long-term restrictions based on macroeconomic theory. It is an effective tool of characterizing the dynamic interactions among economic variables since it introduces very few restrictions (e.g., Lastrapes and Koray, 1990; McMillin, 1991). The model starts by identifying structural fundamental shocks related to the variables of interest. The effects of these shocks are evaluated to determine which are statistically significant, when they become significant and how long they remain significant. It is worth mentioning here that may be more other variables deemed relevant for the current study. However, the SVAR model the study applies requires a sufficient number of observations, given the lag length, the addition of a variable in the system quickly exhaust degrees of freedom and consequently make the estimation inefficient. This consideration restricts the study to use only four domestic macroeconomic variables which believed to be more sufficient to represent the functioning of Sudanese macroeconomy.

4.2 Empirical framework

The modelling approach start by assuming that the economy can be described by a structural form equation, ignoring constant terms, given by the following general form

$$B(L)z_t = u_t \tag{4.1}$$

where $B(L)$ is a pth order matrix polynomial in the lag operator L, such that $B(L) = B_0 - B_1 L - B_2 L^2 - \cdots - B_p L^p$; p is the order of the VAR model, B_0 is a non-singular matrix normalized to have ones on the diagonal and summarizes the contemporaneous relationships between the variables in the model contained in the vector z_t. z_t is an n-vector of relevant variables as follows:

$$z_t = [GDP, CPI, , MS, RER, BRENT, ARAB]$$

---

[84]The selection of these variables is based on the theoretical and empirical research in this area (see, e.g. Bernanke 1986; Sims 1986; Blanchard 1989).

[85] The importance of oil price shocks on macroeconomic activities has been recognized by Hamilton (1983, 1994, 1996, 2003), Ferderer (1996) and Kilian (2009).

[86] Sims (1980) was the pioneer of the fluctuations analysis within the vector autoregressive model, where impulses are apprehended as innovations in a statistical term. These VAR models were introduced as an alternative to the traditional econometric models. Sims proposed a new form of modelling based on no a priori and where no distinction is made between exogenous and endogenous variables.

[87]For a similar approach using short-term instead of long-term restrictions see for example Blanchard and Watson (1986) or Sims (1986).

This vector is partitioned into two blocks of variables: a vector of external variables, $z_{t1} = [BRENT, ARAB]$ and a vector of domestic variables, $z_{t2} = [GDP, CPI, MS, RER]$. u_t is an n-vector of mean zero serially uncorrelated structural disturbances (shocks) with the a variance-covariance matrix $E = (u_t u_t') = \Lambda. \Lambda$. This covariance matrix is a diagonal matrix where diagonal elements are the variances of structural disturbances; therefore the structural disturbances are assumed to be mutually uncorrelated. The u_t vector of structural shocks is also divided into vector of structural external shocks u_{t1} and a vector of structural domestic shocks u_{t2}

Associated with this structural model is the reduced form VAR which is estimated

$$A(L)z_t = \varepsilon_t \tag{4.2}$$

where $A(L)$ is a matrix polynomial in the lag operator L; ε_t is an n vector of serially uncorrelated reduced form disturbances; and $\varepsilon_t = \sum$. The relationships between the components of Eqs. 1 and 2 are as follows:

$$A(L) = B_0^{-1}B(L) = I - A_1 L - A_2 L^2 - \cdots - A_P L^p \tag{4.3}$$

and

The innovations of the reduced form model, ε_t, can be expressed as a linear combination of the structural shocks, u_t, as in Breitung et al. (2004):

$$\varepsilon_t = B_0^{-1} u_t. \tag{4.4}$$

Recovering the structural form parameters of the VAR model specified by Eq. (4.1) from the estimated reduced form coefficients requires that the model is either exactly identified or over-identified. Exact identification requires the same number of free parameters in B_0 and Λ as there are independent parameters in the covariance matrix ($\sum$) from the reduced form model.

Using Eqs. (4.3) and (4.4), the parameters in the structural representation and those in the reduced form equation are related by

$$A(L) = I - B_0^{-1}[B_1 L + B_2 L^2 + \cdots - B_P L^p] \tag{4.5}$$

and

$$\sum = B_0^{-1} \Lambda B_0^{-1'} \tag{4.6}$$

Consistent estimates B_0 and Λ can be obtained only through sample estimates of $\sum$, which can be calculated through the maximum likelihood estimation technique. In equation (4.6), B_0 contains $n \times (n + 1)$ free parameters to be estimated. The summation comprises only $n \times (n + 1)/2$ parameters, which requires at least $n \times (n + 1)/2$ restrictions on the system of equation. However, since diagonal elements are normalizing to be unity, at least $n \times (n - 1)/2$ additional restrictions on B_0 are needed to attain identification. We impose the restrictions based on past empirical findings and on economic theory.

Identification scheme

The identification restriction of the structural VAR for this study is specified as follows: First, the price level is contemporaneously related to output and money supply. Expansionary monetary policy could have an instant effect on price level through an increase in liquidity. Second, given the fact that crude oil is an essential input for most economic sectors, it is assume that the Brent crude oil price affects the real sector and the domestic price level contemporaneously. Third, real exchange rate is responding contemporaneously to all variables

in the system, this is simply because exchange rate is a forward-looking asset price (see, Kim and Roubini, 2000; Cushman and Zha, 1997). Additionally, it is the variable that allows foreign variables to influence domestic ones implicitly.

The identification of the contemporaneous equations is used to convert the correlated VAR residuals into structural innovations as in the following equation:

$$
\begin{bmatrix} u_{GDP} \\ u_{CPI} \\ u_{MS} \\ u_{RER} \\ u_{BRENT} \\ u_{ARAB} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & a_{15} & 0 \\ a_{21} & 1 & a_{23} & 0 & a_{25} & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} & 0 \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & a_{65} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{GDP} \\ \varepsilon_{CPI} \\ \varepsilon_{MS} \\ \varepsilon_{RER} \\ \varepsilon_{BRENT} \\ \varepsilon_{ARAB} \end{bmatrix} \tag{4.7}
$$

In Eq. (4.7) $u_{GDP}, u_{CPI}, u_{MS}, u_{RER}$, represent the structural disturbances (domestic shocks), output shock, domestic inflationary shock, money supply shock, and exchange rate shocks, respectively, while u_{BRENT} and u_{ARAB} are the external shocks. $\varepsilon_{GDP}, \varepsilon_{CPI}, \varepsilon_{MS}, \varepsilon_{RXR}, \varepsilon_{BRENT}, \varepsilon_{ARAB}$ denote the reduced form residuals that are used to describe unanticipated movements of each regressor, respectively.

It is worth mentioning that the system has many equations: the first two equations relate to real GDP and prices, which represent the goods market equilibrium of the domestic economy. The third equation represents the money market equilibrium. The fourth equation represents the financial market equilibrium. The last two equations are assumed to be exogenous shocks that arise from the world economy and regional economy. This indicates that domestic variables do not affect the crude oil price and the GDP for Arab countries contemporaneously, since these equations are exogenous to the domestic economy.

An Impulse Response Analysis

Once the structural VAR model is identified, interrelationships between the variables can be investigated via impulse response functions and forecast error variance decompositions, which show the nature of economic shocks through the system. The impulse response functions are derived and used to examine the dynamic responses of the variables $[GDP, CPI, , MS, RER, BRENT, ARAB]$ to various shocks within the SVAR system. Having identified the structural shocks, it is therefore easy to find the impulse response of a given variable to a one-time shock to any other variable included in the system, which can be obtained from the following:

$$ Z_t = B(L)u_t $$

$$ B(L) = B(L)B_0^{-1} $$

$B(L) = B(L)B_0^{-1}$ generates the impulse response function of X_t to structural shocks to u_t.

Variance Decomposition Determination

Variance decompositions (VDs) are often used to determine the relative contribution of given shocks to the forecast error variance of a variable of interest over different time horizons. These statistics measure the quantitative effect that the shocks might have on the variables. It tells how much of a change in a given variable is due to its own shock and how much due to shocks to other variables in the system.

4.3 Data and Variables

The study employs observations for the period 1970 to 2013 for the six variables used. All series

are expressed in natural logarithm form. Due to unavailability of consistent data, the analysis comprises of annual observations for the period 1970-2013. Variables included, their description and sources are presented in Table 4.1.

Table4. 1: Variables included, their description and sources 1970-2014

Variable	Description	Source
GDP	Real GDP	Central Bureau of Statistics, Sudan
CPI	consumer price index	Central Bureau of Statistics, Sudan
MS	Money Supply	Central Bank of Sudan
RER	calculated as the nominal exchange rate (local currency by US$) multiplies ratio of consumer price index (CPI) divided by the world consumer price index (WCPI)	Central Bank of Sudan
BRENT	Annual oil price	the US Energy Information Administration (EIA)
ARAB	Real GDP for the Arab countries	World Development Indicators

4.4 Estimation results

To model the source and impact of macroeconomic fluctuations for the Sudanese economy, the study applies SVAR model. The advantage of this approach is that it captures empirical regularities in the data with minimal theoretical restrictions imposed in the system. This seems to be important when there is a lack of theoretical consensus about how macroeconomic aggregates are interrelated and yet important interrelationships among them, if any, need to be uncovered (Ibrahim, 2007). The section proceeds as follows: first, the patterns of macroeconomic aggregate will be provided, second in order to properly specify the SVAR, unit root and cointegration tests are carried out. This coupled with lag structure determination. Third, estimation results of SVAR contemporaneous coefficients will be provided. Lastly, to understand the dynamic interrelationships between macroeconomic aggregate and their responses to domestic as well as foreign shocks, impulse response functions and variance decompositions will be estimated.

4.4.1 Patterns of Macroeconomic Aggregates

Table 4.2 provides some stylized fact of macroeconomic aggregate in Sudan over the study period. For the whole period, the results show that the most volatile macroeconomic variable is the real output. The first four rows of Table 4.2 give volatility of the macroeconomic aggregate for two periods when the economy is not producing oil and when the economy is heavily dependent on oil. It is evident that the economy has experienced higher volatility during non-oil period with higher volatility seen for output and money supply in both periods. It is striking that volatility for the output when the economy is not oil dependent is about four times of the period when the economy is producing crude oil. In the same way, volatility of the MS, CPI, and RER is approximately 3, 2, and 2 times higher than the volatility in the second period for these variables respectively. It is worth mentioning at this juncture that the volatile macroeconomic environment in Sudan can be regarded as the result of domestic shocks generated by self-inflicted policy mistakes, poor macroeconomic management and weak institutions. Policy makers should care about this higher volatility as it would leads to the creation of an environment of uncertainty that could profoundly affect the long-run economic growth rates.

Table 4.2 also illustrates the extent to which other variables move with output. The correlation

seems to be very high in both periods, though less during the first period. Finally, the results also show how macroeconomic aggregates in Sudan move with output of the Arab countries. Again higher comovements are seen during the period when the economy was highly dependent on oil.

Table4. 2: Patterns of Macroeconomic Aggregates

		Statistic	
		Non-oil period	Oil period
Volatility	log GDP	3.250	0.758
	log MS	3.089	1.036
	log CPI	1.145	0.576
	log RER	0.453	0.225
Comovement with output	log MS	0.989	0.990
	log CPI	0.643	0.731
	log RER	-0.523	0.962
Comovement with oil price	log GDP	0.373	0.942
	log MS	0.423	0.963
	log CPI	0.591	0.612
	log RER	0.093	0.953
Comovement with Arab output	log GDP	0.731	0.985
	log MS	0.768	0.986
	log CPI	0.722	0.756
	log RER	-0.145	0.968

Notes: volatility is measured as standard deviation of the series; comovement with output is the correlation of the series with log GDP; comovement with Arab is correlation of a series with the output of the Arab countries.
Source: Author's calculation.

4.4.2 Unit root tests

Each time series is subject to augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests. The results are summarized in Table 4.3. As shown in the table, the ADF test of unit root indicates that the null hypothesis of a unit root is accepted for the levels of all variables, while in the first differences are shown the alternative hypothesis is accepted which confirmed the stationary in the variables. Here ADF does not confirm stationarity of logY but PP test suggests that all variables in logarithm have I(1) order of integration.

Table4. 3: Unit root tests results

	Level		First difference		Comment
Variable	ADF	PP	ADF	PP	
log GDP	-1.13	-0.35	-1.81	-2.72*	I(1)
log MS	-1.67	-1.49	-3.32*	-3.23*	I(1)
log CPI	-2.78	-2.64	-8.96***	-8.93***	I(1)
log RER	-3.03	-3.04	-8.60***	-8.87***	I(1)
log ARAB	-2.88	-2.56	-4.61***	-4.68***	I(1)
log BRENT	-2.44	-2.45	-6.27***	-6.27***	I(1)

Notes: The lag lengths are selected according to Schwartz information criterion (SIC). The critical values for the ADF are based on Mackinnon (1996). ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively.
Source: Author's calculations.

4.4.3 Cointegration results

To evaluate whether the set of I(1) variables is cointegrated, Johnsen's cointegration test is applied to confirm that the variables are not long run co-integrated or cointegrated with an "N" relationship; this is done to ensure that the VAR is stable. The results are provided in Table 4.4. The Johnsen's test detects two cointegration relationships within the model. However, in the

analysis of this study the focus will be on SVAR model which implicitly allows the cointegration relationship in the data. This is in line with existing literature (see, e. g., Bagliano and Favero, 1998; Fung, 2002; Cheng, 2006)

Table4. 4: Cointegration tests results

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 critical value	Prob.**
None*	0.648681	138.4094	117.7082	0.0013
At most 1*	0.550613	94.47486	88.80380	0.0183
At most 2	0.475533	60.88029	63.87610	0.0871
At most 3	0.323227	33.77460	42.91525	0.2989
At most 4	0.229131	17.37699	25.87211	0.3873
At most 5	0.142300	6.447020	12.51798	0.4057

Notes: * denotes rejection of the hypothesis at the 0.05 level. ** indicates the Mackinnon-Haug-Michelis (1999) p-values.
Source: Author's calculations.

4.4.4 Lag order determination

The appropriate number of lags for the estimated VAR model has been decided based on Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC) and Hannan-Quinn Information Criterion (HQIC). The results are reported in Table 4.5. The results generally suggest lag five as an optimal lag.

Table4. 5: Lag Length Structure of Vector Autoregression Model

Lag	Information Criteria		
	AIC	SIC	HQ
0	8.710	8.890	8.726
1	-3.382	-1.590*	-2.739
2	-3.133	0.194	-1.939
3	-3.575	1.288	-1.829
4	-4.998	1.400	-2.703
5	-7.739*	0.194	-4.892*

Notes: * indicates lag order selected by the criterion.
Source: Author's calculations.

4.4.5 Estimation results of SVAR Contemporaneous Coefficients

As recommended by the selection criteria in Table 4.5, the SVAR is estimated with five lags. The coefficients of the SVAR Identification restrictions of equation (4.7) are provided in Table 4.6. As shown from the results, some of the estimated structural contemporaneous parameters support their respective equations significantly. For interrelationship between domestic variables, it is very clear that the CPI enters significantly in the money supply and real exchange rate equations. GDP appears to be significant in the money supply equation while the money supply is found to be significant in CPI equation. On the other hand, a look into the impact of world economy through oil price fluctuations reveals that the coefficient of oil price enters the output and equation positively and the inflation equation negatively, circumstances that run counter to standard economic theory. For real exchange rate, the results shows insignificant impact of oil price. Lastly, the domestic economy seems to be unaffected by the GDP of Arab countries through real exchange rate.

Table4. 6: Estimated Contemporaneous Coefficients of SVAR

Restriction	Estimate	Z-statistic	Prob.	Restriction	Estimate	Z-value	Prob.
a_{15}	10.57565	66.04493	0.0000	a_{41}	-0.025420	-0.140357	0.8884
a_{21}	-0.080419	-0.390417	0.6962	a_{42}	0.481583	2.984267	0.0028
a_{23}	-0.809161	-22.93968	0.0000	a_{43}	-0.217383	-1.328761	0.1839
a_{25}	-0.416743	-2.019244	0.0435	a_{45}	-0.225240	-1.240271	0.2149
a_{31}	0.951644	4.528728	0.0000	a_{46}	0.080119	0.500345	0.6168
a_{32}	-0.849770	-23.41755	0.0000	a_{65}	1.673994	10.45409	0.0000
a_{35}	10.28262	39.61368	0.0000				

Source: Author's calculations.

4.4.6 Results of Impulse Response Function

To understand the dynamic responses of domestic variables to various domestic and foreign shocks within the SVAR model, the impulse response functions(IRFs) are estimated. This section analyzes the dynamic responses of domestic variables to a one standard deviation shock in the six structural shocks identified in the system, that is, output shocks, price shocks, money supply shocks, exchange rate shocks, world oil price shocks and shocks in real output of Arab countries. Note that IRFs are presented together with two standard deviation bands. Roughly speaking, if the bands contain zero, then the variable's reactions to innovations in other variables are not significant. The results of IRFs are provided in the following sub-sections.

4.4.6.1 Responses to output shock

Figure 4.1 illustrates the estimated impulse responses to a one standard deviation real output shock. Apart from their own shocks, real output shocks seem to have much stronger and significant impacts on all macroeconomic aggregates in the system. Over the first few time horizons, positive output shocks have positive impact on itself, however, this effect decreases steadily over time until a trough is reached at the eleventh horizon when it starts to show some increase. An analogous result also holds for the responses of money supply. It is also very obvious that there is an immediate decrease of price due to output shock and then it increases after the eleventh horizon. In the case of real exchange rate, it seems that output shocks have significant effects at first horizons and then its responses turn to be insignificant over the longer time horizon.

Figure 4.1: Impulse responses to a positive output shock
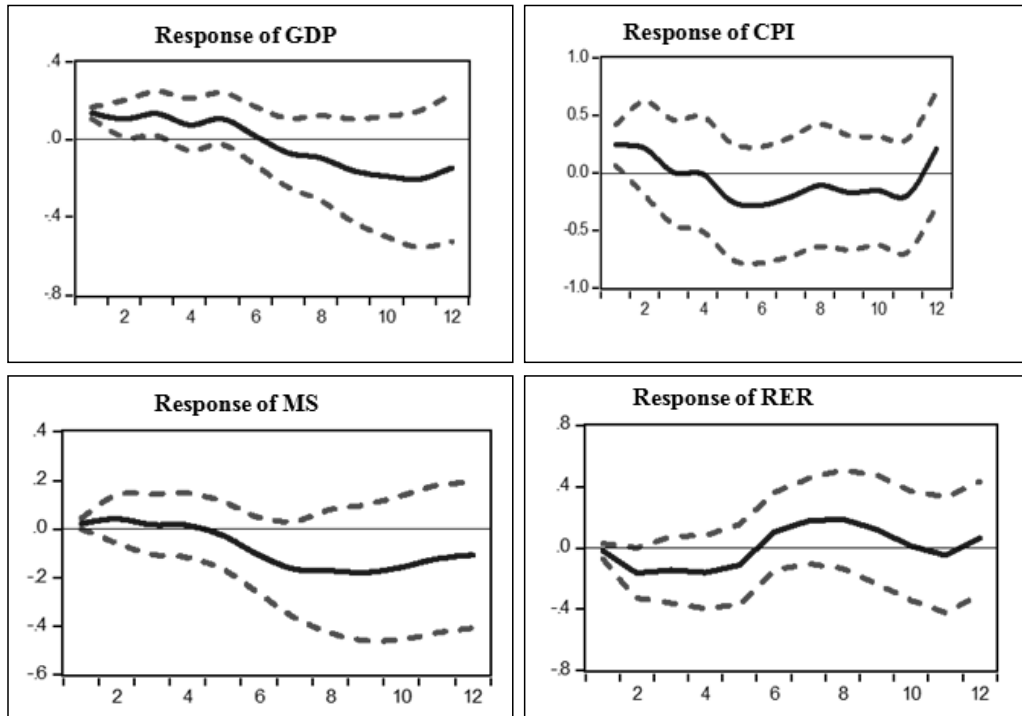
Source: Author's calculations.

4.4.6.2 Responses to money shock

Responses of the variables to a one standard deviation money supply shocks are reported in Figure 4.2. It is very clear that a positive money supply shock is short lived as the impact dissipates almost immediately, especially when we look at the responses of prices and real exchange rate. Real output and money supply are almost do not seem to respond significantly to innovations in money supply. Price responses to money shocks appear to be insignificant over the first two horizons but thereafter they turn to respond significantly up to the fifth horizon. Money supply shocks have little impact on real exchange rate.

Figure 4.2: Impulse responses to a positive money supply shock
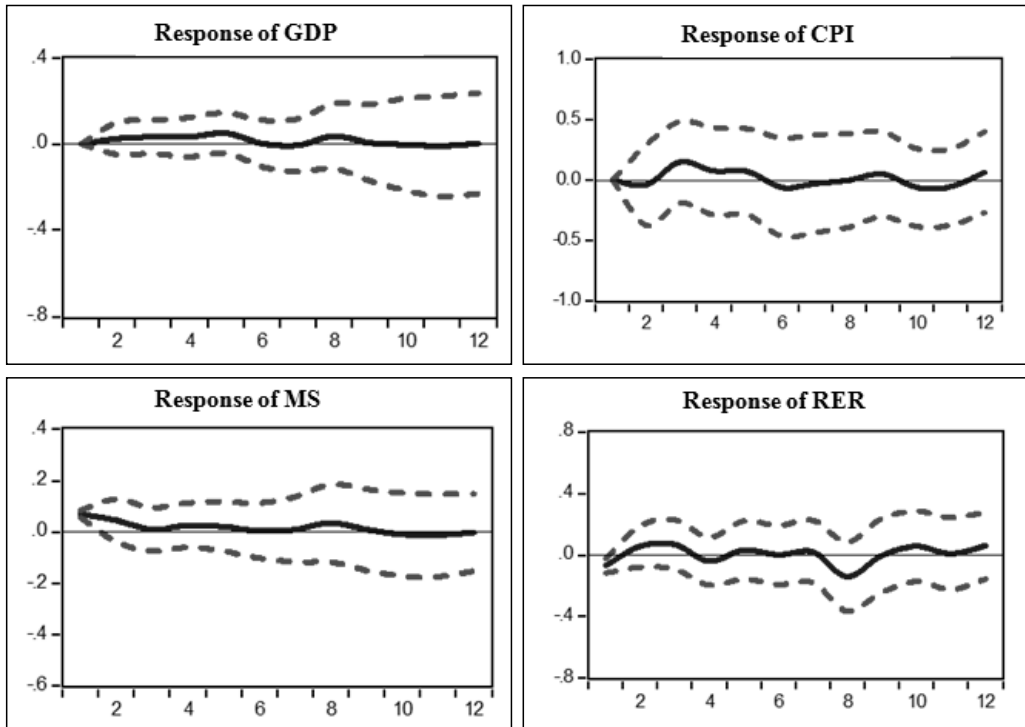
Source: Author's calculations.

4.4.6.3 Responses to price shocks

Figure 4.3 suggests that a positive domestic price impulse results in a gradual increase in real output over the first period, it starts to dissipate by the 6th time horizon. Then it tends to show significant decreases over the rest horizons. Although there seem to be insignificant impact in the first horizon, money supply starts to show significant decreases starting from the sixth time horizon. Additionally the exchange rate depreciates as expected. The significant effect of price shocks can be attributed to some extent to the continuing high food price inflation and to the rising import cost of basic goods as a result of weakening local currency value.

Figure 4.3: Impulse responses to a positive price shock
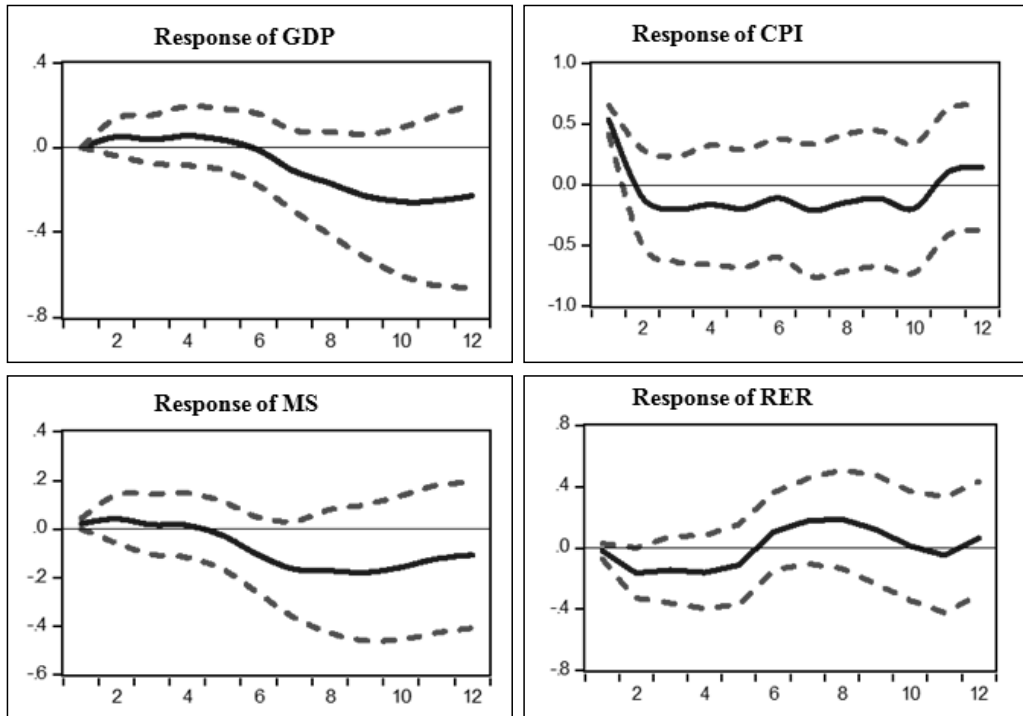
Source: Author's calculations.

4.4.6.4 Responses to Real Exchange Rate Shocks

Figure 4.4 illustrates the responses of macroeconomic aggregates to a structural one-standard-deviation real exchange rate shock. Positive shocks, representing the domestic currency depreciation, did not generate significant results for the real output over the first time horizon but gradually start to show significant responses before returning to the steady state over the rest of the time horizon. The response of the price level seems to be insignificant over the first horizon before it starts to show significant increases in the rest horizons. In fact the strongest impact of exchange rate shock has been seen on price fluctuations, but over longer time horizon. Positive exchange rate shock has significant impact on money supply. Generally, the low level of significance resulting from RER shocks is expected given that Sudan's level of openness is quite small compared to those of other developing countries.

Figure 4.4: Impulse responses to a positive Real Exchange Rate Shock
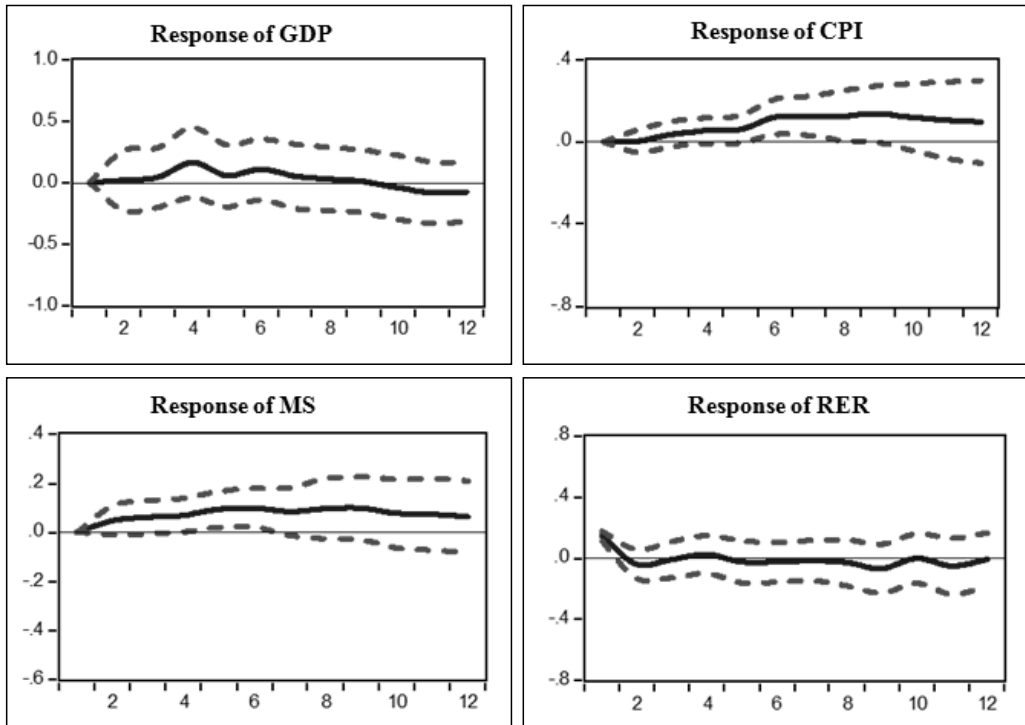
Source: Author's calculations.

4.4.6.5 Responses to Crude Oil Price Shocks

Figure 4.5 shows how domestic macroeconomic variables respond to positive shocks on world oil price. As expected, although the real output seems to be decreasing and the price level show some episodes of increases and decreases in response to oil price shocks, the impact on these variables are negligible and not statistically significant. In the short run, the highest responding macroeconomic variable to oil price shocks is the price which increases significantly over the first two time horizons. This is an expected result for countries that depend on oil imports. Over longer time horizons, oil price shocks have negative effects on real output. An analogous result also holds for money supply variable. No clear evidence is found for the impact of oil price on real exchange rate especially in the short run. However, over longer time horizon there seems to be significant effect.

Figure 4.5: Impulse responses to a positive Crude Oil Price Shock
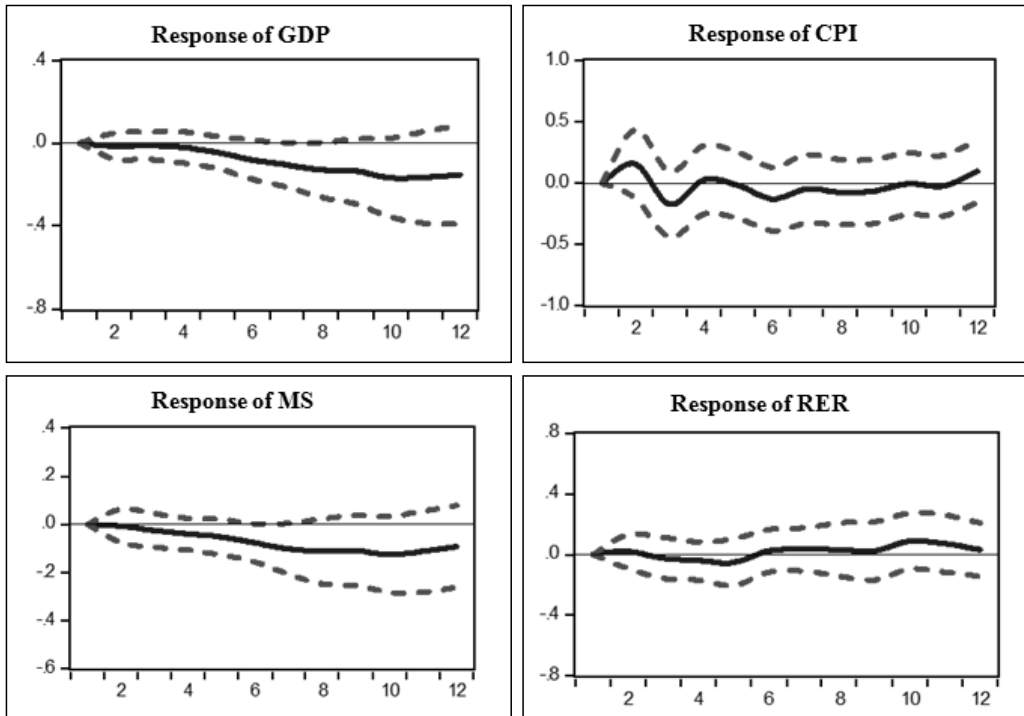
Source: Author's calculations.

4.4.6.6 Responses to Shocks in Output for Arab Countries

Figure 4.6 illustrates impulse responses to a positive shock in Output for Arab Countries. A positive output shock of a foreign economy (output for the Arab countries) is expected to have a positive impact on the output of the smaller domestic trading partner. Figure 4.6 shows the impact of such shock on the Sudanese economy. As the figure explains, the impact of a positive shock in Arab output on the domestic economy is an immediate increase in domestic real output. Surprisingly, output then falls in the second time horizon. This may be due to the net impact of the changes in import and export prices on the import and export quantities of the domestic economy, causing domestic output to decrease. Then the domestic output returns to its steady state after approximately 3 years. The responses of other variables to a positive shock in output for Arab countries seem to be negligible and statistically insignificant.

Figure 4.6: Impulse responses to a positive Shock in Output for Arab Countries
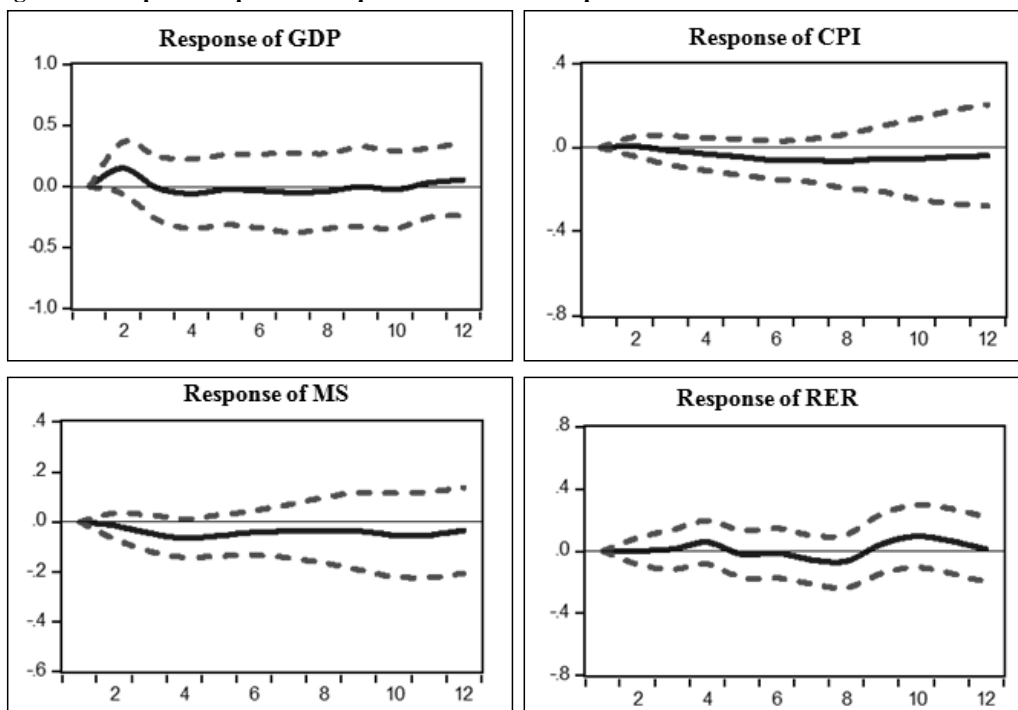
Source: Author's calculations.

4.4.7 Variance Decompositions

While impulse responses are useful in assessing the signs and magnitudes of responses to specific shocks, the relative importance of different shocks for a particular variable's fluctuations can be gauged only through the variance decomposition analysis. Consequently, the impacts of the shocks on macroeconomic aggregates are also analyzed through the variance decompositions of the forecast errors based on SVAR model. Table 4.7 provides the percent of variation in the major macroeconomic aggregates that can be explained by shocks to other economic variables in the SVAR system. The decomposition values for the 1st, 4th, 8th, and 12th horizon into the future are displayed in that table.

As shown from Table 4.7, the significance of real output in explaining the forecast error variance in itself becomes increasingly significant up to the fourth horizon. Empirical results also suggest that apart from their own shocks, much of the real output fluctuations can be explained by the shocks in price level and real exchange rate and, to a lesser extent, by crude oil price shocks and money supply shocks. The contribution of price level is about 10% in first horizon and gradually increases in the subsequent horizons. While the contribution of innovations in real exchange rate in accounting for the forecast error variance of real output is about 6% in the fourth horizon and increases to 22% in the eighth horizon, but becomes about 12% in long run.

Similarly, variations in price level are largely explained by its own innovations, accounting for more than 60% in the shorter time period and about 45% percent in the medium and long run.

Compared to other shocks, real output shocks and oil price shocks seem to explain much of the consumer price variation, while less of the variation is explained by money supply, real exchange rate and output of Arab countries (i.e., which explain only about 4%, 4% and 3% respectively).

For money supply fluctuations, the results show that much of variations are explained by real output shocks and real exchange rate shocks. The contribution of price shocks in explaining the forecast error variance of money supply is also significant, particularly in the long term.

As for real exchange rate fluctuations, the results suggest that apart from the innovations factor in itself, the variations in RER are mainly explained by real output shocks and price shocks. In particular, innovations in real output are significant in the shorter term, while innovations in price are more significant in the medium and long run.

How the domestic economy responded to shocks in world oil price? The results show that higher impact is seen for money supply and real output variations.

When it comes to evaluate the impact of both domestic and external shocks, it is very obvious shocks in crude oil price and output for the Arab countries are less likely to explain the movement of domestic variables than shocks to domestic variables. For instance, shocks in output for the Arab countries have approximately less than 5% impact for all included variables.

In summary, the results of variance decompositions, suggest that in the long run up to 20% of the real output variance in Sudan is due to external shocks as measured by world oil price and real output for the Arab countries. In the short run it is only about 3-4%. In the short-run, highest impact of external variables into domestic economy is seen for the price level where the impact is approaching 14%.

Table4. 7: Variance Decomposition Results

Horizon	Percent of variation due to the shocks to					
	GDP	CPI	MS	RER	OIL	ARAB
GDP						
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
4	76.77341	10.23024	3.900911	6.015540	1.253440	1.826462
8	32.32914	20.46566	2.698759	22.49724	15.54412	6.465088
12	26.78974	37.24271	0.873919	14.03204	17.77973	3.281871
CPI						
1	16.82797	83.17203	0.000000	0.000000	0.000000	0.000000
4	16.97281	60.25196	4.678819	4.665871	9.076766	4.353775
8	30.72833	49.16083	3.798639	4.651580	8.278368	3.382251
12	35.21397	45.26184	4.071587	4.793642	7.633793	3.025164
MS						
1	75.85069	2.152826	21.99649	0.000000	0.000000	0.000000
4	46.85597	4.522729	12.74138	19.30439	4.554309	12.02122
8	22.87738	32.00049	3.780272	19.87088	15.16775	6.303233
12	22.61489	35.56959	2.040136	15.67467	18.97186	5.128849
RER						
1	54.76351	0.974063	8.786986	35.47544	0.000000	0.000000
4	39.28213	39.06237	7.128359	11.54996	1.459790	1.517392
8	32.03139	45.53641	9.960179	7.016074	2.242392	3.213557
12	31.81312	40.79033	9.432985	7.354559	4.805001	5.804005

Notes: The results are based on the structural VAR model with five lags as described in the text.
   Numbers may not add up to 100% at each horizon due to the rounding errors.
Source: Author's calculations.

CHAPTER 5

5. FLUCTUATIONS IN THE SUDANESE STOCK MARKET

5.1 Introduction

Within the turbulent macroeconomic environment in Sudan, it seems very interesting for policy makers to understand how well the stock market is performing given the fact that stock market serves as a reliable barometer of the economy's health. Generally, the literature suggests that the performance of stock market can be explained by considering a wide range of economic forces, including, for example, gross domestic product, rate of inflation, change in exchange rates, interest rates, changes in terms of trade, money supply, crude oil price, industrial production, and employment etc. Some other factors like macroeconomic management and political stability can also be considered.

How does the Sudanese stock market react to the wide range of fluctuations which hit the Sudanese economy during the past few years? Do these fluctuations affect stock returns and volatility? If so, what are the major driving forces behind this volatility? Are the driving forces domestically originated or imported from outside? The main objective of this section is to address these questions by considering exchange rate fluctuations, changes in inflation rate (as internal factors) and crude oil price fluctuations (as external factor).

Such empirical research may have several practical implications for investors, portfolio managers and policy makers. Considering investors, for example, a clear understanding of the dependencies between these economic forces can help them in explaining the flow of information which significantly affects their investment decisions. For policy makers, this type of analysis may be very useful in assessing the informational efficiency of stock market. It may also provide very useful insight into the way that volatility shocks originated in these variables are transmitted to stock market and therefore they can assess the degree and persistence of these innovations over time to adopt proper policies and forecast the full impact of their decisions. For portfolio hedgers, it is crucial to spell out how markets are linked over time to develop an effective hedging strategy. Finally, the importance of this empirical investigation is enhanced considering the fact that correlations are time-varying.

There have been a lot of empirical studies on the response of stock markets to the movements in the crude oil price, inflation and exchange rate and of course, the theoretical background on the subject is solid. First, the rationale for the possible oil price impact on stock prices can be explained by at least two transmission channels. First, as the economic theory suggests that the price of a share at any point in time is exactly equal to its discounted future cash flow[88], any factor that could alter the expected discounted cash flows should have a significant effect on these share prices[89]. In this regard, as crude oil along with capital, labor and materials represent key inputs in the production of many goods and services, any oil price increase would result to increased production costs of companies, restraining profits and in greater extend, would cause a

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[88]These discounted cash flows reflect economic conditions (inflation, interest rates, production costs, income, economic growth, investor and consumer confidence, and so on) and are then affected by macroeconomic events that may be influenced by oil price changes (Arouri, 2011).

[89]In a pioneering empirical evidence focusing mainly on the standard cash-flow dividend valuation model, Jones and Kaul (1996) show that oil price shocks had a detrimental effect on four developed equity markets (Canada, the UK, Japan and the US) during the post-World War II period.

decrease in shareholders' value. Hence, any oil price increase should be accompanied by a decrease in the stock prices (See, e.g., Apergis and Miller, 2009; Arouri and Nguyen, 2010; Ciner, 2001; Filis et al., 2011; Nandha and Faff, 2008; Sadorsky, 1999; Sukcharoen et al., 2014). Second, oil price fluctuations may also affect the discount rate used in standard equity valuation models. Rising oil prices are often indicative of inflationary pressures which central banks typically control by raising interest rates, with the subsequent negative effect on share prices via the discount rate (Huang et al., 1996; Miller and Ratti, 2009; Mohanty et al., 2011). Consequently, the impact of increasing oil prices on the stock markets of net oil-importing countries should be negative. In contrast, increasing oil prices should have a positive influence on the stock markets of oil-exporting countries in the form of higher income and wealth effects. Additionally, financilisation of oil markets and intensive crude oil trading can also amplify the transmission of oil price shocks to the real economy (see, Creti et al., 2013).

Second, regarding the impact of inflation fluctuations on the stock market performance, it is generally accepted since the late 1970s that the relationship between stock market prices and inflation is negative which contradict Fisher's (1930) hypothesis who postulated that stock markets are independent of inflation expectations, implying that prices and inflation should move in the same direction[90]. The relationship between inflation and stock market returns operates through the impact of the expected changes in real output on the general price level. According to Fama (1981), the negative association between stock market performance and inflation results from the relationship between inflation and future output. An increase in inflation causes uncertainty and reduces future economic activity. The returns on the stock market reflect future earnings of the firm, and an economic decline predicted by an increase in inflation will cause a reduction of stock price, hence the relationship between stock market prices and inflation is negative. Empirically, a large body of empirical literature exists on the movement of stock market prices in response to inflation changes, but conclusions have been widely debated. Several studies document that stock returns and inflation are negatively correlated (Linter, 1975; Bodie, 1976; Fama and Schwert, 1977, Hu and Willett, 2000; Hagmann and Lenz, 2004; Patra and Poshakwale, 2006). On the other hand, some others found a positive relationship[91] (Cagan, 1974; Choudhry, 1998). Explanations of negative (or positive) relation can be found as in Hess and Lee (1999) who showed that the relationship between stock returns and inflation can be either positive or negative, depending on the source of inflation in the economy. They concluded that the negative stock returns-inflation relationship is due to supply shocks which reflect real output shocks while the positive relationship is due to demand shocks, are mainly due to monetary shocks. However, some empirical investigations provide no significant relationship (see e. g., Hardouvelis, 1988; Pearce and Roley, 1988; Spyrou, 2001; Joyce and Read, 2002; Payne, 2006; Jareno, 2008).

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[90]This is attributed to the fact that the expected nominal return on equities consists of two components, the real return and the expected inflation rate. The generalized Fisher hypothesis or effect states that equities are a claim against real assets of the company and can serve as a hedge against inflation. When inflation is pronounced, investors would sell financial assets in exchange for physical or real assets such as stocks. If that takes place, the prices of equities should reflect fully the expected inflation, and the relationship between the two variables (inflation and stocks or equities) should be positive.

[91]In theory, there is a case to support the view that since the rate of inflation means an increase in the general level of prices, and since common stocks can be considered as capital goods, then the stock prices should move with the general level of prices. So, when the general inflation rate increases, common stocks should also increase to compensate investors for the decrease in the value of money. In this framework, it is expected that there is a positive relationship between the inflation rate and stock prices (Omran and Pointon, 2001)

Third, the impact of exchange rate on the performance of stock market can be explained by the "flow-oriented" approach (Mundell, 1963, 1964; Dornbusch and Fisher, 1980; Gavin, 1989) which assumes that the currency fluctuations affect international competitiveness and the balance of trade position, and consequently the real income and output of an economy, which in turn affects current and future cash flows of companies and their stock prices. According to this approach when exchange rate depreciates, the competitiveness of exports will increase, and the input cost of imports will increase, thus, depreciation will cause positive (negative) effect for export (import) firms and increase (decrease) their stock prices; however, appreciation will cause negative (positive) effect for export (import) firms and decrease (increase) their stock prices. It is very clear that the impact of exchange rate fluctuations on stock market performance would depend on both the degree of openness of domestic economy and the degree of the trade imbalance.

The rest of this chapter is organized as follows: Section 5.2 introduces the empirical framework, while Section 5.3 describes the data and provides their statistical properties and motivation for empirical framework. Section 5.4 discusses the empirical results.

5.2 Empirical Framework

For modelling the responses of the Sudanese stock market to the fluctuations in crude oil prices,, inflation, and exchange rate, a VAR(1)-GARCH(1,1) model[92] proposed by Ling and McAleer (2003) is employed. In this model, there are two distinct equations, the first one for the conditional mean and the second one for the conditional variance. The interest is mainly in the second equation as it provides estimates of volatility transmission.

The conditional mean equation can be expressed as follows:

$$\begin{cases} R_t = \mu + \Pi R_{t-1} + \varepsilon_t \\ \quad\; \varepsilon_t = H_t^{1/2} \eta_t \end{cases} \tag{5.1}$$

where

$R_t = \left(r_t^s, r_t^F\right)'$ where r_t^s are the returns on the general market index and r_t^F represents the returns of (oil price, inflation, and exchange rate). So when the interest is to look at the impact of oil price fluctuations on stock market performance, this vector can be written as follows: $R_t = \left(r_t^s, r_t^o\right)'$. For the impact of exchange rate fluctuations it can be presented as $R_t = \left(r_t^s, r_t^{ex}\right)'$. Finally $R_t = \left(r_t^s, r_t^{inf}\right)'$ is used when examining the impact of inflation fluctuations. For explaining the rest of this methodology, F is used to indicate that one of the three variables (oil price, inflation, and exchange rate) is used.

$\mu = \left(\mu_t^s, \mu_t^F\right)'$ is the vector of constant terms.

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[92]This model has two major advantages. First, it has an analysis advantage since it has relatively less excessive in parameters and allows the modeler to focus more on the estimation of meaningful and interpretable parameters. Second, it permits a multivariate analysis of conditional volatility of the series under investigation as well as of conditional cross effects and volatility spillovers between the series. This model has previously been used to study the dynamic properties of different financial and economic phenomena, such as international tourism demand and volatility (Chan et al., 2005), dynamic relationship between stock market returns and exchange rate fluctuations (Abdalla, 2013; Boubaker and Jaghoubi, 2011), conditional correlations in volatility of rubber spot and futures returns (Chang et al. 2011), Shock and Volatility transmissions between bank stock returns (Chaibi and Ulici, 2014), return and volatility transmission between gold and stock sectors (Kumar, 2014). It appears to provide meaningful and interpretable coefficients.

Π is a (2×2) matrix of coefficients allowing for cross-sectional dependency of conditional mean between stock market and (oil price, inflation, and exchange rate) of the following form:

$$\Pi = \begin{pmatrix} \Pi_{11} & \Pi_{12} \\ \Pi_{21} & \Pi_{22} \end{pmatrix}$$

$\varepsilon_t = \left(\varepsilon_t^s, \varepsilon_t^F\right)'$ is the vector representing the error terms of the conditional mean equations.

$\eta_t = \left(\eta_t^s, \eta_t^F\right)'$ is a sequence of independently and identically distributed $(i.i.d)$ random errors;

$H_t = \begin{pmatrix} h_t^s & h_t^{sF} \\ h_t^{sF} & h_t^F \end{pmatrix}$ is the matrix of conditional variances of stock and returns of (oil price,

inflation, and exchange rate) with h_t^s and h_t^F being the conditional variances of r_t^s and r_t^F respectively. Their time series dynamics are modelled as follows:

$$h_t^s = C_s^2 + \beta_{s1}^2 h_{t-1}^s + \alpha_{s1}^2 (\varepsilon_{t-1}^s)^2 + \beta_{s2}^2 h_{t-1}^F + \alpha_{s2}^2 \left(\varepsilon_{t-1}^F\right)^2 \tag{5.2}$$

$$h_t^F = C_F^2 + \beta_{F1}^2 h_{t-1}^F + \alpha_{F1}^2 \left(\varepsilon_{t-1}^F\right)^2 + \beta_{F2}^2 h_{t-1}^s + \alpha_{F2}^2 (\varepsilon_{t-1}^s)^2 \tag{5.3}$$

According to Eqs. 5.2 and 5.3, negative and positive shocks of equal magnitude have identical effects on conditional variances. The equations also show how volatility is transmitted over time. The cross values of error terms, $\left(\varepsilon_{t-1}^F\right)^2$ and $(\varepsilon_{t-1}^s)^2$, represent the return innovations in the (oil price, inflation, and exchange rate) and to the corresponding stock price at time $(t-1)$, and thus capture the impact of direct effects of shock transmission. The transfer of risk is accounted for by the lagged conditional volatilities, h_{t-1}^F and h_{t-1}^s. To guarantee stationarity, the roots of the equation $|I_2 - AL - BL| = 0$ must be outside the unit circle where the expressions $(I_2 - AL)$ and BL satisfy some other identifiability conditions as proposed by Jeantheau (1998). L is a lag polynomial, I_2 is a (2×2) identity matrix, and A and B are defined as:

$$A = \begin{pmatrix} \alpha_{s1}^2 & \alpha_{s2}^2 \\ \alpha_{F2}^2 & \alpha_{F1}^2 \end{pmatrix} \text{and } B = \begin{pmatrix} \beta_{s1}^2 & \beta_{s2}^2 \\ \beta_{F2}^2 & \beta_{F1}^2 \end{pmatrix}$$

The conditional covariance between returns of each of the three variables (oil price, inflation, and exchange rate) and stock market in the bivariate VAR(1)-GARCH(1,1) is modeled as:

$$h_t^{sF} = \rho * \sqrt{h_t^s} * \sqrt{h_t^F} \tag{5.4}$$

where ρ is the constant conditional correlation (CCC) coefficient.

Overall, the proposed empirical model simultaneously allows capturing both return and volatility spillover effects between (oil price, inflation, and exchange rate) and stock market. Note that the CCC assumption can be viewed as restrictive given that correlation coefficient is likely to vary over time according to changes in economic and market conditions. The quasi-maximum likelihood estimation (QMLE) method of Bollerslev and Wooldridge (1992) is used to estimate the empirical model in order to take into account the fact that normality condition is often rejected for majority of macroeconomic and financial series.

5.3 Data and preliminary analysis

5.3.1 The data used for the Analysis

The data used in this analysis consist of daily observations on crude oil price and the closing value of the KSE index. Monthly data on KSE index, exchange rate, inflation rate are also used. Crude oil prices expressed in USD per barrel for Brent spot prices to represent the international crude oil market given that they are serving as pricing benchmark for two thirds of the world's internationally traded crude oil supplies (see Aloui et al., 2013; Maghyereh, 2004). To look at the impact of the secession of South Sudan on July 9, 2011, the study uses a sub-period analysis by splitting the whole sample period into two sub-periods (before and after the secession). Table 5.1 provides the description and sources of the variables.

Table5. 1: Variables included, their frequency, period and sources

Variable	Frequency	period	Source
KSE index	Daily	2/8/2008-20/10/2014	KSE database
KSE index	Monthly	9/2003-10/2014	KSE database
Exchange rate	Monthly	9/2003-10/2014	Central Bank of Sudan
Inflation rate	Monthly	9/2003-10/2014	Central Bank of Sudan
Crude oil prices	Daily	2/8/2008-20/10/2014	the US Energy Information Administration

Source: Author

Daily (monthly) returns on the variables are computed as percentage by taking the difference in logarithm of two successive values as follows:

$$r_t^{\text{F}} = log\left(\frac{P_t^{\text{F}}}{P_{t-1}^{\text{F}}}\right) * 100 \tag{5.5}$$

$$r_t^{s} = log\left(\frac{P_t^{S}}{P_{t-1}^{S}}\right) * 100 \tag{5.6}$$

Equ. 5.5 is used for calculating the returns of oil prices, exchange rate and inflation. P_t^{S} and r_t^{s} in Equ. 5.6 denote daily (monthly) closing values of the KSE index and their returns respectively.

5.3.2 Descriptive Statistics of KSE index, inflation, exchange rate and crude oil prices

To specify the distributional properties of the variables and their returns during the sample period, some descriptive statistics are reported in Tables 5.2 and 5.3. It is very clear that returns on oil prices and KSE index have very small means (very close to zero). In view of the value of standard deviation (an indication of unconditional variance in the return series) regarding the mean value, the results show that oil prices, inflation, and exchange rate are characterized by higher volatility and risky nature in comparison with KSE returns. The results also indicate that all series do not conform to normal distribution but display positive skewness (the distribution has a long right tail), in addition to that, a highly leptokurtic distribution is also observed for all returns series. The Jarque-Bera (JB) statistic confirms that the returns distribution is non-normal at a p-value of almost 1% in all cases (except for inflation variable in post-secession period). As for comparing the behavior of the KSE index before and after the secession of South Sudan, Table 5.2 indicates that the average value of the KSE index in post-secession period is greater and with higher volatility. This feature is also true for the returns series (Table 5.3) but with less volatility. ARCH-LM test results provide strong evidence for rejecting the null hypothesis of no ARCH effects indicating that the variance of the residuals series of returns on the variables under

investigation is non-constant. The presence of ARCH effects is a justification to use the GARCH methodology.

Figures 5.1-5.3 display the KSE index, crude oil prices, inflation, exchange rate and their returns. To some extent, there seems to be some comovements between the KSE index and the three variables during most of the time, except for some relatively short sub-period (end of 2011 up to the beginning of 2012) where there was no significant change in the index returns. For all returns series, there is evidence for volatility clustering a phenomenon indicating that large changes tend to be followed by large changes, and small changes tend to follow small changes. This characteristic suggests the possibility of return and volatility spillover effects and makes GARCH types models to be the preferred methodology for modeling such time series (Francq and Zakoian, 2010).

Table5. 2: Summary statistics for crude oil prices, inflation, exchange rate and KSE index

Measures	Oil Prices	KSE Index		Inflation Rate		Exchange Rate	
		Before	After	Before	After	Before	After
Mean	95.79	2586.14	2673.09	10.4621	35.3103	2.3175	4.3576
Std. dev.	22.39	168.81	300.64	4.4406	9.8817	0.2191	1.1757
Maximum	143.95	3077.12	3423.37	21.800	47.900	2.7816	5.6958
Minimum	33.37	2353.20	2365.02	1.7000	18.900	2.0051	2.6789
Skewness	-0.79	0.24	0.77	0.1399	-0.5062	0.0752	-0.3368
Excess Kurtosis	2.86	2.38	2.47	2.4518	1.7165	1.8107	1.7159
Jarque-Bera	185.25[a]	23.75[a]	91.88[a]	1.4992	4.3427	5.6881*	3.4028
No. of Observations	1770	934	827	95	39	95	39

Note: [a] denotes statistical significance at the 1% significance level.
Source: Author's calculations.

Table5. 3: Summary statistics for returns on crude oil prices, inflation, exchange rate and KSE index

Measures	Oil Prices	KSE Index		Inflation Rate		Exchange Rate	
		Before	After	Before	After	Before	After
Mean	-0.0052	-0.0148	0.0263	1.7808	2.0533	0.0266	1.9205
Std. dev.	2.1535	1.3585	0.4222	40.6697	11.956	1.5518	6.9098
Maximum	18.1297	21.1228	3.3937	189.712	31.536	6.4437	37.314
Minimum	-16.8320	-11.6074	-3.9978	-151.634	-31.408	-5.5912	-0.299
Skewness	0.0947	2.8156	1.7141	0.6002	0.0599	0.7655	4.0779
Excess Kurtosis	11.0428	97.4340	42.407	9.4970	4.0247	7.3963	19.787
Jarque-Bera	4770.65[a]	347912[a]	53851.8[a]	170.972[a]	1.7297	84.879[a]	566.01[a]
ARCH(30)	416.14	316.83		32.172		44.204	
No. of Observations	1770	934	827	95	39	95	39

Note: ARCH(30) and $LB^2(12)$ refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 30.
[a] denotes statistical significance at the 1% significance level.
Source: Author's calculations.

Figure 5.1: Crude oil price (USD) and KSE index (January 2, 2008 – October 20, 2014)
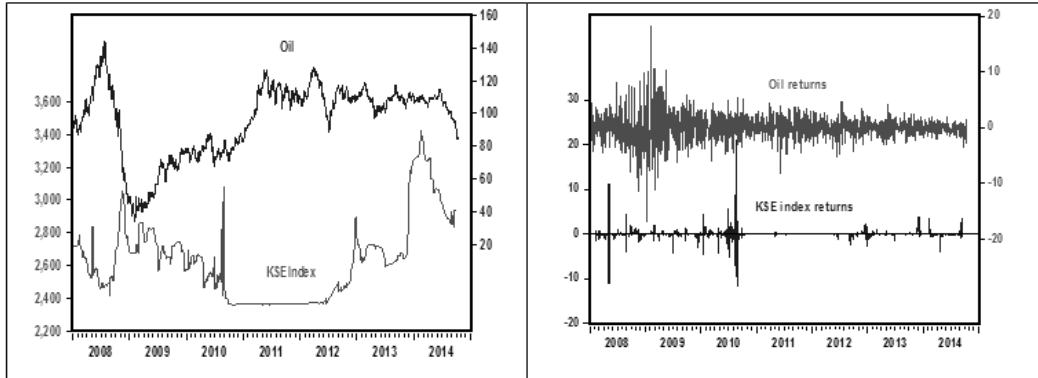
Source: Author's calculations based on Khartoum stock exchange and the US Energy Information Administration (EIA) database.

Figure 5.2: Inflation rate (%annual) and KSE index (September 2003 – October 2014)
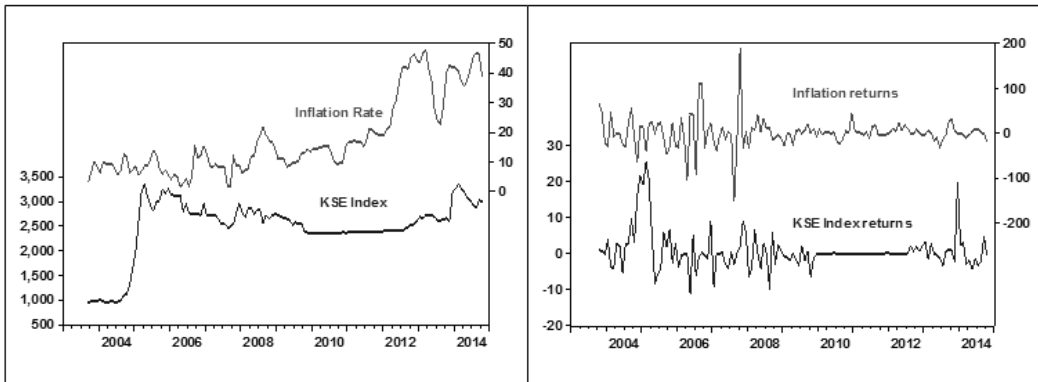
Source: Author's calculations based on Khartoum stock exchange database and the Central Bureau of Statistics (Sudan).

Figure 5.3: Exchange rate (SDG/USD) and KSE index (September 2003 – October 2014)
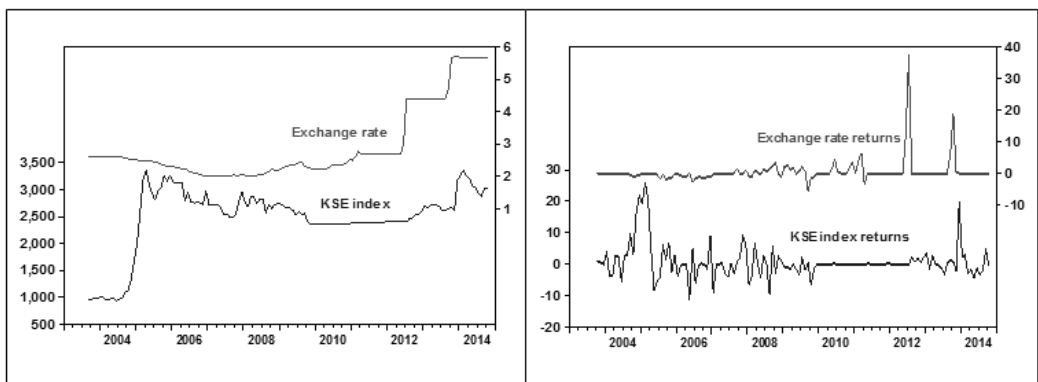
Source: Author's calculations based on Khartoum stock exchange database and the Central Bank of Sudan.

5.4 Empirical Results

Given the results of ARCH-LM test in the previous section, it is now possible to proceed with modeling the responses of the Sudanese stock market to fluctuations in crude oil prices, inflation, and exchange rate by employing a VAR(1)-GARCH(1,1) model. The proposed model is estimated using maximum likelihood method under the assumption of multivariate normal distributed error terms. The log likelihood function is maximized using Marquardt's numerical iterative algorithm to search for optimal parameters. Beside the estimation output of the VAR(1)-GARCH(1,1) model, diagnostics test results are also provided to see whether there still ARCH effects left in the estimated model[93]. The results of returns and volatility spillovers are presented in Tables 5.4-5.6.

When considering crude oil price fluctuations, the empirical findings in Table 5.4 documents that KSE index returns is significantly affected by its own past returns suggesting some evidence of short-term predictability in KSE index changes. This finding is consistent with some existing literature in this regard (see, e.g., Arouri and Nguyenk 2010; Arouri et al., 2012; Elder and Serletis, 2008; Shambora and Rossiter, 2007). But when inflation and exchange rate are considered, the significant of short term predictability is not confirmed (see Tables 5.5 and 5.6).

Regarding the returns spillover effects in the conditional mean equations, Table 5.4 indicates that a one-period lagged oil returns, oil (-1) parameter, significantly affects the current value of returns on the KSE index for the first sub-period and for the full sample period. In contrast, the autoregressive term of oil is insignificantly different from zero during the post secession period. When inflation and exchange rate are considered, the results show that their lagged values are statistically significant specially, in the post secession period.

Table5. 4: Estimation results of VAR(1)-GARCH(1,1) model for oil and KSE returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	-0.1173***	-0.0005*	-0.0085***
Return(-1)	0.2132***	0.4412***	0.8343***
Oil(-1)	0.0033*	0.0004	-0.0017***
Conditional variance equation			
Constant	0.0499***	0.0008**	0.00012***
$(\varepsilon_{t-1}^s)^2$	2.7693***	13.0857***	3.66881***
$(\varepsilon_{t-1}^o)^2$	0.04726***	0.03713***	0.04525***
h_{t-1}^s	0.4286***	0.01603***	0.63243***
h_{t-1}^o	0.9481***	0.95261***	0.95362***
Diagnostics			
ARCH(30)	9.1875	4.0775	15.231
LB^2(12)	10.028	3.8519	24.633

Note: ARCH(30) and LB^2(12) refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 30 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.
Source: Author's calculations.

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[93]If the variance equation of GARCH model is correctly specified, there should be no ARCH effect left in the residuals.

Table5. 5: Estimation results of VAR(1)-GARCH(1,1) model for inflation and KSE returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	0.0612	0.5288***	0.1385**
Return(-1)	0.1406	-0.1218	0.1733
INF(-1)	0.0058	0.1013***	0.0122***
Conditional variance equation			
Constant	-0.0096	0.3759	-0.0007
$(\varepsilon_{t-1}^s)^2$	0.4149***	2.6545**	1.3618***
$(\varepsilon_{t-1}^{inf})^2$	0.2143***	0.2542*	0.1994***
h_{t-1}^s	0.6825***	-0.0518	0.5089***
h_{t-1}^{inf}	0.8085***	0.3919**	0.8145***
Diagnostics			
ARCH(5)	43.253	0.3134**	15.315
LB^2(12)	55.356	0.5756*	14.415

Note: ARCH(5) and LB^2(12) refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 5 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.
Source: Author's calculations.

Table5. 6: Estimation results of VAR(1)-GARCH(1,1) model for exchange rate and KSE returns

Variables	Before Secession	After Secession	Full Sample Period
Conditional mean equation			
Constant	0.0419	0.2209*	0.02424
Return(-1)	-0.0052	-0.0267	-0.0041
EX(-1)	0.0179	0.0892***	0.1329***
Conditional variance equation			
Constant	-0.0143***	-0.0297	0.0612
$(\varepsilon_{t-1}^s)^2$	0.3813***	2.0628**	0.5936***
$(\varepsilon_{t-1}^{ex})^2$	-0.0727**	1.1513**	0.6822***
h_{t-1}^s	0.7071***	0.4518**	0.6685***
h_{t-1}^{ex}	1.1206***	1.2168***	1.1624***
Diagnostics			
ARCH(5)	25.768	0.4765*	11.324
LB^2(12)	50.825	0.7596**	10.608

Note: ARCH(5) and LB2(12) refer to the empirical statistics of the Engle (1982) test for conditional heteroscedasticity up to order 5 and the Ljung-Box test for autocorrelation of order 12 applied to the standardized residuals.
*, **, and *** indicate the rejection of the null hypothesis of associated statistical tests at the 10%, 5%, and 1% levels respectively.
Source: Author's calculations.

When it comes to look at the shock dependence and volatility persistent (ARCH and GARCH coefficients), the results of Table 5.4 indicate that they are statistically significant in all cases when oil price returns are considered. These coefficients are significant for most cases when the focus is on the impact of inflation and exchange rate (see Tables 5.5 and 5.6).In empirical finance literature, it is stylized fact that volatility persistent is attained when the sum of ARCH and GARCH coefficients is less than one. For example, the summation of these coefficients is 0.99, 0.98 and 0.99 for the crude oil returns for three periods respectively. On the other hand, the results show that the sum of these coefficients is more than one for returns on KSE in all cases, indicating that volatility can be considered as an explosive process especially after the secession of South Sudan. These results are completely consistent with the turbulent macroeconomic environment in Sudan over the last few years. Additionally, the results suggest that the current

conditional volatility of KSE index returns depends on past shocks affecting return dynamics since ARCH-terms are significant for all sub-periods. This suggests that the conditional variance of stock market does not only depends on its immediate past values and innovations but also on those of the oil market, inflation, and exchange rate fluctuations as previously hypothesized. A closer inspection of the above coefficients reveals that in general, conditional volatility is changing very rapidly as the ARCH-terms measuring the impact of past shocks on conditional volatility are large in size (especially after the secession).

The empirical findings regarding the volatility transmission between oil and stock market the results indicate that the conditional volatility of returns on KSE index is affected by innovations in the oil market as indicated by the significance of the coefficient of $(\varepsilon^o_{t-1})^2$. It is also affected by what is going on inflation and exchange rate, given the statistical significance of the terms $\left(\varepsilon^{inf}_{t-1}\right)^2$ and $(\varepsilon^{ex}_{t-1})^2$ respectivelly. Apparently, a shock originating from the oil market, inflation, or exchange rate leads to increase stock returns volatility. In addition, there is strong evidence to suggest that past volatility of the oil market, inflation and exchange rate is transmitted to stock market because the coefficients associated with h^o_{t-1}, h^{inf}_{t-1}, h^{ex}_{t-1} are statistically significant.

Some diagnostics tests such as the Ljung–Box (LB) test for autocorrelation and ARCH LM test for ARCH effects are reported to validate the estimates of the VAR-GARCH model. LB statistic suggests that the null hypothesis of no autocorrelation cannot be rejected for most cases; thus, the residuals are free of autocorrelation (except for inflation and exchange rate in post secession period[94]). The ARCH-LM test suggests that the null hypothesis of no ARCH effects cannot be rejected for most cases, implying that the residuals do not suffer from the ARCH effects which means that VAR(1)-GARCH(1,1) has effectively captured the ARCH effects (except for inflation and exchange rate in post secession period.

Estimated conditional volatility graphs (as conditional standard deviation) for the returns on KSE index accompanied with volatility of returns on crude oil price, exchange rate and inflation rate are provided in Figures 5.4-5.9. It is obvious that KSE index returns experienced higher levels of volatility in post-secession period confirming the results of the conditional mean and variance equations of Tables 5.4-5.6.

Figure 5.4: Volatility of Crude oil prices and KSE index (Before the Secession of South Sudan)
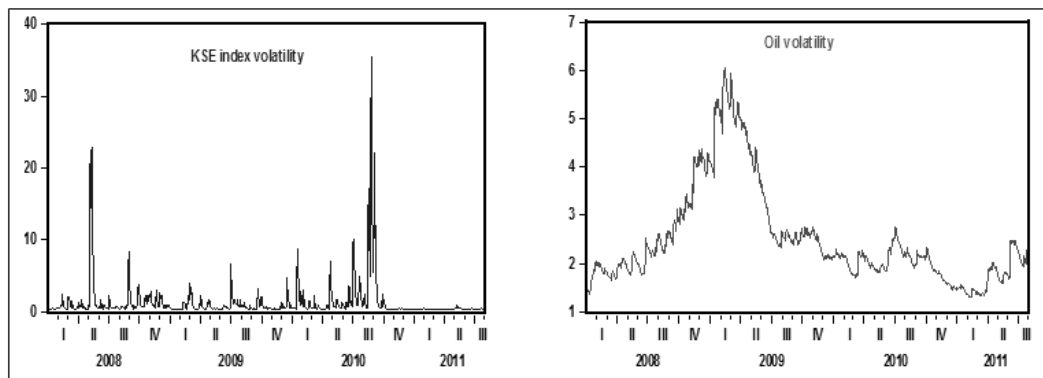
Source:Author's calculations based on Khartoum stock exchange database and the US Energy Information Administration (EIA) database

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[94]This result can be justified by low number of observations.

Figure 5.5: Volatility of Crude oil prices and KSE index (After the Secession of South Sudan)
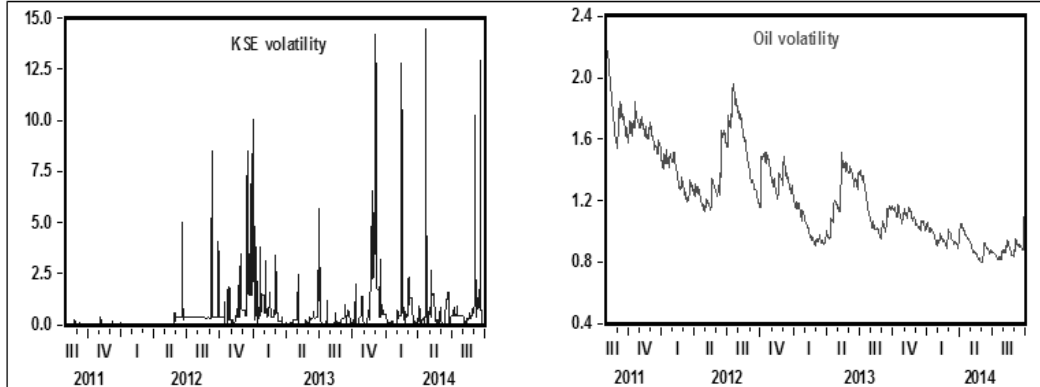
Source: Author's calculations based on Khartoum stock exchange database and the US Energy Information Administration (EIA) database

Figure 5.6: Volatility of inflation and KSE index (Before the Secession of South Sudan)
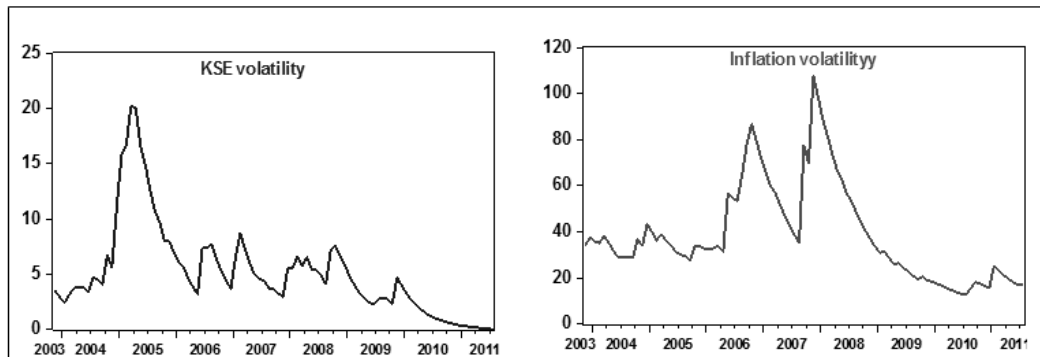
Source: Author's calculations based on Khartoum stock exchange database and the Central Bureau of Statistics (Sudan).

Figure 5.7: Volatility of inflation and KSE index (After the Secession of South Sudan)
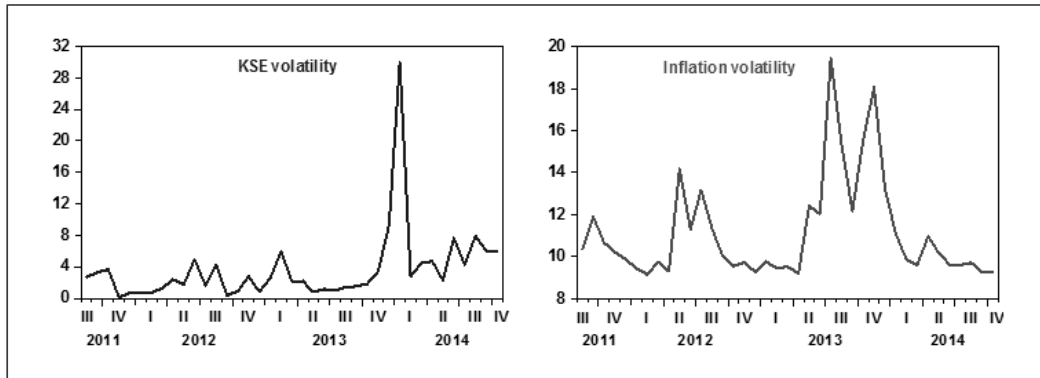
Source: Author's calculations based on Khartoum stock exchange database and the Central Bureau of Statistics (Sudan)

Figure 5.8: Volatility of exchange rate and KSE index (Before the Secession of South Sudan)
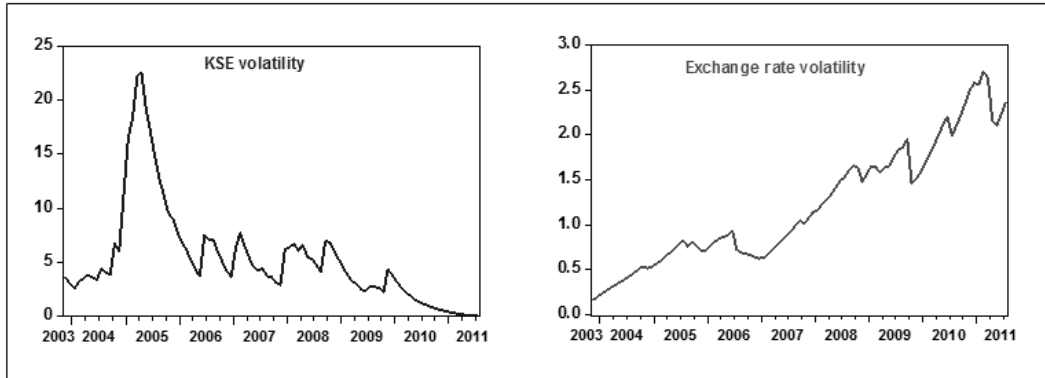
Source: Author's calculations based on Khartoum stock exchange database and the Central Bank of Sudan.

Figure 5.9: Volatility of exchange rate and KSE index (After the Secession of South Sudan)
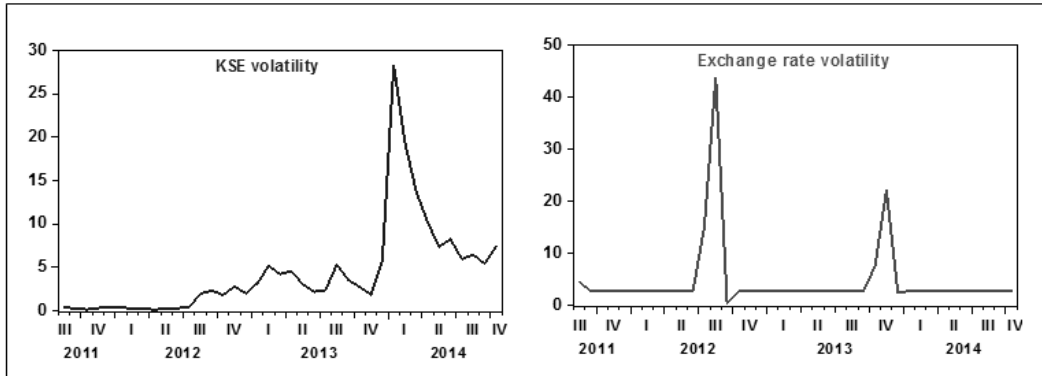
Source: Author's calculations based on Khartoum stock exchange database and the Central Bank of Sudan

To sum up, this chapter provides evidences that the Sudanese stock market has experience higher levels of fluctuations consistent with turbulent macroeconomic environment in Sudan during the past few years, especially after the secession of South Sudan in 2011. It shows that these fluctuations are greatly explained by the oil shocks and exchange rate fluctuations. Little evidence is found for the inflation rate movements.

CHAPTER 6

CONCLUDING REMARKS, POLICY RECOMMENDATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

6.1 Introduction

Understanding how well (or how badly) an overall economy is performing has long been one of the major preoccupations in both theoretical and empirical macroeconomic research. Greater emphasis has been placed on analyzing the cyclical behavior of key macroeconomic aggregates. Recently, a great deal of empirical research has again started to focus on business cycle phenomenon, especially in developed economies, given the fact that the world's economies have become increasingly integrated. However, debates concerning the dominant driving forces behind business cycle fluctuations and their propagation mechanisms do not completely come to a conclusion. More generally, business cycle theory illustrates that the major driving force behind these macroeconomic fluctuations can be volatile market expectations about future sales and profits according to the Keynesian Business Cycle Theory; fluctuations in monetary growth rate as illustrated by the Monetarists Theory; unanticipated fluctuations in aggregate demand according to New Classical Theory; some kind of nominal price/wage rigidities according New Keynesian Theory; and random shocks to total factor productivity that result from technological change according to the Real Business Cycle Theory. There is broad consensus that the major driving forces behind business cycle fluctuations have significant impacts on the long-term economic growth and related variables such as productivity, employment and price levels and therefore impacted the standard of living. To counteract the length and severity of these kinds of forces, strong macroeconomic policy responses are needed. Toward that end, the current study represents an attempt to look empirically at the impact of both internal and external shocks in the Sudanese economy so that relevant macroeconomic policies for enhancing sustainable growth can be envisioned. It is in this context that this study aims to identify the sources and impact of macroeconomic fluctuations in the Sudan by considering a set of major macroeconomic variables including: real output, price level, real exchange rate, and money supply as domestic forces and world oil prices and real output for Arab countries to represent the external forces. It also investigates how the Sudanese stock market responds to fluctuations in key economic forces.

The study applies the structural vector autoregression (SVAR hereafter) methodology proposed by Shapiro and Watson (1988), Blannchard and Quah (1989), and King et al. (1991) to look at the dynamic interrelationships between key macroeconomic aggregates. Here the dataset is divided into two sub-periods; the first representing the functioning of the economy without oil, while the second period represents when the economy is heavily dependent on oil. The study also uses a VAR(1)-GARCH(1,1) model proposed by Ling and McAleer (2003) to see how the Sudanese stock market (the Khartoum Stock Exchange, KSE) responds to changes in fundamental economic forces? In particular, the study focuses on the fluctuations of inflation rate and exchange rate as key domestic forces and world oil price as an external force. To look at the impact of the secession of South Sudan, the study uses a sub-period analysis by splitting the whole sample period into two sub-periods (before and after the secession).

6.2 Concluding Remarks

Because of data availability problem, the empirical part of the study has been divided in two

chapters in terms of econometric methodologies employed. In the first and main chapter of the study, a structural analysis of the sources and dynamic of macroeconomic fluctuations is explored. To that end, a system of variables containing output growth (GDP), price level (CPI), money supply (MS), real exchange rate (RER), the price of Brent crude oil (Brent) and GDP for Arab countries (ARAB) is analyzed by applying the structural vector autoregression (SVAR hereafter) methodology proposed by Shapiro and Watson (1988), Blannchard and Quah (1989), and King et al. (1991). Based on a description analysis, the study finds in general that the economy has experienced higher volatility during non-oil period. It is striking that real output volatility over the first sub-period is about four times of that seen when the economy is heavily depend on oil. For the whole sample period it is evident that the most volatile macroeconomic variable is the real output.

The estimation results of a SVAR model with block-exogenous restrictions lead to the conclusion that the shocks in crude oil price and output for the Arab countries (external shocks) are less likely to explain the movement of domestic macroeconomic variables than shocks to domestic variables. For instance, external factors account for approximately 21% of the real output dynamics in the 12th time horizon. Additionally, the results show that fluctuations in world oil prices account for more domestic fluctuations than that related to movements in the real output of the Arab countries. As for domestic fluctuations, empirical results suggest that apart from their own shocks, much of the real output fluctuations can be explained by the shocks in price and real exchange rate.

The second part of the study is for understanding fluctuations of Sudanese stock market. Here the main focus of the study is to address the question: How the Sudanese stock market responds to changes in fundamental economic forces? In particular, the study focuses on the fluctuations of inflation rate and exchange rate as key domestic forces and world oil price as an external force. The dataset is divided into two sub-periods, before and after the secession of South Sudan. The empirical results show that the returns on KSE index are significantly affected by their own past values suggesting some evidence of short-term predictability in KSE index changes. In addition, significant effect of a one-period lagged of returns on crude oil price, inflation and exchange rate on KSE returns is provided. Consistent with turbulent macroeconomic environment in Sudan during the past few years, the study concludes that KSE has experienced higher levels of fluctuations especially in the post-secession period. The study tells that KSE fluctuations are greatly attributed to oil shocks and exchange rate fluctuations.

6.3 Policy Recommendations

Through the results based on the two econometric methods, there are a number of policy recommendations that policy makers can consider in their attempts to restore macroeconomic stability. Perhaps it seems appropriate to emphasize that the study has underscored that the major driving forces of macroeconomic fluctuations in Sudan is domestic in nature, but external forces as measured by world oil price and real output of Arab countries seems to have a role in explaining real output dynamics. Based on these findings, the study presents many policy implications pertinent to policy makers, authorities and future researchers.

Sudan has experienced different episodes of macroeconomic volatility through its history and the degree of volatility has significantly increased after the secession of South Sudan in July 2011which has inflicted a large permanent fiscal and external shock on Sudan. The later has been linked, to a large extent, to inefficient management of oil revenues which in turns led to the country's failure in diversifying the economy out of oil despite its rich natural resource endowment. In fact, during the oil boom (1999-2010), the government did not succeed in use the

oil windfalls to invest in developing other real sectors of the economy (especially, the agricultural and industrial sectors). This has resulted in the creation of substantial challenges for the Sudanese economy performance during the post-secession period. To address the permanent oil shock posed to the economy by South Sudan secession, it is imperative that the government authorities should intensify their efforts to secure alternative avenues of revenue generations. The paramount task they should consider is to find a new growth paradigm towards broad-based economic diversification in order to make the economy less vulnerable to a crisis in one industry. More specifically, the current study recommends the diversification of the economy through prioritizing agriculture and agro-industries. In this context, the Government needs to deepen and sustain its efforts to revive agriculture from its current impasse through investment and technological transfer. This would help Sudan to improve food supplies and diversify and expand its exports base in the coming period.

Along the same lines, Government authorities should not disregard the need of greater diversification of trade partners and the development of bilateral trade relationships with the countries in the region. In this regards, trade cooperation with South Sudan in particular would be beneficial in increasing foreign exchange earnings and reserves which can be used to promote growth and to large extent decrease the country' vulnerability to different types of shocks.

Additionally, turning to other natural resources such as gold, could also be considered as a lead in driving the economic diversification agenda of the country given that gold has the potential to be one possible source to offset the losses of oil revenues. However, this potential is yet to be realized as the majority of gold production is still relies on unlicensed artisanal producers and the majority of gold miners are operating in the remote desert areas of the country. This has led to a low tax intake and thus the benefits accruing to the budget are negligible. In a forward looking perspective, more efforts are extremely needed to legalize and regulate the informal mining sector and to reduce the amount of gold smuggling to overseas markets. More importantly, the Government authorities should also work to improve business environment in gold industry to attract foreign investments. In this regard, establishing partnerships with international stakeholders such as Extractive Industries Transparency Initiative (EITI) would be very helpful given that strong commitment to the EITI would send a strong message to the international investment community about the country's dedication to improved investment climate of the gold industry. Additionally, more efforts are required to develop the capacity of local labor force to meet the demand from foreign mining companies.

Based on the fact that Sudan still has a relatively huge economic potential in terms of its endowment of natural resources, economic growth in Sudan is expected to be driven by natural resources (mainly oil and gold). In fact, Sudan is currently working to expand oil exploration efforts and also looking to gold mining as a new source of foreign exchange earnings. For more significant role of oil and gold on Sudan's economy, Government authorities should have to be cautious in the management of oil and gold revenues. They should invest them to diversify the economy to achieve long-term sustainable development.

To push the economic diversification program and accelerating economic growth, policy makers should embark on a series of serious plans to attract more investments from both domestic and foreign sources. They should prioritize infrastructural improvement, adequacy of government agencies, transparency in customs and taxation rules and the quality of the legal system. They should continue to implement sound fiscal and monetary policies to reduce government budgetary deficit as this reduction would spare resources to develop physical as well as financial infrastructures to be able to attract more investments.

While government has the key role to play in diversification program, other relevant stakeholders can also play a part. The private sector, in particular has an important role to play in boosting economic diversification. Accordingly, Government authorities should made considerable efforts to strengthen support to the private sector by creating a business-enabling environment for the sake of entrepreneurship.

Perhaps it is appropriate to note that Sudan economy will continue, at least in the coming few years, to be confronted with the substantial challenges in the area of macroeconomic management, which in turn would require continued institutional and human capacity to design and implement appropriate policies for national development. There is a critical need for capacity building programmes in key areas of financial sector reforms, public resource management, trade reform, debt management and the need for strengthening the institutional capacity and building fiscal, monetary, and statistical frameworks that meet international best practice. For an effective capacity building programmes, the government authorities should work to enhance their partnerships with regional and international like African Development Bank, International Monetary Fund, and the World Bank, among others.

Based on the result that domestic forces were found to dominate the macroeconomic fluctuations in Sudan, it is therefore critical for policymakers to pay serious attention to fluctuations in these domestic forces. Of course they should also take account of the foreign variables in all stabilization policies of the economy. Of critical importance, policy makers should pay special attention to control higher exchange rate volatility as it contributes to a higher exchange rate pass-through to inflation. According to the results of the SVAR model there is clear evidence that exchange rate shocks represent the major driving forces of real output and KSE fluctuations, appropriate policies are needed to reduce exchange rate volatility. Greater emphasis should be given to factors that stimulate exchange rate fluctuations like high inflation and budget deficit. Within this context, authorities at the Central Bank of Sudan should emphasize the use of monetary policy with the sole goal of fighting inflation which, in turn, would be enough to stabilize output. They also need to intensify their efforts to rapidly unifying the foreign exchange rates and markets, and pursuing a flexible exchange rate policy to lessen pressure on the exchange rate and build up external reserves. Further, authorities should try to avoid systematic currency devaluations in order to maintain the exchange rate volatility at a rate that allows adjustment of the balance of payments. Given the relation between crude oil prices and real exchange rate, the Central Bank of Sudan should fine tune its policy to place more focus on maintain stable inflation.

Additionally, fiscal adjustments to include actions on expenditures and revenues should also be considered in maintaining macroeconomic stability. On the expenditures side serious actions need to be taken, including: significant compression of expenditures is required to drive the fiscal balance to manageable levels within the coming few years. In this context, Government authorities should work to cutting non-priority spending (e.g., goods and services), placing capital expenditures on priority activities that enhance growth and they should also work on phasing out subsidies. On the revenue side, the government authorities should work to diversify and widen the tax base, rationalizing government spending, eliminate the various exemptions and revenue earmarking. Additionally, strengthening revenue administration and increasing the efficiency and transparency of revenue collection systems should also be in the top of their priorities.

Forward-looking macroeconomic policies should put greater emphasis on domestic resource mobilization by enhancing the performance of financial institutions. In particular, the current

study highlights that the Khartoum stock exchange (KSE). It is worth mentioning at this juncture that previous and ongoing efforts and policy discussions are generally assign a relatively minor role to the dynamics of KSE. Given the fact that KSE serves as a reliable barometer of how well the overall economy is performing, it is not surprisingly to expect a far-reaching impact on macroeconomic stability given that its efficiency is to be improved. In order to develop the Sudanese stock market further, the study recommends that the government authorities and market regulators should emphasize on the elimination of any impediments to the growth and development of the KSE including any regulatory barriers that may act as disincentives to investment. Specifically, the study illustrates that significant progress in KSE performance can be made by (i) curbing market volatility; (ii) disclosing timely and reliable information; and (iii) strengthening the public confidence and awareness about the potential market opportunities. Specific recommendations include: (i) Policy-makers in the Central Bank of Sudan are required to enhance monetary policy transparency to ensure symmetric information between monetary policymakers and other economic agents, (ii) Market regulators can introduce some margin regulations to discourage investors from excessive speculation by making future trading more costly, (iii) Regulators should adopt circuit breakers (such as trading halts and daily price limit) to temporarily suspend trading activity if price movements exceed certain thresholds. This provides time for traders to re-evaluate market conditions in times of panic selling and to bolster their liquidity and credit, (iv) Public awareness about KSE activities should be strengthened through regular and intensive educational and promotional campaigns programs, (v) To attract significant portion of the potentially large amount of financial wealth exists outside the Sudanese financial system, the geographic coverage of educational programs should be expanded to include the general public not only in the Khartoum state but also in other states of the country, and (vi) Policy makers should put greater emphasis on enhancing information disclosure and transparency by developing a new disclosure regime and transparency standards which lead to timely, consistent, complete and accurate information about KSE activities.

Overall, to achieve the foregoing recommendations, government authorities, leaders and politicians should recognize that extraordinary political will is required. It seems timely for them to intensify their efforts to play a preeminent role in the peaceful resolution of armed conflicts and wars across the country. Without any doubt, political instability and partisan intrigues will continue to be the main concern for achieving macroeconomic stability.

6.4 Directions for Further research

This study sought to investigate the dynamic and sources of macroeconomic fluctuations in Sudan. The study has applied SVAR methodology by considering a limited number of major driving forces. At this juncture it might be worth mentioning that there may be more other variables deemed relevant for such type of macroeconomic research. In fact, the SVAR model requires a sufficient number of observations, given the lag length, the addition of a variable in the system quickly exhaust degrees of freedom and consequently make the estimation inefficient. This consideration restricts the study to use only four domestic macroeconomic variables which believed to be more sufficient to represent the functioning of Sudanese macroeconomy as well as two external forces. Within this context, future research on macroeconomic policy analysis and forecasting should try other econometric methodologies to overcome the limitations of SVAR model. Considering the dynamic stochastic general equilibrium (DSGE) model may be one of the best choices as it features a sound micro-founded general equilibrium framework, characterized by the optimizing behavior of the various agents of the economy (firms, households, and monetary authority) and the solution methods explicitly adopt the framework of

"general equilibrium" theory. This model represents a powerful tool that provides a coherent framework for policy discussion and analysis. In principle, it can help to identify sources of fluctuations; answer questions about structural changes; forecast and predict the effect of policy changes, and perform counterfactual experiments". Additionally, DSGE model has advantage over the traditional ones by making use of the calibration method where parameters are not estimated; instead, they will be estimates from existing studies or modelers' own judgment about the likely parameter values are plugged directly into the model. Other advantages of DSGE model include its forward-looking behavior which is important because the agents' expectations for the future change their behavior in the present; it's explicitly about the shocks that might affect the economy; and its mathematical ability to forecast the behavior of the whole economy.

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Annex 1
Political Map of Sudan

Source: http://www.mapsopensource.com

Annex 2
Poverty profile for Sudan

	Poverty			Poverty gap among the poor
	Incidence	Gap	Severity	
Sudan	46.5	16.2	7.8	34.8
Poverty by Residence				
Rural	57.6	21.3	10.6	36.9
Urban	26.5	7.1	2.7	26.6
Poverty by Regions				
Darfur	62.7	24.6	12.6	39.3
Kordofan	58.7	23.1	11.7	39.3
Eastern	46.3	17.7	9.0	38.2
Central	45.4	13.8	6.1	30.4
Northern	33.7	9.4	3.8	28.0
Khartoum	26.0	6.4	2.4	24.7
Poverty by States				
Northern Darfur	69.4	27.4	14.2	39.6
Southern Darfur	61.2	24.5	12.7	40.1
Southern Kordofan	60.0	20.7	9.4	34.5
Northern Kordofan	57.9	24.6	13.1	42.5
Red Sea	57.7	24.9	13.7	43.1
Blue Nile	56.5	20.6	9.9	36.5
Western Darfur	55.6	19.8	8.9	35.6
White Nile	55.5	17.6	7.8	31.7
Al-Gadarif	50.1	15.9	6.7	31.8
Sinnar	44.1	14.0	6.4	31.7
Al-Gezira	37.8	10.1	4.1	26.6
Kassala	36.3	14.7	8.0	40.6
Northern	36.2	10.5	4.2	29.1
River Nile	32.2	8.8	3.5	27.3
Khartoum	26.0	6.4	2.4	24.7

Source: Author's compilation based on Sudan National Budget Household Survey (NBHS) 2009.

Annex 3

Real Gross National Product by type of Economic Activity at prices of 1981/82 (2001-2013)

Sector	2000	2001	2002	2003	2004	2005	2006
Agriculture, Forests, Animal Resources and Fisheries		6.1	6.1	6.3	6.2	6.5	6.9
oil		0.9	1.0	1.1	1.3	1.5	1.6
Mining and quarrying		0.0	0.0	0.0	0.0	0.0	0.0
Electricity and Water		0.3	0.3	0.2	0.4	0.4	0.5
Building and Construction		0.4	0.4	0.4	0.5	0.6	0.7
Wholesale and Retail Trade, Hotels and Restaurants		1.5	1.5	1.6	1.6	1.7	1.8
Transport and Communications		1.3	1.3	1.7	1.8	2.0	2.1
Finance, Insurance, Real Estate and Other services		2.0	2.0	2.3	2.3	2.5	2.7
Community and other Social Services		0.2	0.2	0.2	0.3	0.3	0.3
Processing and Handcraft		1.7	1.9	1.9	2.1	2.2	2.3
Financial intermediation service		-0.2	-0.3	-0.4	-0.4	-0.4	-0.4
Government Services		1.7	2.3	2.4	2.5	2.6	3.3
Non-profit private households services		0.1	0.2	0.2	0.2	0.2	0.2
Import Charges		0.2	0.3	0.3	0.4	0.3	0.4
GDP at constant prices		16.3	17.2	18.3	19.3	20.3	22.4
GDP deflator		2501.1	2771.4	3042.9	3568.6	4212.8	4416.4
GDP at current prices		40658.6	47756.1	55733.8	68721.4	85707.1	98718.8

Sector	2007	2008	2009	2010	2011	2012	2013
Agriculture, Forests, Animal Resources and Fisheries	7.5	8.1	8.6	9.2	7.8	8.3	8.6
oil	2.4	2.3	2.3	2.2	1.8	0.6	0.8
Mining and quarrying	0.1	0.1	0.1	0.1	0.05	0.2	0.2
Electricity and Water	0.6	0.6	0.7	0.7	0.7	0.7	0.7
Building and Construction	0.7	0.8	0.9	1.0	0.9	0.9	0.9
Wholesale and Retail Trade, Hotels and Restaurants	1.9	2.1	2.2	2.3	2.4	2.4	2.5
Transport and Communications	2.3	2.5	2.7	2.9	2.8	3.0	3.0
Finance, Insurance, Real Estate and Other services	2.9	3.1	3.3	3.4	3.3	3.4	3.4
Community and other Social Services	0.3	0.3	0.3	0.4	0.3	0.3	0.3
Processing and Handcraft	2.6	2.8	3.0	3.2	3.5	4.1	4.2
Financial intermediation service	-0.4	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5
Government Services	3.5	3.7	3.8	3.8	3.1	3.2	3.2
Non-profit private households services	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Import Charges	0.4	0.4	0.4	0.4	0.4	0.4	0.4
GDP at constant prices	24.8	26.4	27.6	29.4	27.0	27.1	28.1
GDP deflator	4720.0	4907.3	5362.4	5517.1	6914.4	8984.5	10485.1
GDP at current prices	114017.5	127746.9	148137.1	162203.9	186689.9	243412.8	294630.2

Source:. Author's compilation based on Central Bank of Sudan (Annual report, various issues).

Annex 4

Nominal Gross National Product by type of Economic Activity at current prices (2001-2013)

Sector	2000	2001	2002	2003	2004	2005	2006
Agriculture, Forests, Animal Resources and Fisheries		14547.9	17986.3	21411	23369.4	28454.7	31190.8
oil		2777.5	3193	3811.6	4760.7	6461.1	9110.2
Mining and quarrying		99.4	105	119.6	120.1	157	191.6
Electricity and Water		227.4	303.6	128.7	828.9	1070.8	1819.6
Building and Construction		1485.5	1893.4	2136.3	2614.5	3824	4242.7
Wholesale and Retail Trade, Hotels and Restaurants		6466.3	7016.7	8643.7	10773.1	12662.9	14328
Transport and Communications		4308.2	4069.4	5580.9	8410.5	12501.6	14147
Finance, Insurance, Real Estate and Other services		3194.6	4117.4	4387.2	5340.1	6597.6	7613
Community and other Social Services		753.2	811.9	854.6	916.7	994.6	1118.6
Processing and Handcraft		3354.1	4426.6	4862.1	6392.5	7322.3	8041.7
Financial intermediation service		-179.6	-293.4	-379.7	-546.7	-884	-1026.1
Government Services		2227.5	2433.3	2661.7	3845.6	4269.1	5297.4
Non-profit private households services		593.9	638.7	669	707.9	744.3	861
Import Charges		802.6	1054.2	847	1188	1531	1783.4
GDP at current prices		40658.6	47756.1	55733.8	68721.4	85707.1	98718.8

Sector	2007	2008	2009	2010	2011	2012	2013
Agriculture, Forests, Animal Resources and Fisheries	32985.5	37480.6	44969.6	52691.4	63609.1	80675.2	99681.4
oil	17612.2	19792.3	9621.2	15654.2	9248.4	8095.1	8962.3
Mining and quarrying	212.1	272	309.8	364.8	2179.8	4751.9	5807.8
Electricity and Water	1981.4	2242.4	2513	2894.3	1606.1	21676.8	26101
Building and Construction	4650.5	5239.3	6171.2	7457.6	8717.7	11525.3	13866.1
Wholesale and Retail Trade, Hotels and Restaurants	16727.8	18376.2	21107.6	24827.4	30708.8	40719.9	48664.4
Transport and Communications	13781.2	15045.5	17076.2	19835.4	24425.6	32510.5	39178.4
Finance, Insurance, Real Estate and Other services	7808.9	8961.1	10399.1	11860.8	14531.4	18910.9	22712
Community and other Social Services	1258.2	1393.5	1522.6	1735	1968	2564.3	3064.6
Processing and Handcraft	8781.9	9726.3	11508.2	13672.9	16285.4	2181.1	2643.5
Financial intermediation service	-719.6	-789.3	-872.7	-1417.9	-1625.2	-2122.6	-2549.2
Government Services	5943.7	6680.6	7481.6	8362.4	9998.4	15248.2	18465.6
Non-profit private households services	996.4	1109.3	1206.7	1309.1	1501.5	1953.5	2351
Import Charges	1997.4	2217.1	2645.1	2956.6	3535	4722.7	5681.4
GDP at current prices	114017.5	127746.9	135659	162203.9	186689.9	243412.8	294630.2

Source: Author's compilation based on Central Bank of Sudan (Annual report, various issues).

Annex 5
Common Definitions of main Islamic financial instruments

Musharaka (Partnership):

Under *Musharaka* the investment is necessarily be implemented between two or more parties, each of them contribute a share of the total capital. It works according to the following conditions;

1. The capital of *Musharaka* is generally paid in liquid money; however, payment in kind is also acceptable. In this case, the value of that property(not the property of per se) is considered for determining the percentage of his contribution to the capital and his obligations toward any liability.

2. A partner ought to enjoy full legal capacity to act on his own and on behalf of others(partners) with respect to the different dealings of *Musharaka*.

3. The means by which profits and losses are distributed among partners must be stated.

4. It is acceptable for a partner who contributes more effort than others and/or who enjoys more experience to take a %age in profit in lieu of his extra labor and expertise but losses are always incurred in direct proportion to the respective shares in capital.

Mudaraba:

Mudaraba is a special type of *Musharaka*. In a *Mudaraba* contract, one partner contributes the capital and the other partner provides labor and expertise. Common conditions for this mode of Islamic finance include:

1. Capital of Al-*Mudaraba* must be identified, known to the parties, and delivered to the investor (entrepreneur), and it should, under no circumstances, be a debt resting with the investor (entrepreneur).

2. The duty of the investor (entrepreneur) is to exert his best effort for investing the capital, and at the same time to take all precautionary measures to protect the assets of the project under the *Mudaraba* financing.

3. The investor (entrepreneur) is a trustee. He is, therefore, under no obligation to guarantee any damage or loss incurred in the due process of investment. In this case, the damage and loss is borne by the investor (entrepreneur). However, the investor (entrepreneur) is bounded to pay any damages and bear losses if he transgresses the limits as a trustee, through will-full acts, negligence and breach of contract.

4. The distribution of the profit must be explicitly agreed to and in such a way as to ensure its distribution between the parties i.e. in percentage. However, losses are borne by the owner of capital.

Muzara'a:

Al *Muzara'a*is a type of sharecropping agricultural partnership. Traditionally the land owner would provide the land and inputs while the farmer provides labor. The yield is distributable among the partners in accordance with their predetermined contract. The increasing cost of inputs and production often lead to changing the formula. Some new forms may be illustrated as follows: the contract of *Muzara'a*may be undertaken by:

1. The landowner, the expert farmer and the owner of irrigation scheme.

2. The landowner who also undertakes to administer the farm and the bank that provides the inputs.

Common Definitions of main Islamic financial instruments

Murabaha:
The steps to be followed for the formation of this sale contract may be summarized as follows: 1. The intending buyer asks the would-be seller creditor (Islamic bank) to buy a commodity, the intending buyer promises to buy that commodity for mark-up price (margins) that is determined by the monetary authorities. 2. If the creditor (Islamic bank) agrees to enter into that transaction, it has to buy the demanded commodity from the original owner according to the guidelines of the commodity under financing. 3. Having that commodity, creditor (Islamic bank) has to make a fresh offer -depending of course on the previous negotiations and promise to the buyer. 4. According to the preponderant *Shariah* point of view and despite his previous promise, the buyer has the right to accept or reject that offer, and in case of acceptance, a valid contract of sale is concluded between the two parties. 5. In case of rejecting the offer, the ownership of the community rests with creditor (Islamic bank).
*Ijarah***:**
Ijarah refers to a leasing contract in which some specified assets (e.g. tractor) are leased for use by a farmer/client according to an agreed price and for a specific period of time.

Annex 5(cont.)
Common Definitions of main Islamic financial instruments

Istisna'a:

Istisna'a is a sale contract whereby the buyer asks the seller to manufacture and sell a commodity well defined. Or that the seller commodity might be specified without necessarily manufacturing it, e.g. forming a contract with a factory for agricultural capital goods, and other inputs to be delivered by specification within a definite period of time. The dominate point of view among jurists is to the effect that the contract of *Istisna'a* is not obligatory on the two parties i.e. any one of them has the right to withdraw without a prior notice. However, among leading Hanafi's jurists there is an opinion that *Istisna'a* is as binding on its parties as any other pecuniary contract. This view is the more acceptable one for dealings in Sudan.
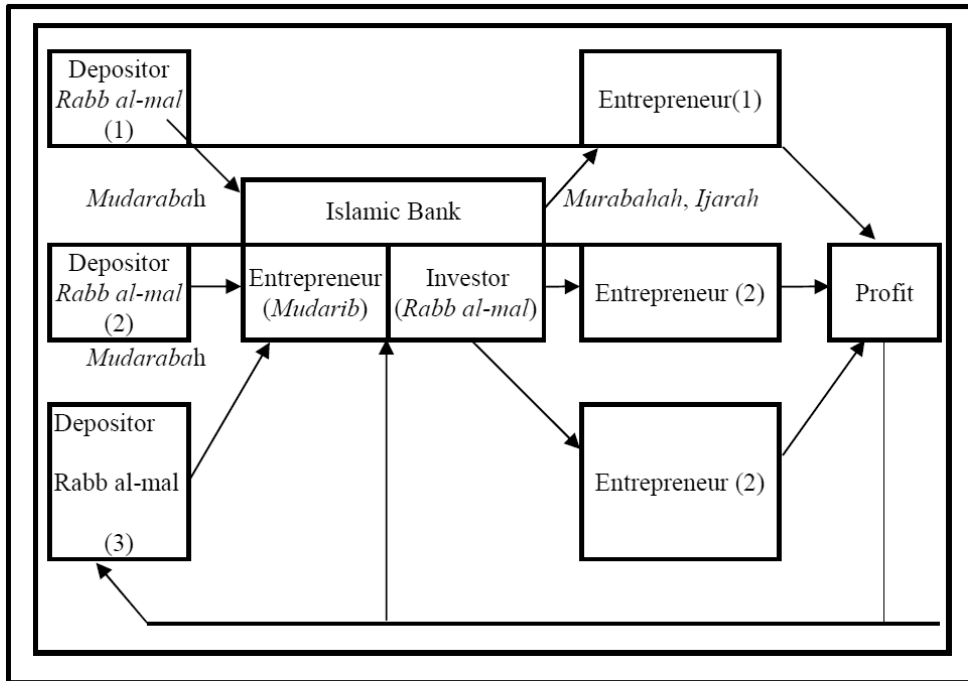
Salam:

Salam is a special type of sale contract, which is valid for both agricultural and industrial products. It is exactly the reverse of the deferred sale. In this contract, the price has to be paid immediately, whereas, the delivery of the commodity agreed on with specifications has to take place at a specific future period. The following terms must be satisfied for the validity of the contract of *Salam*.
1. The price (known as capital of Al-*Salam*) must be identified and known
2. The price should be paid immediately after the constitution of the contract. Nevertheless, a delay for short period is condensable according to the Maliki School.
3. The sold commodity must be known by specifications, in order to provide the seller with wide room to get the commodity from wherever it is available.
4. Its delivery should be postponed to a specific time in the future; therefore, the availability of the commodity in the market is usually the main determining factor for fixing a time in the contract.
5. To avoid uncertainty, the place of delivery has to be stated in the contract.
6. The seller ought not to have stipulated that he would honor his obligation from specific source such as his farm or farms in specific area. Therefore, if the seller is unable to secure the commodity due to its unavailability in the markets, the buyer has two options; either to wait for its availability or to resign the contract and recover the paid up price.

This appendix has benefited from the discussion of Elhiraika and Khalid Abu (2000).
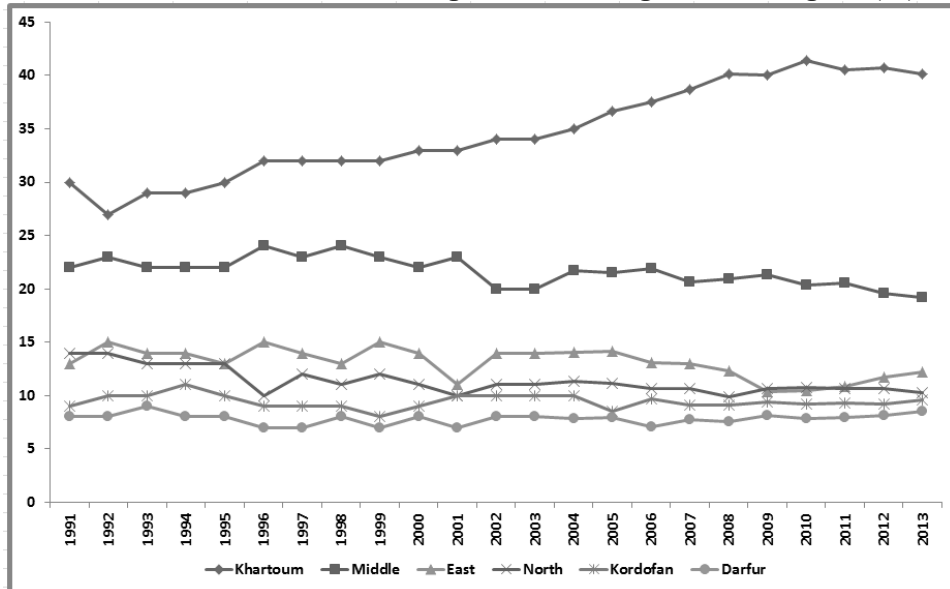
Annex 6
The Main Structure of the Islamic Banks

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┌──────────────────────────────────────────────────────────────────────┐
│  ┌─────────────┐                            ┌──────────────────┐       │
│  │ Depositor   │                            │ Entrepreneur(1)  │       │
│  │ Rabb al-mal │                            │                  │       │
│  │    (1)      │                            └──────────────────┘       │
│  └─────────────┘                                                       │
│   Mudarabah      ┌──────────────────────┐  Murabahah, Ijarah          │
│  ┌─────────────┐ │     Islamic Bank     │           ┌──────────┐       │
│  │ Depositor   │ │ Entrepreneur│Investor│ ┌───────────────┐ │  Profit  │
│  │ Rabb al-mal │ │  (Mudarib)  │(Rabb    │ │ Entrepreneur(2)│ │         │
│  │    (2)      │ │             │ al-mal) │ └───────────────┘ └──────────┘
│  └─────────────┘ └──────────────────────┘                              │
│   Mudarabah                                                            │
│  ┌─────────────┐                         ┌──────────────────┐          │
│  │ Depositor   │                         │                  │          │
│  │ Rabb al-mal │                         │ Entrepreneur (2) │          │
│  │    (3)      │                         └──────────────────┘          │
│  └─────────────┘                                                       │
└──────────────────────────────────────────────────────────────────────┘
```

Form this structure; there is a two-tier partnership with three main groups: the depositors/investors *Rabb al-mal*, the Islamic banking, and the entrepreneurs (with whom the Islamic bank signs a partnership contract and to whom it provides finance). The functions of those banks are as follows: First: on the liability side, the Islamic banks collect all the funds from their investors. They then have to utilize those funds by financing the entrepreneurs. Here, it worth mentioning that the Islamic banks have a double personality. In the first phase, they function as a *mudarib* (speculator/agent) to whom the investors entrust their savings, and secondly, they themselves assume the role of a major investor financing a multitude of entrepreneurs. Hence, the characteristic of Islamic banking changes at this point from *mudarib* to *rabb al-mal*, once it has signed partnership contracts with those entrepreneurs. Whatever form of partnership is used, the profit of each entrepreneur is shared according to the stipulations of the contract signed with the bank, the bank's share of profits from all the ventures is then pooled in a service. This profit pool is shared between the bank and the holders of the so-called investment accounts

Source: Mohsin (2005, page 33).

Annex 7
The Distribution of the Banking Network among Sudanese Regions (%)

Source: Author's compilation based on Central Bank of Sudan (Annual report, various issues).

Annex 8
Some historical facts about insurance sector in Sudan

The practice of insurance industry in Sudan started since 1920 by the agents and branches of foreign companies with the aim to cover government units and aliens, properties against local risks. This form of insurance practice continued until 1970 when all foreign companies were prohibited from operating and consequently national insurance companies entered the insurance market. The first insurance company was the Sudanese Motor Insurance Company (Later Khartoum Insurance Company) which established in 1952 to cover motors risks. The government started to control and regulates insurance sector by issuing the first insurance Act in 1960. The implementation of that Act was done by insurance department at the Ministry of Finance and National Economy. In 1992, a new Act was issued. Accordingly, the insurance industry was put under the supervision of Insurance Supervisory Authority (ISA) based on Islamic principles*, and hence all insurance companies were transferred into cooperative insurance companies instead of being commercial.

Beside the ISA, the insurance sector is also regulated by the Higher *Shariah* Board (HSB) which is a division of ISA. The board's main responsibility is to give the ISA advice and input on all *Shariah* matters. It also helps ensure the insurance industry is transacting according to Islamic principles. It has given full authority to investigate all aspects of the insurance market, including investment activities. In addition to the HSB, each insurance company has a *Shariah* Supervisory Board (SSB) consisting of two *Shariah* experts and one legal professional who is knowledgeable in *Shariah*. The work of the SSB complements the function of the HSB.

* Islamic insurance is based on the ground that insurance is not intended for profit maximization. Rather, it aims at realizing cooperation and solidarity among policyholders when one of them or some of them face catastrophes. The collective power of the group will bring the aggrieved one back to his initial situation.

Source: Central Bank of Sudan (2013)

Annex 9
Commercial Banks Balance Sheets Indicators (2001-2013)

	Total Deposits to Total Liabilities (%)	Capital and Reserves to Total Liabilities (%)	Total Finance to Total Assets (%)	Total Finance to Total Deposits (%)	Total Liquid Assets to Total Deposits (%)
2001	60.2	10.5	24.5	40.6	20.9
2002	59.4	12.1	26.2	44.1	18.6
2003	59.9	14.0	37.3	62.3	19.2
2004	61.9	13.8	41.8	67.5	18.3
2005	59.4	13.8	45.3	76.2	17.9
2006	53.2	16.8	48.1	90.5	17.0
2007	53.2	17.6	49.6	93.2	21.0
2008	53.9	8.7	48.8	90.6	20.9
2009	56.9	18.2	49.5	87.1	27.6
2010	60.0	17.3	49.1	81.9	22.5
2011	60.0	19.4	49.2	82.0	-
2012	59.3	16.2	45.5	76.7	-
2013	57.5	17.0	48.6	84.5	-

Source: Author's compilation based on Central Bank of Sudan (Annual report, various issues).

Annex 10
Credit to the Economy, January 2004--June 2013 (y-o-y growth, in percent)
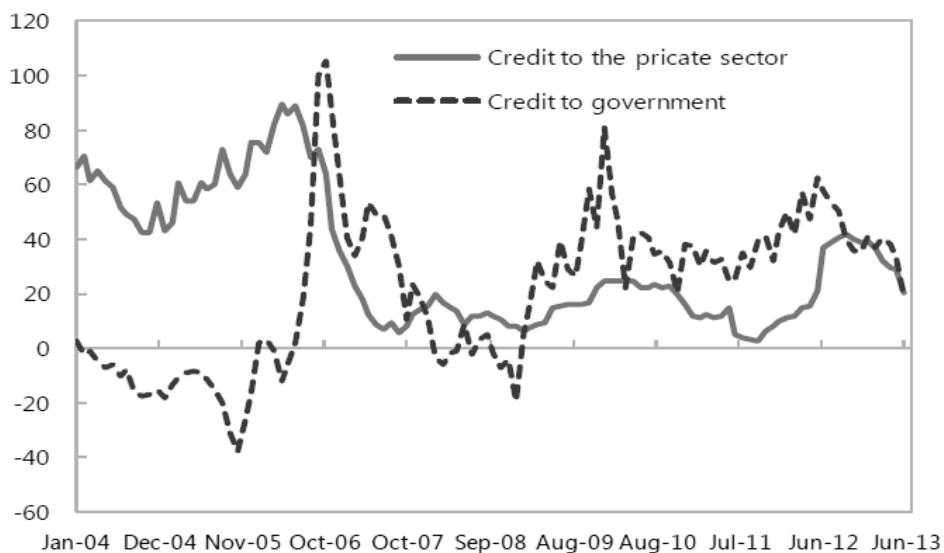
Source: IMF (2013).

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