The Determinants of Unemployment in Sudan: A Co-integration and Error Correction Model Analysis (1981-2011)

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Abstract

The main purpose of this paper is to investigate the determinants of unemployment in Sudan using time series data over the period 1981 - 2011. Co integration and VECM techniques were applied to carry out the investigation. The overall econometric analysis showed that the variables under consideration have co integrating relationships implying that they have long-run relationships. The results of VECM estimation suggests that growth in GDP, the interaction between FDI and average years of schooling play a positive role in unemployment reduction in the long-run, while in the short-run this impact has been reversed. Inflation is found to have a positive impact on unemployment mitigation in the short run and, therefore, provides strong evidence to be added to the already existing large body of literature validating the existence of short-run Phillips Curve. On the other hand, the estimated results suggest that economic openness and oil production contribute negatively to unemployment reduction in the short as well as in the long run. Also the findings of the study confirmed the pivotal role for privatization policy in combating unemployment.

Keywords: Co integration, VECM, Sudan, Unemployment.

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استخدام تحليل التكامل المشترك ونموذج تصحيح الخطأ لدراسة محددات البطالة في السودان (1981-2011)

المستخلص

تهدف هذه الورقة إلى دراسة محددات البطالة في السودان عن طريق استخدام بيانات السلاسل الزمنية في الفترة من 1981م إلى 2011م وذلك في إطار تقنيات التكامل المشترك ونموذج تصحيح الخطأ (VECM) حيث أظهرت نتائج التحليل القياسي أن المتغيرات قيد الدراسة لها علاقات تكاملية في المدى الطويل. من جانب آخر أشارت النتائج الخاصة بنموذج تصحيح الخطأ أن كل من النمو في الناتج المحلي الإجمالي والأثر الناتج من تفاعل متوسط سنوات الدراسة مع الرصيد المتواجد من الاستثمار الأجنبي المباشر في البلاد يلعبان دوراً ايجابياً في تقليص معدلات البطالة في المدى الطويل، في حين إن هذا الدور الايجابي يتبدل ليصبح سلبياً في المدى القصير. كما توصلت الدراسة إلي أن المعدلات العالية للتضخم تعمل على خفض معدل البطالة في المدى القصير وهو ما يعتبر دليلاً إضافياً يعزز ما هو موجود أصلاً من دراسات سابقة حول ما يعرف بمنحنى **فيلبس** والذي يشير إلى وجود علاقة تبادلية بين معدلي التضخم والبطالة في المدى القصير. لقد أظهرت نتائج الدراسة بأن تسارع وتيرة الانفتاح الاقتصادي تجاه العالم وزيادة إنتاج النفط يسهمان سلبياً في الحد من ظاهرة البطالة في كل من المديين الطويل والقصير. بالإضافة إلى ذلك، فقد أكدت الدراسة على الدور الإيجابي لتطبيق سياسة الإصلاح الاقتصادي المتمثلة في انتهاج سياسة الخصخصة في خفض معدلات البطالة في السودان خلال الفترة موضع الدراسة.

INTRODUCTION

The study of unemployment and its main determinants have always been at the forefront of labor economics research. Many countries, whether advanced with industrial economies or developing ones, have experienced very high rates of unemployment**.** The unemployment is very costly economically, socially, and politically. Economically, the presence of unemployment in a certain economy represents a loss in gross domestic product (GDP). Alternatively said, when an economy falls short to generate enough jobs to employ all those who are agreeable to work, a valuable resource is lost. Besides, due to idleness in labor source, the possible production of goods and services that might have been enjoyed by consumers is lost, representing a real economic cost. Socially, unemployment is considered one of the severe problems facing the contemporary societies. It embodies the causal roots of most societal diseases such as alcoholism, social exclusion, damage in mental health, moral disorder, crime, destructive practices such as drug addiction and above all the chronic poverty. Politically, for most people, the loss of a job means a reduced living standard and thus drastic psychological distress. However, it is not an easy task to separate the economic and political outcomes of high unemployment in a society, as the two were intertwined and inter-reliant on so many levels. Therefore, it is not a surprise that unemployment is a frequent topic in political debate and that politicians often claim that their proposed policy would help create jobs (Mankiw, 2003).

As in many other developing countries, unemployment in Sudan represents one of the most discussed economic issues from both public and policymakers. No country in SSA (Sub-Saharan Africa) and MENA (Middle East and North Africa) has as great an unemployment problem as the Sudan. The Sudanese unemployment rates are the highest compared to regional and international standards (see Table 1). The stylized facts on labor market in Sudan tell that during the three past decades, unemployment rates remain very high. It increased from nearly 17.33% in the period from 1981 to1984 to 18.55% in the period from 1986 to 1989. Then it came down again to 15.79% in the period 1990 to 1994; to 13.5%, 15.62% and 15.77% in the periods from 1995 to 1999, 2000 to 2004 and 2005 to 2010, respectively (IMF, 2010).

Nowadays, although these rates have witnessed slight fluctuations, however, they remain very close to 16% and have been almost 17% on average for the last three decades. Therefore, unemployment issue represents one of the most important areas that need to be extensively addressed. It represents the basis of many economic, social and political problems that face the country at current stage of development. Many sociological studies have proven that the person or persons who have salaried jobs are less willing to engage in sectarian and ethnic conflicts such as those widespread in Sudan.

Accordingly, a comprehensive solution for this problem can contribute greatly in bringing economic and political stability to this disturbing country. Reducing the extreme rates of unemployment can help in solving many of these problems, or at least contributes to any possible solutions. However, from a macroeconomic point of view, a problem such as unemployment cannot be addressed in isolation from other macroeconomic problems experienced by Sudan economy. In other words, no way out to exist this chronic problem can be suggested without achieving higher economic growth rates. Also it is impossible to talk about increase in the economy's absorptive capacity, which makes it competent to absorb surplus labor, without realizing increases in the value added generated by industrial sector. According to Arthur Lewis's argument, this sector is capable to mitigate unemployment by shifting surplus labor in rural areas to urban areas. Specifically, the author stated that this desirable shift can be materialized by providing rural workers with employment opportunities in the urban areas' industrial sector with a relatively high wages. However, this cannot be realized unless the economic surpluses yielded in this sector are re-employed in a

manner that adds to the existing capital. Therefore, the sustainable growth in this sector would qualify it to accommodate the army of surplus workers in the labor market.

It is notable that the Sudanese industrial sector is very weak and grows at low rates compared to other sectors. Moreover, the growth maintained by this sector is depends , to a large extent, on growth in the extractive industries such as oil and gold. In terms of employability, the sector's contribution is considerably very low compared to its counterparts sectors in the economy. As reported, in the year 2007 the sector contributes only by 7% to the total employment in the country (See Figure 3). While, in the same year, the shares of agriculture and services sectors i were 51% and 42% , respectively.

Before that, now the country exposes, especially after the high economic growth rates supported by oil, a wide immigration from foreign workers who came from different nationalities, mainly Ethiopians, Eritreans, Egyptians, Syrian, and Asians,…etc. Unfortunately, these immigrations came despite the fact that the country is still populated with native unemployed workers. As consequence, the growing immigration of foreign workers shift labor supply curve, at the national level, to the right. Taking the weakness and rigidities in demand for labor into account, the growth in foreign labor would produce further increases in unemployment rates and more deterioration in the standards of living among native workers. Many studies documented that the inflow of foreign workers has played a critical role in determining the level of unemployment in recipient countries by "taking jobs away from national labor" (Dustmann and Glitz 2006 and Jean et al. 2011).

These bitter facts in Sudanese labor market, which has suffered from high unemployment rate, make it very crucial to carry out a proficient study to investigate the real factors behind this phenomenon. More specifically, by utilizing factors identified by economic theory and previous empirical works, this study attempts to explore the determinants of unemployment in Sudan during the period 1981-2011.

By investigating unemployment determinants, this paper makes several contributions: (1) It provides evidence on the factors that affecting unemployment in Sudan by employing national-level data from World Bank Indicators. Owing to this, the study's findings would refer to the country as a whole and not only to its large cities, which are considered outliers in terms of labor market conditions; (2) The paper uses data sample covering the period extended from 1981 to 2011. The sample is chosen not only because of data availability, but also because it comprises the period in which the country has witnessed many important economic transformations. The significance of this period is that it includes both years before and after 1992 as well as years before and after 1999. The year 1992 was marked by economic reforms undertaken to satisfy the structural adjustment program suggested by IMF, and represented a starting point for the adoption of economic liberalization policies. In the same way, the year 1999 covers the beginning of oil production which has contributed to a great extent in achieving some desirable changes in Sudan economy.

These two events are supposed to have a significant impact on the country' economic performance including labor market indicators;(3) The period under consideration was characterized by high economic growth rates supported by relative political stability followed the signature of the Comprehensive Peace Agreement (CPA) in 2005; and (4) According to the information available to the author, there is no comprehensive study that has been made on this issue by using modern econometrics techniques. Thus, this study comes in order to bridge this gap in unemployment studies in Sudan through the use of cointegration and error correction model methodology.

The investigation undertaken by this study focuses mainly on the determinants of unemployment in the context of a macroeconomic model incorporating structural, cyclical and institutional factors. The empirical model is tested using annual data on Sudan extended from 1981 to 2011. In this model, the dependent variable is represented by unemployment rates while,

on the other hand, the independent variables include factors such as growth in gross domestic product, foreign direct investment, education, inflation rate, trade openness, government expenditure as percentage of GDP, oil exploitation and the adoption of privatization policy. To make the objective of this study achievable, we firstly present some stationarity tests in order to determine whether the used data is stationary or not. This step is followed by executing cointegration tests to capture the long run relationship among variables concerned. In this context, if the results of cointegration analysis provide support for this long run relationship, then the study proceed to apply VECM model to estimate the long run and short run relationships.

The rest of the paper is organized as follows: Section 2 includes an overview on unemployment in Sudan. Section 3 discusses the theories of unemployment and reviews the previous literature. Section 4 presents the methodology employed to carry out the empirical investigation. Section 5 introduces the results from applying the cointegration and VECM estimation. Finally, Section 6 summarizes the main results and conclusion.

Unemployment in Sudan Economy: An Overview

Sudan is one of the Sub-Saharan African countries with a relatively low size of population, which is roughly 37 million according to the last census conducted before the secession of the South in 2011. It has a complex social and political history that has adversely affected population and the country's economic performance.

The long-life war in the South has dominated the progress and the decline of Sudanese economy over the past five decades and has influenced the evolution and the perception of the chronic unemployment. The economy is still characterized by a large, mostly agricultural-based sector, which comprises about two-thirds of the labor force (see Figure 3), and by smaller urban sector, which has benefited from the uneven economic development and from the provisions of services that successive governments have provided in the country's large cities.

Table 1: Sudan Economy's Key economic Indicators, 1980-2010

Year	GDP Growth Rate	Industry Value-Added growth Rate	Trade as percentage of GDP	Urban Population Growth Rate	Total schooling (% total population)	Unemployment rate
1980-1984	2.39	7.56	31.62	5.80	28.72	17.33
1985-1989	4.39	2.09	14.68	6.95	33.36	18.55
1990-1994	2.84	3.99	14.38	6.37	37.44	15.79
1995-1999	5.98	10.52	20.49	3.07	40.84	13.52
2000-2004	6.43	14.45	30.96	2.37	43.46	15.62
2005-2010	7.6	10.22	41.96	1.95	45.56	15.77

Sources: World Bank Indicators & International Monetary Fund (IMF)

Although Sudan has become one of the oil's suppliers to the world in 2002, the country's social and economic indicators have remained below the average of most developing countries. About 80% of its population live in absolute poverty, life expectancy is only 61 years (WB, 2011) and infants mortality rate is as high as 57 per 1000 live birth (WB, 2011). Political instability, wars, mismanagement of resources, high inflation and high unemployment rates have been the roots of Sudan's economic deterioration.

It is worth mentioning that many significant events during the three past decades have greatly affected the country's economy in general and labor market in particular. These events

includes the adoption of privatization policy, the exploitation of oil in commercial quantities, the ending of civil war in the south, and the secession of the South.

First, the adoption of privatization policy in 1992, although it was not properly executed, has contributed significantly to the country's overall economic performance. The initial shock caused by that policy produced a collapse in economic growth from 7.50% in 1991, 6.58 % in 1992, 4.57% in
1993, and to 1% in 1994. However, the economy started to recover again in 1995 with GDP growth of 5.99% in that year. In general, the policy succeeded
in elevating the level of GDP per capita from $278 in 1992 to $337 in 1999 (WB, 2011). The growth reached to a double digit growth rate (10.57%) in 1997 and continued to grow steadily with slight fluctuations since then without showing the negative growth rates which marked the periods of 1970s and 1980s. In our opinion the domestic demand, and more specifically final consumption, has played a significant role in this growth, reflecting in part the growing importance of the service sector for the economy. During the period 1992 to 2001 the mentioned policy was particularly successful in reducing inflation rates from nearly 117% in 1992 to a single digit rate which accounted to 4.9% in 2001(WB, 2011).

With regard to the impact of the policy on labor market, it can be observed that the labor force has grown at a very high rates. It recorded 2.90% annual average growth rate during the period 1990-2000, as well as a 2.61% annual average growth during the period extended from 2001 to 2010 (Figure 1). In a broader time span, the annual growth rate in labor force was approximately 2.90% during the period extended from 1990 to 2011. However, the unemployment rate rose slightly during the first years of restructuring, reaching 15.76% in 1993, but falling back to 15% in 2001. Perhaps, these ups and downs in unemployment rate has resulted from privatizing many public firms and corporations that were previously populated with public sector employees. Nevertheless, although the high growth in labor force, the unemployment rates remain, to some extent, reasonable. This indicate that the absorptive capacity of the economy have grown to the extent that it became capable to absorb these increases in labor force.

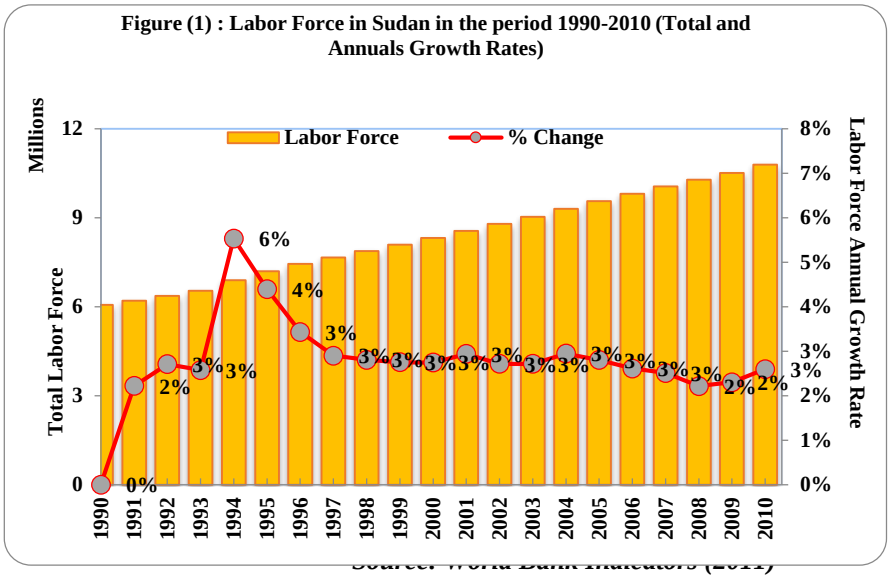
Table 2: Unemployment rates in Sudan with regional and international comparison

Year	Unemployment rates				
	Advanced countries	Egypt	Jordon	Malaysia	Sudan
1980-1985	5.97	-	-	-	21.66*
1986-1990	6.79	-	8.29	6.43	18.55
1991-1995	6.84	9.57	17.72	3.82	15.79
1996-2000	6.88	8.99	14.16	2.95	13.52
2001-2005	6.35	9.93	14.57	3.48	15.62
2006-2010	5.57	9.80	13.35	3.4	15.77

Source: IMF database. * calculated for the period 1981-1984.

The main conclusion is that, the adoption of privatization policy has contributed significantly in reducing unemployment rates in Sudan economy, which opposes the prior expectations. It is well known that the privatization, especially if implemented in a shock therapy, could lead to discharge large numbers of workers from jobs. On the contrary, what has actually happened is that the economy maintained the same levels of unemployment rates, with some limited slight decreases (from 15.79% to 13.52% during the periods from 1996 to 2001 and 1991 to 1995, respectively). What's more, Table 2 shows that during the period 1980 to 2010 the unemployment rate have been stable although there is a high growth rate in the labor force. Similarly, Figure (1) shows that the labor force has grown by 2%, rose to 6% and 4% in 1994 and 1995, respectively. It then drifted back to 3% in the year 1996 and continued to grow at the same rates till the year 2011.

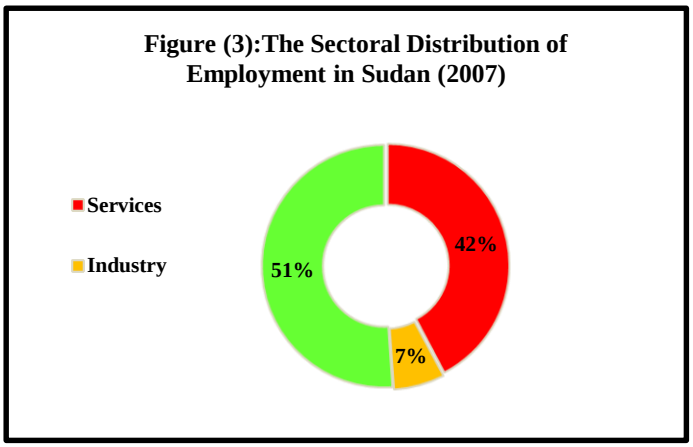
Figure (1) : Labor Force in Sudan in the period 1990-2010 (Total and Annuals Growth Rates)



The second event that may have affected the overall economic performance of the country was the utilization of oil in 1999. Producing oil in commercial quantities, accompanied with high oil prices, brought huge revenues into the country that contributed positively in increasing GDP per capita by 63% from $337 in 1999 to $549.86 in 2010. However, although the impact of oil on unemployment is expected to be positive, the figures tell the opposite.

According to Arab Labor Organization reports, the oil sector contributes only by 0.0087% to the total employment from total labor force in Sudan.

More specifically, it shares to the total employment in industrial sector by 0.52% in 2001. Possibly this weak contribution of oil sector to employment is attributable to the fact that the sector is highly dominated by foreign workers. The boom in the economy, and the appreciation of Sudanese national currency, supported by oil export, attracted workers from neighboring countries, namely Ethiopia, Egypt and Eretria. As a result, the increases in the numbers of immigrants create further unemployment among national workers. It should be noted that the crowding out between native workers and foreign workers has several justifications. For instance, the majority of native workers lack the appropriate experiences as well as they are extremely poor in terms of efficiency. Given these considerations, the investors, whether they are Sudanese or foreigners, tend to employ foreign workers instead of native ones. Moreover, this crowding out has been strengthened by the absence of labor legalization that oblige investor, regardless of his nationality, to give national workers priority in employment opportunities. Furthermore, a large percent of the graduates who added to labor market by Sudanese universities are mostly graduated from theoretical specializations. At the current stage of development the country is in need to graduates from technical disciplines rather the theoretical ones. The increases in the numbers of graduates have greatly contributed in fueling unemployment rates during the last three decades. Consequently, although the country has witnessed significant economic growth rates during 1990s and 2000s, however the rates of unemployment rates remained at its high rates.



Source : Arab Labor Organization

Also, one of the events that have exerted a great effect on labor market in Sudan was the signature of the General Peace Agreement (GPA) between Sudanese government and SPLM (Sudan People Liberation Movement) in 2005.The advent of peace led to an improvement in the country's macroeconomic indicators. Among these indicators, was the growth in GDP (led mainly by the expansion in oil exports) which keep to grow at a reasonable rates. Surprisingly, in spite of the peace' presence and these successive increases in economic growth rates, unemployment rates in the economy increased at an alarming rate, reached nearly17.50% in 2006. The rising trend in unemployment during this period has many explanations. It is probable that these increases in unemployment come due to the relative stability in the areas that were previously engaged in military activities. By the advent of peace, it is natural for individuals to try to find civil jobs that can provide them with a support to maintain their livelihood. Consequently, the shift from military to civil activities has contributed in creating a new equilibrium in Sudanese labor market in which the supply became greater than demand.

Finally, in 2011's referendum, the citizens of the south have decided to separate from the north by establishing their own state. The occurrence of secession is expected to exercise numerous consequences on labor market in the country. Firstly, after the secession it became reasonable to think about significant decreases in unemployment rates since the majority of southerners have left to their new state.

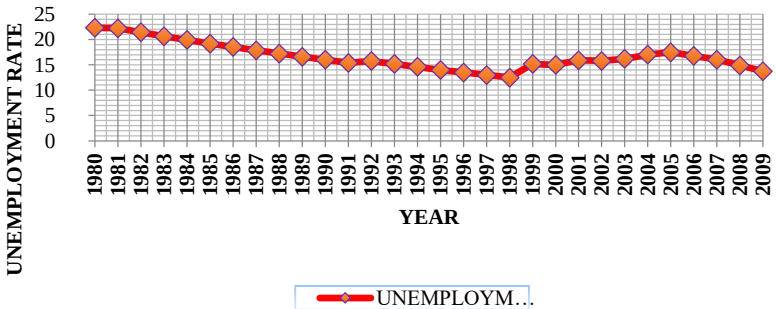
However, unemployment rates have not witness any decreases trends. On the contrary, the situation has been worsened to the extent that it turn out to be a threatening factor to the country's future, given the midst of the so-called Arab Spring which started in Tunisia, ended in Libya, and is still going on in Syria. Second, the secession of the south is expected to lead to severe consequences on the economy in general and labor market in particular. For instance, a large part of oil revenues used to be received by government in the north have been diverted since a greater part of oil fields are situated in the South (75% decrease in oil production). Due to this bleeding in revenues, the country lost a 50% of its revenues. This collapse in government revenues may push the government to finance its budget through money creation, which may produce rapid inflation rates. Moreover, since Sudan's imports have grown at alarming rates during the oil boom, the country may face severe economic difficulties due to the lack in foreign currencies.

It is worth to mention that Sudanese policymakers have tried to initiate many ambulatory solutions to face unemployment problem, especially among graduates. Unfortunately, these solutions did not give any sign of success and become fruitless due to the current circumstances experienced by the economy. The failure occurred because, in treating unemployment problem, policymakers relay largely on the government as source of employment opportunities. By doing so, the governments substitutes open unemployment by disguised unemployment, and

thus undermine the private sector by increasing the tax burden that will be imposed on taxpayers to finance these new jobs. If such practices are applied in a wide range, they may possibly cause uncertain projections on the economy in the long run. Additionally, such policy may facilitate the spread of corruption between the government bureaucrats, given the fact that the government, in most cases, lacks the ability to offer its employees the sufficient salaries that guarantee them a decent standard of living. Furthermore, this type of employment undermines workers' incentives and reduces their aspirations to realize higher income and, as a result, bring negative consequences to the private sector.

Summing up, the country approaches the coming years, facing a severe reality: the bleedings in revenues caused by the secession may lead to more deteriorations in economic conditions in general and labor market in particular. As can be seen from Figure (2), at the end of 2010, the unemployment rate in Sudan show a significant rising tends. The rise in population growth rates in addition to the age composition of the population are the main factors that can be accounted for these increases in unemployment rates. According to the last census, the population in Sudan grown at a high growth rates compared to other developing countries. This is expected to increase the labor force and thus leading to further increases in unemployment rates. Additionally, at the current stage, the Sudanese nation is considered a young nation in essence that most of the population is from a young people who actually entered labor market or will enter in the nearer future. Moreover, as a result of the financial crisis and the contraction in international aids and loans, the public sector's capacity to absorb manpower surpluses is expected to decrease. Accordingly, in the light of these developments, the government is supposed to adopt austerity policies that lead to reduction in public sector. More specifically, government may try to accomplish the concept of "graceful government ", which can be realized by adopting polices that lead to reductions in the numbers of its existing staffs. Consequently, a large number individuals will be pumped into labor market and high unemployment rates.

Figure (2): Unemployment rates in Sudan: 1981-2010



Sources: International Monetary Fund (IMF)

In short, it can be argued that unemployment in Sudan is attributable to many overlapping and complex factors that cannot be separated from each other. For instance, the demographic factors interfere strongly with other economic and social factors. Any consideration to this problem in either social or economic context only would disregard other aspects and, therefore, fall short in addressing unemployment problem. In other word, the possible solutions that built on one perspective by ignoring other aspects can fail to mitigate the problem and become useless for policymakers. From this point of view, this paper can be considered as a contribution to explore the primary diagnosis for the main causes of the chronic unemployment problem in Sudan.

LITERATURE REVIEW

Literature Review on Theory

The analysis of unemployment's determinants represents an important topic within applied macroeconomics; as such an analysis can provide important insights into the functioning of labor markets and debatably the entire economy.

There are many schools of thought that have attempted to address the problem of unemployment in different societies including the classical, Marxist, Keynesian, neoclassical etc. These schools have greatly differed in terms of vision and the solutions proposed to deal with unemployment problem. For stance, in all aspects of the economic issues, the theorizations of the classical theorists were mainly based on the social and political dimension of economic phenomenon. Therefore, in their analysis to unemployment, they focused on the long run by linking unemployment to the factors such as population problem, capital accumulation and economic growth as well as the productive capacity of the economy. Moreover, the classics had believed in the principle of general equilibrium on the basis of Say's law which states that "each supply creates its own demand". Thus, the wide unemployment could never happen and the equilibrium will be achieved at full-employment position. According to the classics, unemployment arises from inadequate supply of goods because firms' production is less than demand which in turn occurs due to higher wages and less profits. Accordingly, unemployment, from the classical point of view, only results from wrong function of labor market, and thus if it occur in a certain economy, wages mechanism will be capable to absorb unemployed labor. As a result, the reduction in the level of wages will raise the level of profits across different sectors. It, therefore, gives investors green light to increase investments and, consequently, lift up employability levels, especially under the competition for jobs and the acceptance of prevailing wages level. We conclude that, from classical perspective, wages represent a key factor in labor market mechanisms, as it affects the supply and demand for labor simultaneously.

Following the classics, the neoclassical economists have relied on the theory of "general equilibrium", which takes place in goods and services market as well as in labor market. The neoclassical analysis is constructed on the assumptions derived from the conditions of the perfect competition. Whatever the case is, by adopting Say's law for markets, the neoclassical theory assumed the case of full employment, and did not pay any considerable attention to the occurrence unemployment.

On contrary to the classical argument, Marxist ideology criticized the capitalist system, because it emphasizes that unemployment is the temporary and transitory situation since market mechanisms, through the free interaction between supply and demand, automatically equilibrate labor market. For Marxists, the unemployment manifest from the decrease in consumption of working class. This shortage in consumption results from the fact that the value of wages does not equal the value of production. In other words, capitalism production exceeds the value of wages paid to labor. Furthermore, the crisis is exacerbated by the rise in organic composition of capital which substitutes labor by machines and, consequently, pushes labor to unemployment and reduces worker's purchasing power. Thus, "unemployment is a natural result of increased labor productivity in capitalist systems of accumulation".

According to Keynesian school, the equilibrium in an economy results from the simultaneous equilibrium in two markets: goods and services and money markets. Keynes stated that the equilibrium in an economy is realized because the demand for labor is a decreasing function in the level of the income and profit maximization requires the equality between marginal productivity of labor and real wage rate. This means that the low rate of real wages could lead to rises in demand for labor and thus the size of employment. Another premise

in Keynesian economics is that labor supply will be linked to nominal wage rate (W) as workers expose to money illusion.

To detect the causes of unemployment, Philips analyzed the British labor market over the period extended from 1861 to 1957. His analysis revealed the existence of a strong statistical relationship between the ratio of unemployed to total population on one hand, and the rate of change in workers' hour wages on the other. The author concluded that the low rate of unemployment is always accompanied by a rapid rise in nominal wages and vice versa. Lately, many economists, like Lipsey 1960 and Paul Samuelson, have contributed in developing this idea. Their different empirical analyses were based on the inverse relationship (trade-off) between inflation and unemployment rates which known in unemployment literature by Phillips Curve.

Before the introduction of natural unemployment concept it was possible for policy designers to use fiscal and monetary stimulus to keep the economy at a low level of unemployment. However, this solution for combating high unemployment rates will not be realized unless the society become willing to accept a high enough rate of inflation. In contrast, Friedman (1968) and Phelps (1967) argued that the level of unemployment in an economy is likely to remain lower than a certain natural rate only in so far as the policymakers could realize an actual inflation rate that exceeds the predictable rate (Kee and Hoon, 2005). The insight of their argument is that the permanent higher rate of inflation would not produce a permanent reduction in unemployment rate and thus the long run Philips curve is vertical (**Russell and Banerjee**, 2008).

In conclusion, it is our belief that a general overview of theories and approaches of unemployment could provide us with an appropriate point of departure in understanding unemployment in Sudan economy. The above mentioned theories are vary, either fundamentally (Classic versus Keynesian) or just by particular aspect (Philips and Friedman), in their assumptions and limitations. These schools of thought followed different ways in interpreting unemployment phenomena and, consequently, prescribe different policy mechanisms for achieving full employment. However, we observed that every theory represent a result of economist's findings a previous theory lacking in some manner. For example, the classical and neoclassical theory was a well-established theory, but its dependence on the perfect competition as well as its limitation in viewing the importance of demand in determining unemployment level, promoted Keynes to coin his general theory. However,
Keynes's theorization stresses the role of demand in the short run and neglected the determination of employment in the long run. To jump over
this shortage in Keynesian analysis, Friedman (1968) and Phelps (1967), on the other hand, offered the most comprehensive study on unemployment by explaining the concept of natural unemployment rate which each economy must experience.

In sum, the above theoretical outline on unemployment shows a wide disagreement among economists regarding the possible reasons for changes in the level of unemployment. Therefore, in this paper, our theoretical framework can be based, to a large extent, on the previous empirical evidences done on this area.

LITERATURE REVIEW ON EMPIRICS

On the empirical front, either in developed or developing countries, there is a broad agreement among economists that the problem of unemployment stems from sources which fall into three related categories including: (1) structural; (2) cyclical and (3) other sources including institutional factors.

Building on the above mentioned argument, the structural approach is mainly devoted to explain unemployment by focusing on factors which take account the nature of education

system and its interface with the labour market (i.e. the mismatch problem), GDP composition, technological changes, permanent shifts in demand for goods and services in addition to the skills content of labour force.

In the same way, several studies have employed factors such as GDP gap, total investment, exchange rate, foreign direct investment, language and growth in GDP to interpret and determine changes in unemployment rates in different economies during different time periods (Saint-Paul 1996; Valadkhani, 2003; Saarela et al., 2006; King and Morely, 2007; Eita and Ashaipala, 2010 and Chaudhuri et al., 2010, and FU et al., 2010). Most of these studies used either time-series data or data collected by questionnaires to study the state of unemployment in a specific country or in group of countries that are largely differ in their levels of economic development.

Moreover, in line with this structural resonation, the type and the developments in population have been also elected to interpret the occurrence of unemployment. In this context, both rural-urban drift and internal immigration patterns which tend to convert unemployment in rural areas into hidden one in urban centers are cited among the factors affecting labor market. According to the findings brought by these studies, urban
people tend to be comparatively well educated since they have more chances to learn themselves, and therefore, get more exposure to employment opportunities than their rural counterparts (LIU, 2013; Dessendre, 2009; Li Gana,b, Qinghua Zhang ,2006).

Moreover, many economists have endeavored to study the channel through which trade openness influence domestic labor markets (Gaston and Rajaguru, 2013; Roger and Skjerpen, 2006; Hasan et al. 2012; Dutt et al., 2009). However, the results brought by these studies are considerably different and contrasted. For instance, most of these studies have confirmed the positive role of trade openness in escalating the level of employment in trade oriented countries. In contrast, some of these studies have argued that trade has a destructive effect on jobs creation specially in developing economies (**Hasan** et al.2012).

Additionally, in consistence with structural approach, many researchers in social and economic issues have tested factors generated from educational system as factors responsible from high and rising levels of unemployment. Relying on U.S longitudinal data extended from 1980 to 2005, Riddell and Song (2011) investigated the causal effects of education on individuals' transitions between employment and unemployment. The study particularly focuses on detecting the extent to which education improves re-employment outcomes among unemployed workers. Their yielded results indicated that the education is significantly increases reemployment rates of the unemployed.

Correspondingly, the cyclical unemployment approach has drawn the attention of a huge number of studies. Most of these studies have focused on trade-off between inflation and unemployment rates which embodied by the so called Philips Curve. However, their findings were also, to some extent, varied. Some have stressed the existence of Phillips Curve in the short term (Mortensen, 1970; Caporale, 2011), while, on the other hand, many have confirmed its presence in the long term (Karanassou et al., 2005; Kee and Hoon, 2005; King and Morely, 2007**;** Karanassou and Sala, 2010). These results, regardless of the time dimension, cited the great importance of the cyclical fluctuations caused by inflation in determining unemployment in a certain economy. But so far, the concept of the Phillips Curve is considered more suited to more advanced economies than for developing economies.

This is because the latter are countries which already suffer from high rates of inflation associated with a recession in all sectors. Nevertheless, it is possible to say that high inflation rates are likely to contribute negatively to
wages growth in industrial sector in underdeveloped countries and, thus, weaken its ability to absorb the surplus labor in rural and urban areas.

By employing secondary data on population, employment and unemployment obtained from the Fifth Sudan Population and Housing Census in 2008, Nour S. (2011) examined the structure of labor market and unemployment in
Sudan,. Her results were very interesting because they oppose the existing literature on unemployment which emphasized the trade-off between inflation and unemployment rates during the period 2000-2008.

Finally, the institutional approach is basically concerned with the legal work from society's perspective as well as the political aspects of that work. Accordingly, factors such as the presence of strong labour unions and labour legislation would be expected to have a say in determining changes in unemployment. For example, Lefter (2008) designed a model to examine the relationship between generosity of unemployment insurance (UI) system and the duration of post-unemployment jobs in U.S.A by utilizing weekly panel data over the period 1978-2002. His results indicated that a 10 percent increase in weekly benefit amount raises the expected duration of post-unemployment jobs by 2 to 4 weeks. Furthermore, from economic policy point of view, economists documented that the adoption of liberalization and privatization polices have a significant impact on unemployment. For example, Horst Feldmann, 2012 used data on 53 countries to study the unemployment effects of the far-reaching banking liberalization that many countries engaged in between the 1970s and early 2000s. His results showed that the liberalization substantially decreased unemployment, particularly among young people. A similar unemployment reducing effect of liberalization was obtained in empirical work of Aly and Shields (1999). The authors examined the impact of privatization on unemployment in publicly owned Egyptian textile industry using 1990 data for 31 textile firms. Likewise, Liu (2012) used national representative micro data to study labor market changes in China since 1980s. The estimation from logit models demonstrated that age, education, communist party membership and marital status are significantly associated with employment opportunities and this impact increased over time.

In conclusion, the Sudanese labour market shares many elements with labour market in other counties. Part of these elements is confirmed theoretically as well as empirically. For example, variables such as GDP growth, trade openness and inflation are expected to influence Sudanese labour market in the same way as they affect the labour market in other countries. On the other hand, given the fact that in a country in which one cannot differentiate between those who work and those who do not such as Sudan, we have to think a lot in order to see which theory of labour market can be applied to analyze unemployment determinants? That is because, in our opinion, the social support that Sudanese societies present to those who stay jobless is equivalent to formal social programs and unemployment benefit systems which have been accounted as one of unemployment determinants in developed countries. The reason behind this phenomenon and its aggravation comes from the high rates of growth in labour force participation which makes it difficult to absorb labour market's new entrants particularly in urban areas. Moreover, the role of trade unions as one of the critical determinants of unemployment in developed countries can be replaced by the strong social tightness in the Sudanese social environment.

Based on that, since the area of unemployment is debatable, the empirical investigation is basically intended to focus on the determinants of unemployment in the context of a macroeconomic model incorporating structural, cyclical and institutional factors such as growth in gross domestic product, foreign direct investment, education, inflation rate, trade openness, government expenditure as percentage of GDP, oil exploitation and the adoption of privatization policy.

RESEARCH METHODOLOGY

This section contains description of the model specification; sources of data as well as details of the econometric approach used in the empirical analysis. The methodology used includes the stationary test for time series data and the cointegration techniques to avoid spurious results.

Model specification:

From the theoretical and empirical literature which has been mentioned in previous sections, a number of possible structural, cyclical and institutional determinant factors for unemployment (employment) in Sudan economy have been suggested.

Initially, common explanatory variables that have been found to be significant in past studies on unemployment in Sudan in addition to studies from other countries and regions are chosen as explanatory variables. These are seven variables, i.e. growth in gross domestic product, foreign direct investment (FDI), education, inflation rate, the degree of trade openness, government expenditure as percentage of GDP, oil exploitation and the adoption of privatization policy.

It has to be mentioned that studies on unemployment, as mentioned previously, strongly emphasize the role of education in reducing unemployment. Therefore, the coefficient on this variable is expected to carry a positive sign. However, the effect of FDI on unemployment rate in a certain economy is anticipated to be positively associated with educational attainment. That is, the higher the level of education in a country, the higher will be the effect of FDI on unemployment. It is worth to mention that this link between FDI and education stems from the fact that the application of sophisticated technologies, characterized the FDI inflows, requires a sufficient level of education in the host country (Guntlach, 1995; Borenstztein et al.,1998). Hence, to integrate such a complementary relationship between FDI and education, this study employs an interactive variable to incorporate the impact of these two variables (FDI and education) on unemployment in Sudan.

To summarize, based on the empirical conclusions derived from reviewed literature, the study set unemployment rate as response variable and growth in GDP, the interaction between FDI and education, inflation rate, trade openness, government expenditure as percentage of GDP, oil exploitation and the adoption of privatization policy variables as the predictors. The regression model to capture the impact of these factors on unemployment in Sudan economy can be expressed by the following equation:

$$UNE_t = F(INFR_t, OPEN_t, \mathrm{GDPG}_t, GOV_t, Fdi_t * Edu_t, PRIV_t, Oil_t) \qquad (1)$$

Where UNE_t is the unemployment rate, $(INFR)$ is the inflation rate, $(OPEN)$ is the degree of openness, $(GDPG)$ is the growth in gross domestic product, (GOV) is the government expenditure as percentage from GDP, $(Fdi * Edu)$ is the interactive variable which has been constructed to capture the effect of
education on FDI, $PRIV$ is a dummy variable employed to represent the privatization policy which has been adopted in 1992. A value of 0 is thus assigned to the years prior to 1992 (the year in which the policy has been adopted), while the value of 1 is assigned to the period post 1991. (Oil) is a
dummy variable employed to convey the impact of oil exploitation on unemployment and it takes value of 1 from the year 1999 and onward and 0 other wise. By adding the constant and error terms to equation (1) and converting the variables into logs yields:

$$\ln UNE_t = \beta_0 + \beta_1 \ln INFL_t + \beta_2 \ln OPEN_t + \beta_3 \ln GDPG_t + \beta_4 \ln GOV_t + \beta_5 \ln Fdi_t * Edu_t + \beta_6 PRIV_t + \beta_7 Oil_t + \varepsilon_t \qquad (2)$$

Where the constant or intercept value β_0 is the predicted value of unemployment rate when each predictor is zero. That is when the predictors are zero the unemployment rate regression

equation is estimated to be β_0 (percent from total labor force). The β is $1 \times K$ vector of unknown parameters ($\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6,$ and β_7) are the coefficients to be estimated; ε_t is error term; t represents time and ln is natural logarithm. The rest of the variables remained as defined before. The log-log specification is employed to reflect the elasticity of dependent variable with respect to each explanatory variable.

Based on the earlier theoretical explanation, the expected signs of coefficients of inflation rate ($INFL$); trade openness ($OPEN$); GDP growth ($GDPG$); government expenditures as percentage of GDP (GOV); the interaction between FDI and education ($Fdi * Edu$) and oil (Oil) are expected to be negative. In contrast, coefficient of the adoption of privatization policy variable is expected to be positive.

Econometric Methodology

In this paper, the cointegration technique is used to estimate the specified model within the VECM framework model. However, in the basic regression analysis, the need to check for the stationarity of the data used is considered very important. This is so because the existence of non-stationary of any time series may cast serious doubts on the consistency and reliability of the estimated coefficients (Gujarati and porter, 2099). Therefore, in estimating the above model, a number of steps are considered. First, the time series property of each variable is investigated by implementing Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) tests for unit roots. Conducting such tests is a crucial requirement to confirm the statioarity of the time series data. Second, if the variables are found to be conintegrated, the Johansen multivariate test will be used to identify the long run relationship between the variables concerned.

Once the co integration relationships are confirmed, it would be possible to conclude that there exist long run equilibrium relationships between the variables under consideration. Therefore, as a third step, a VECM model can be formulated to differentiate between the short and the long run relationships. A detailed discussion of this estimation procedure is provided in the next subsections.

The stationarity test

The modern expansion in time series analysis demonstrates that most macroeconomic time series variables have unit roots that may create spurious relationship between concerned series variables (Wai 2002). To construct cointegration between unemployment rate and possible determinant variables we have to check, in a preliminary step, whether each series is integrated and has a unit root using both Augmented Dickey-Fuller (ADF) (1979) and Philip–Perron (PP) (1988) tests. The two tests are performed by assuming the presence of a unit root (non-stationary variable) in the null hypothesis (H_0) and a stationary variable in the alternative hypothesis(H_a).

Augmented Dickey – Fuller Test

This test was introduced and developed by Dickey and Fuller (1979) and it has been designated to use in case the random components of the regression are uncorrelated (Gujarati 2003). The test consists of running a regression for the first difference of the series against the series lagged once, lagged difference terms and optionally, a constant and a time trend of the form:

$$\Delta Z_t = \alpha_0 + \alpha_1 + \alpha_2 Z_{t-1} + \sum_{j=1}^{p} a_j \Delta Z_{t-j} + \varepsilon_t$$

The additional lagged terms are includeded to make sure that the errors are uncorrelted. According to ADF procedure, the test for unit root is conducted on the coefficient of Z_{t-1} in the regression. If the cofficient is signficantly different from zero, then the hypothesis that Z_t contains a unit root is rejected. In other words, the rejection of null hypothesis (H_0) means

stationarity. More specfically, the null hypothsis is that the varaible Z_t is non-stationary series ($H_0: \alpha_2 = 0$) and it is rejected when $\alpha_2$is significantly negative ($H_1: \alpha_2 < 0$).

Phillips - Perron Test

The Phillips -Perron test is an alternative non-parametric approach recommended by Phillips (1987) and extended by Perron (1988) and Phillips and Perron (1988). The PP test takes the *AR (1)* regression form as following:

$$\Delta y_t = \alpha + \theta y_{t-1} + \epsilon_t$$

It has to be noted that the Phillips and Perron statistic is just modifications of the ADF statistic, which takes into account the less restrictive nature of the error process. Hence, the ADF test corrects the serial correlation by including lagged differenced terms, while the Phillips and Perron test corrects the t-statistic of the coefficient θ from the AR(1) model to account for the serial correlation in error terms.

Tests for Cointegration

After having completed examination of the stationarity of each time series, the next step is to figure out the level of cointegration between the examined variables. For simplicity, this step investigates whether the stochastic trends in the examined variable, which is supposed to contain unit roots, have a long term relationship. In this paper, we test for the presence of cointegrating relationships between the concerned variables using the Johansen (1988) maximum likelihood method within a vector autoregressive (VAR) framework as it is the most commonly used procedure. Gonzalo (1994) declared that Johansen's procedure performs better than other cointegration tests even when the error distribution is no normal and the lag structure in the error-correction model (VECM) is miss-specified. The procedure followed in constructing the cointegration test can be illustrated as follows:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + \cdots + \Gamma_{k-1} \Delta z_{t-k-1} \Pi z_{t-1} + \mu + \varepsilon_t \ : t = 1, \ldots, T$$

where Δ is the first difference operator, Z'denotes a vector of variable, $\varepsilon \sim$ iid $(0, \sigma^2)$, μ is a drift parameter , and Π is a $p \times p$ matrix of the form

$\Pi = \alpha\beta'$, where α and β are both $p \times 1$ matrices of full rank, with β containing the r cointegrating relationships and α carrying the corresponding adjustment coefficients in each of the r vectors. Johansen and Juselius (1990) developed two likelihood ratio tests: the Maximum Eigen value test, which evaluates the null hypothesis of r cointegrating vectors against the alternative of $r + 1$ cointegrating vectors and the Trace test, which evaluates the null hypothesis of, at most, r cointegrating vectors versus the general null of p cointegrating vectors.

Trace test statistics

The trace test statstic can be specified as:

$$\tau_{trace(r/k)} = -T \sum_{i=r_0+1}^{k} \ln(1 - \hat{\lambda}_i)$$

where, λ_i are the estimated eigenvalues $\lambda_1 > \lambda_2 > \lambda_3 > \cdots > \lambda_k$ and r_0 ranges from zero to $k - 1$ depending upon stage in the sequence. That is to say, in trace test, the null hypothesis of $r = 0$ is tested against the alternative of $r + 1$ cointegrating vectors.

Maximum eignvalue test

The maximum eigenvalue test investigates the null hypothesis of exactly r conintegrating relationships against the alternative of $r + 1$ cointegrating relationships with test statitic :

$$\lambda_{max}(r_0) = -T\ln(1-\lambda_i)$$

the λ_{max} is closely related to trace statistic, but arises from changing the alternative hypothsis from $r \geq r_0 + 1$ to $= r_0 + 1$. The reason is to improve the power of the test by limiting the alternative to co-integration rank which just by one more than the null hypothesis (Georgantopoulos, 2011). Johansen and Juselius (1990) indicated that the trace test might lack power relative to the maximum eigenvalue test. Based on the power of the test , the maximum eigenvalue test statistic is often prefered.

Vector Error Correction Model (VECM)

If the cointegration has been confirmed between the series under consideration, we conclude that there exists a long-term equilibrium relationship between them. Then the third step in estimation procedure requires the construction of error correction mechanism of Johansen for multiple equations to model this realationship in the short- and long -run. Other wise , if no coinegration has been detected, VECM is no longer required and we directly procede to Granger causality tests to eastablish causal relationship between varaibles.

A vector Error correction model (VECM) is a resricted VAR designed to be used with non-stationary series that are known to be cointegrated. Once the equilibrium conditions are imposed, the VECM describes how the examined model is adjusting in each time period towards its long-run equilibrium sate. Since the variables are supposed to be conitegrated, then in the short-run, deviations from this long-run equliibrium will feedback on changes in dependent variables in order to force their movements towards long-run equilibrium state. Hence, the cointegrated vectors from which the error correction terms are derived are each indicating an independent direction where a stable meaningful long-run equlibrium state exists. This is an important incentive for us to adopt VECM that corresponds to the situation in Sudan economy as the counrty macroeconomic indicatros have gone through a dramtic swing over the three two decades. The theoretical model, which also serves as a basic framework for our statistical analysis, is the VEC model of order *p* . Mathematically, the model is represented by the following equation :

$$\Delta y_t = \Psi + \Pi y_{t-1} + \sum_{t=1}^{p-1} \Gamma \Delta y_{t-1} + \mu_t$$

where y_t are independent $I(1)$ variables being integrated to an $I(0)$ vector , Ψ is the intercept , Γ is the matrix conveying the short-run dynamic relationship among factors of y_t, while Π is matrix containing long-term equilibrium information. $\mu_t \sim$ iid $(0,\sum)$is the vector of impulses that represent the unexpected movements in y_t, $\ln \Delta = (1-L)$, L is the lag operator. The rank of Π represents the number of linear combination of stationary $y_t$and is denoted as *r*. If there are k endogenous variables, Granger's representation theorem asserts that if the matrix Π has reduced rank $r < k$, then there exits $k \times 1$ matrices, α and β, each with rank *r* such that $\Pi =$ such that $\Pi = \alpha\beta'$ and $\beta' y_t$is $I(0)$ (Johansen and Juselius,1990).

The order of *r* is determined by the likelihood ratio (LR) trace test. If Π has a full rank, then the models could be rejected, as y_t would be stationary and has no unit root, which means no error correction relationship can be derived. On the other hand, if the rank of Π is zero, the elements of y_t are not conintegarted at all and there is no long-run equlibrium among these elements. Under those circumstances, the conventional VAR model in the first difference of the vaiables should be adopted instead. (Ryan & Wong , 2011).

The data

Economic data on developing countries is often incomplete, inaccurate and sometimes biased in unknown directions. This problem may particularly be true for statistics on unemployment rate, but even worse for the country such as Sudan. However, fortunately, this is not the case in international organizations, where different organizations monitor all indicators in developing countries, among them is Sudan. Therefore, a secondary data from different sources including World Bank (WB), International Monetary Fund (IMF), and Baro & Lee is used to run the empirical analysis. This type of data not only saves time and cost, but it also makes longitudinal research possible when data sources are collected at systematic intervals over time. However, it should be recognized here that, because of data limitations, it is not possible for us to consider some important variables concerning our analysis such as labour cost (wages) and job creation policy adopted by government under the Graduates Recruitment Scheme.

In this paper, the statistical analysis covers 31 years extended over the period 1981 to 2011. All variables are measured with annual time series data, so that there is one observation per year for each variable. Table 4.1 (See the appendix) summarizes the data for all variables. The data reported include unemployment rate (percent), inflation rate (percent), the degree of trade openness (ratio of export plus import to GDP), growth in gross domestic product (percent), average years of schooling (year), Foreign direct investment (millions 2000 US dollar), government expenditure as percentage of GDP (percent), the adoption of privatization policy which takes value 1 after the adoption of policy and 0 otherwise, Oil stand for oil exploitation take value of 1 from year 1999 and onward and 0 other wise.

Empirical Results and Discussion

Based on the abovementioned model and dataset, the determinants of unemployment in Sudan are estimated using cointegration and the VECM techniques. The empirical results are reported in Tables 3 to 9. However, before bringing the data to further empirical examination, descriptive tests are performed in order to map out the nature and distribution of data under consideration.

Descriptive Statistics Analysis

In this part of the analysis we carry out some descriptive statistical tests to examine the nature and distribution of the used data by adopting conventional descriptive statistics techniques such as mean, median, standard deviation, Skewness and Kurtosis as well as testing normality of data using Jarque-Bera test. According to results reported in Table 3, the majority of variables been employed in this study have shown normal distribution. A closer inspection reveals that the mean and median do not show any extreme variations. Equally, the small coefficients of standard variation show its low value compared to the mean of the variables which is desirable from statistical point of view. Also from Table 3, it can be observed that the range of variation between maximum and minimum is acceptable. In the same vein, the variables' skewness maintain a quite low values that vary between negative for some variables (GDPG, OPEN, GOV and PRIV), and positive for the rest of variables (UNE, INFL, Fdi*Edu and Oil).

Table 3: Descriptive Statistics

	UNE	INFL	OPEN	GDPG	GOV	Fdi*Edu	OIL	PRIV
Mean	2.8018	3.2433	3.1651	2.3738	2.2140	7.0513	0.3667	0.6333
Median	2.7738	3.1993	3.1967	2.5841	2.2774	6.0462	0.0000	1.0000
Maximum	3.1059	4.8890	3.8630	3.0681	2.7287	11.096	1.0000	1.0000
Minimum	2.5258	1.5834	2.4058	-3.13E-06	1.5759	4.1858	0.0000	0.0000
Std. Dev.	0.1529	1.0208	0.4600	0.6924	0.3613	2.4216	0.4901	0.4901
Skewness	0.3899	0.1612	-0.1168	-2.3027	-0.2814	0.4566	0.5534	-0.5534
Kurtosis	2.5328	1.7239	1.7518	7.4814	1.6627	1.6102	1.3062	1.3062
Jarque-Bera	1.0330	2.1655	2.0156	51.614	2.6313	3.4569	5.1172	5.1172
Probability	0.5966	0.3387	0.3650	0.0000	0.2683	0.1776	0.0774	0.0774

The values of kurtosis for majority of the variables are found to be less than three, confirming closeness to normality. The only exception is GDPG which shows a relatively high kurtosis (7.4814). Finally, the Jarque-Bera normality test statistics demonstrate the acceptance for the null hypothesis that the variables under consideration, excluding PRIV and Oil as dummy variables and GDPG, are normally distributed with different probabilities.

Table 4: The correlation Matrix

	UNE	INFL	OPEN	GDPG	GOV	Fdi*Edu	OIL	PRIV
UNE	1.0000							
INFL	-0.1424	1.0000						
OPEN	0.0898	-0.6345	1.0000					
GDPG	-0.2020	-0.1866	0.3205	1.0000				
GOV	0.4069	-0.6699	0.6826	0.2616	1.0000			
Fdi*Edu	-0.2344	-0.4395	0.7077	0.2373	0.5025	1.0000		
OIL	-0.2489	-0.6225	0.7645	0.3200	0.6138	0.7292	1.0000	
PRIV	-0.7671	-0.1239	0.3903	0.3335	-0.0484	0.4340	0.5789	1.0000

Additionally, we have performed another preliminary test prior to empirical analysis. This test is conducted to make sure that the proposed model does not suffer from any serious multi-collinearity problem since this could damage the statistical inference inspired from the results. Table 4 presents the correlation matrix (using Person's r) for all underlying variables. The reported results indicate that there is an obvious correlation between unemployment rates and the suggested explanatory variables. However, the absolute magnitudes of the correlation coefficients are, to some extent, reasonable and reflect the probable relationships. The highest absolute magnitude among the reported correlation results is 0.7671, indicating a strong association between privatization and unemployment rates. The next largest correlation coefficient (0.7645) is detected between oil and trade openness. These results of correlation would not cause any problems to our analysis since only two relevant correlation coefficients have an absolute value higher than 0.50. Therefore, the regression analysis may proceed with no reason for worry regarding over correlated variables.

Time Series properties of the Data

As mentioned previously, it is necessary to verify, before identifying possible long run relationship, the order of integration between the concerned variables. Therefore, as a first step in the empirical analysis, we have taken the unit root tests because each variable must satisfy stationarity conditions. Table 5 reports the results of unit roots tests at log-level and log first difference for ADF and PP tests in constant and constant plus time trend. The results clearly

show that the null hypothesis, the variables in their levels contain unit roots, in the level of the series with constant plus time trend cannot be rejected except for GDP growth variable (GDPG). In other words, the results indicate that UNE, INFL, OPEN, Fdi*Edu and GOV variables are non-stationary with and without trend at levels.

Table 5: Agumented Dickey–Fuller and Phillips-Perron Unit Root Tests Results

Variable	ADF		Phillips-Peron		Decision
	Constant	Constant +Intercept	Constant	Constant +Intercept	
Level					
Log UNEM	-1.0766	-2.1801	-0.9234	-1.5767	Non-stationary
Log (Fdi*EDU)	0.5535	-1.1309	0.3844	-1.2729	Non-stationary
Log INFL	*-1.2391*	-2.9352	-1.9879	-2.9095	Non-stationary
Log OPEN	-0.9859	-2.2859	-1.3652	-2.1872	Non-stationary
Log GOV	-1.8957	-2.1071	-2.0259	-2.1265	Non-stationary
Log GDPG	-2.6706*	-1.2038	-4.2940***	-7.8412***	Stationary
First Difference					
Log UNE	-3.6359**	-1.4777	3.7045***	-3.6421***	I(1)
Log (Fdi*Edu)	-4.0107***	-4.1821**	-3.9927***	-4.1742**	I(1)
Log INFL	-8.5156***	-8.3982***	-8.7456***	-8.6696***	I(1)
Log OPEN	-7.4359***	-7.6811***	-7.2659***	-7.6811***	I(1)
Log GOV	-4.8974***	-4.8989***	-4.8779***	-5.0568***	I(1)
Log GDPG	-8.8433***	-4.9178***	-14.976***	-14.472***	I(1)

Note: **the optimal lagged differences are determined based on Akaike Information Criterion (AIC). The asterisk (***), (**) and (*) denoted as significant level of 1%, 5% and 10% respectively.**

The bottom part of Table 5 reports the results of the tests at first difference for ADF and PP tests with constant and constant plus trend. It can be seen that for all series the null hypothesis of unit root test is rejected at %1 significance level. More specifically, the ADF and PP tests provide strong evidence that all the series are in fact integrated of order one (I(1)). Accordingly, since the variables appear to be stationary in the first differences, no further tests are performed. Hence, the Johansen-Juselius procedure of multivariate co-integration technique would be legitimately preformed to find out the existence of long run relationship between the variables under consideration.

The cointegration results

After confirming that the series are stationary as shown in previous subsection, the next step is to detect the number of cointegration vectors which connect the variables together by applying the Johansen and Juselius test (1990). This approach is especially appealing since it offers a combined framework for estimating and examining the cointegrating relationships in the context of the VECM model. Table 6 shows the trace statistic and the maximum eigenvalue (λ_{max}) results tests at 5% critical value, as well as the corresponding λ values. The test is performed using unrestricted intercept term, which assumes the existence of a deterministic time trend in the data. The reported results suggest that both the trace and the λ_{max} tests reject the null hypothesis of no cointegration and accept that there is more than one cointegration vector. For instance, according to trace test, the result of at most 1 cointegrating vector is

rejected as the computed value of the test statistic (197.1985) is greater than the critical value (95.75366) at 5% critical value. In the same way, the null hypotheses of at most 2, at most 3, at most 4, at most 5 and at most 6 ,cointegrating vectors are also rejected. Thus, we conclude that there is evidence of 6 cointegrating vectors in the system. On the other hand, the λ_{max} test provides more conclusive evidence on the exact number of cointegrating vectors in the system. The results again confirm that there are four cointegrating vectors in the system. However, since the trace test and maximum eigenvalue suggest a different number of cointefgrating vectors, the number of the vectors can be selected on the basis of maximum eigenvalue based on the argument of Banerjee et al. (1986) and Huag (1996). This means that there exists a significant cointegrating relationship among the variables under examination.

Table 6: Johansen Multivariate Co-integration Tests

Unrestricted Co integration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05Critical Value	Prob.**
None *	0.892996	197.1985	95.75366	0.0000
At most 1 *	0.812817	134.6217	69.81889	0.0000
At most 2 *	0.721490	87.70293	47.85613	0.0000
At most 3 *	0.635133	51.91053	29.79707	0.0000
At most 4*	0.354801	23.68032	15.49471	0.0024
At most 5*	0.334708	11.41083	3.841466	0.0007
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05Critical Value	Prob.**
None *	0.892996	62.57681	40.07757	0.0000
At most 1 *	0.812817	46.91878	33.87687	0.0008
At most 2 *	0.721490	35.79240	27.58434	0.0035
At most 3 *	0.635133	28.23021	21.13162	0.0042
At most 4*	0.354801	12.26949	14.26460	0.1009
At most 5*	0.334708	11.41083	3.841466	0.0007

Note: * denotes rejection of the hypothesis at the 0.05 level, Trace test and Max-eigenvalue test indicate 6 and 4
cointegrating equations at the 0.05 level respectively, **MacKinnon-Haug-Michelis (1999) p-values.

VECM results

According to cointegration result presented in the upper part of Table 7, the unemployment in Sudan is found to be highly affected by inflation rate, trade openness, GDP growth, government expenditure as percentage from GDP and the interaction between average years of schooling and foreign direct investment. As can be seen in the table, the long run coefficients for all explanatory variables, except inflation rate, are statistically significant but associated with different signs. For instance, the results clearly show that the elasticity of unemployment rate (UNE) with respect to trade openness (OPEN) and government spending (GOV) indicates that a 1% increase in these two variables raise unemployment rate in the long run by an estimated 0.22% and 0.19%, respectively. On the other hand, the long run relationship between GDP growth (GDPG) and the interaction between FDI and average years of schooling (Fdi*Edu) indicates that these variables are negatively related to unemployment rates in Sudan.

As shown in Table 7, the elasticity of UNE with respect to GDPG and (Fdi*EDU) indicates that a 1% increase in these two variables lower UNE in the long run by an estimated 0.18% and 0.12%, respectively.

Table 7: VECM results:

Dependent variable : Unemployment Rate Estimation period : 1981-2011				
Long-run cointegrating equation				
Variable	Coefficient	Standard error	Test statistic	P-value
C	2.8405	-	-	-
Log UNER(-1)	1.0000	-	-	-
Log INFL(-1)	0.0279	(0.0342)	-0.8163	0.4239
Log OPEN(-1)	0.2191***	(0.0364)	-6.0137	0.0000
Log GDPG(-1)	-0.1778***	(0.0306)	5.8094	0.0000
Log GOV(-1)	0.1850***	(0.0573)	-3.2260	0.0021
Log (Fdi*Edu)(-1)	- 0.1153***	(0.0123)	9.3788	0.0000
Short-run				
Variable	Coefficient	Standard error	Test statistic	P-value
Constant	-0.0981***	(0.01842)	-5.32659	0.0000
ΔLog UNER(-1)	-0.1225	(0.15412)	-0.79491	0.4284
ΔLog INFL(-1)	-0.0363**	(0.01875)	1.94049	0.0549
ΔLog OPEN(-1)	0.0516	(0.03564)	1.44655	0.1509
Δ Log GDPG(-1)	0.0360***	(0.01203)	2.99219	0.0034
ΔLog GOV(-1)	-0.1803***	(0.05601)	-3.21776	0.0017
ΔLog (Fdi*Edu)(-1)	0.0403	(0.03131)	1.28562	0.2013
ΔPRIV	-0.0094	(0.02002)	-0.46795	0.6408
ΔOil	0.1898***	(0.03334)	5.69341	0.0000
ECT(t-1)	-0.4017***	(0.07529)	-5.33523	0.0000
R-squared	0.69	Prob.(F-statistic)		0.003250***
Adjusted R- squared	0.54	Mean D.V		-0.017184
Sum squared resid	0.023435	S.D. D.V		0.053102
S. E of Regression	0.036082	Log likelihood		59.47016
F-statistic	4.497778			

Note: **The asterisk (***), (**) and (*) denoted as significant level of 1%, 5% and 10% respectively.**

The results on the short run VECM model are reported in the bottom part of Table 7. These results show that the error correction term coefficient in the model is statistically significant at 1% percent level and carries the expected negative sign. The magnitude of this error term coefficient suggests that unemployment rate in Sudan cannot drift far from its equilibrium value in the long run. In addition, in case there is disequilibrium between the short run and long run unemployment rates, the adjustment can be achieved in the long run by speed equal to 40% from its previous equilibrium value. However, this percent reflects a very low speed of adjustment towards the equilibrium. In other words, the unemployment takes approximately 2.49 years to adjust toward its equilibrium after the impact of any shock in the system resulting from changes in its determinants.

Also, from the results given in the same table, it can be observed that the short run coefficients of UNE, INFL, GOV and PRIV are negatively related to unemployment rate. Nevertheless, only INFL and GOV are found to be significant at 5% and 1% levels, respectively. These outcomes indicate that both INFL and GOV play a positive role in decreasing unemployment rate in the short run. This result may come due to the fact that the higher government spending, which normally accompanied by high inflation rate, leads to short run increase in economic growth and, therefore, lower unemployment rates. Conversely, in the long run, this relationship may be reversed since the increases in government expenditure,

financed through high taxes, are anticipated to destruct the existing jobs. Moreover, according to Laffer curve's argument, a high tax burden would undermine the ability of national economy to create new jobs in the long run.

With respect to the impact of trade openness on unemployment, the results show that this variable is positively correlated with unemployment rates in both the short and the long run. The destructive role of trade openness on jobs can be interpreted by the fact that the local infant industries in Sudan economy do not possess the capabilities to resist the waves of imports from aboard. Moreover, given the fact that the majority of Sudanese exports are raw materials (mainly agricultural products), the demand for these products is always inelastic in the long run.

Therefore, with no equivalent increases in exports, the trade openness is expected to raise unemployment rates in the long run as well as in the short run. Turning to privatization policy's coefficient, the possible justification for the negativity of the sign associated with this variable is that the adoption of such policy may contributes greatly in facilitating economic growth and thus helps in decreasing unemployment rates. The policy assist the country economy by introducing productivity enhancing technologies and, most importantly in any sense, it symbolizes economic soundness that creates confidence in future development. However, this is not the case in the long run whereas the soundness of the economy and its ability to absorb unemployed persons is governed by other institutional and political factors.

Also, from the short-run analysis, it can be noted that the interaction between FDI and average years of schooling although it is not significant, however, it has a positive sign. This outcome indicates that the interactive impact of these two variables on employability is negative. This is somewhat surprising when compared to the long-run findings in which the variables play a key role in reducing unemployment rates in the country. Such result can be justified on the ground that in the long run the interactions between FDI and schooling could increase job creation through several channels. First, in the long run, the presence of FDI would lead to diffusion of knowledge, technology as well as it helps in upgrading the skills of national labor force. Therefore, through this process FDI is expected to replace foreign workers by national workers who have already become skilled to steer the available jobs. Second, in the long run, the sophisticated technologies accompanied FDI's inflow would generate more economic surplus, especially in industrial sector, leading to more economic growth and further jobs creation. Third, the period under consideration is remarked by dramatic educational expansion at all levels by rates exceeding the growth rates in other macroeconomic indicators in Sudan. In other words, this expansion in education did not accompanied by significant improvement in the economy's absorptive capacity. Accordingly, the short run outcome of this expansion is found to be negatively correlated with employment. Fourth, most of sociologists tend to link the problem of high unemployment rates among educated workers to the existing breakdown in the relationship between national systems of education, on one hand, and nationwide labor markets, on the other. They agree upon that what one learns in school ought to be related to what one does or will do as a labor
market participant. But most of them don't agree about (1) what one learns in school,(2) what one actually does on the job, and (3) whether or not what one learns in school is related directly to what one actually does on the job. In fact, this coincidence of high unemployment rates and the phenomenal increases in total schooling, forced economists to propose that educational systems are increasingly becoming an investment in idle human capital that development strategies need to be readdressed (Edwards & Todaro1973; ILO, 1972).

Moreover, the reported results clearly demonstrate the existence of a short run trade-off between inflation and unemployment rates in Sudan economy. In contrast, this trade-off, as we have seen previously, disappears in the long run. This conclusion implies that in the short run

a high inflation rate, which is expected to result from increases in government expenditures, would be associated with economic expansion if government spending is oriented to the soft and hard infrastructures. On the contrary, the long run expansion in economic activities and, thus, the jobs creation remain highly dependent on other real factors such as availability of capital and the well-trained labor force.

Concerning the short run impact of growth in GDP (GDPG) on unemployment, the results prove that increases in GDP growth have a negative role in promoting employability in Sudan. How should we understand these contradicting results on the same variable in different time trends? One possible answer for this puzzling question is that the growth in GDP may not always have a linear association with unemployment rates. Furthermore, the short run increases in GDPG are likely to be mainly based on the factors such as oil shock and government expenditures. Consequently, its role in elevating employment is expected to be negative. On contrary, the long run increases in GDPG are expected to result from structural and institutional changes proceed in the economy and, therefore, lead to high employment rates.

Finally, in a quite surprising finding, the reported results reveal that exploiting oil in Sudan doesn't contribute positively in creating jobs opportunities during the period under consideration. Such results may lend a great support for the episode of Dutch Disease in Sudan economy.

Table 8: Residuals Diagnostic Tests:

Statistics	Estimated Value	Probability
Normality Test(Jarque-Bera)	0.2530	0.8811
Breusch-Godfrey Serial Correlation LM Test	0.6571	0.7200
ARCH Test	1.0110	0.3147
White Heteroskedasticity test (with cross terms)	7.3658	0.5991

Lastly, to guarantee that the specified model was statistically free from the standard problems, several tests have been conducted. The residuals diagnostic tests statistics reported in Table 8 shows that the model pass all tests, such as Jarque-Bera normality test (the test support the hypothesis of normal distribution since the estimated value of Jarque-Bera is 0.2530 and probability of 0.8811), LM test for serial correlation which demonstrates no evidence for autocorrelations between the variables (observed R-squired 0.6571 and p-value 0.7200). Additionally, both White and ARCH tests for Heteroskedasticity revealed the homoscedasticity of data distribution since the observed R-squired values are (1.0110) and (7.3658) with P-values (0.3147) and (0.5991), respectively.

Conclusion and Policy Implications

The main purpose of this study is to examine the determinants of unemployment in Sudan by using time series data over the period 1981-2011. The cointegration and VECM techniques are employed to run the empirical investigation. As a preliminary step, the study applied both ADF and Philips Perron unit roots tests to ensure the stationarity of the used data. The overall econometric Johansen-Juslieus evidences demonstrate the existence of cointegrating relationships among the variables under consideration implying that they have long run relationships. Accordingly, the study furthers its analysis by adopting the VECM techniques in order to distinguish between the long run and shorn run relationships between the variables included.

The results pertain to the VECM estimates suggest that GDP growth and the interaction between FDI and education play a positive role in reducing unemployment rates in Sudan during the period studied. This is particularly evident in the long run since the two variables are coupled with the expected negative signs. In contrast, the impact of these two variables becomes negative in the short run indicating a negative role in mitigating unemployment.

The results also show that government expenditure exert a negative influence on employment in the country. However, its short run effect in overcoming unemployment turns out to be negative. This outcome indicates that, short run, a high government spending contribute positively in mitigating unemployment in Sudan economy. Similarly, the results confirm that the short run increases in inflation rates play a crucial role in defeating unemployment. This finding supports the presence of Philips Curve hypothesis in Sudan economy during the period under consideration. In addition, the findings strongly confirmed the pivotal role of privatization policy in escalating jobs creation. Moreover, the results indicate that the average year of schooling add negatively to employability in the short run although its coefficient is insignificant. Also, the positive sign of trade openness in both the short run and long run confirms the theoretical argument which states that the increases in trade openness lead to jobs destruction and, therefore, push the economy in high unemployment rates.

Summing up, if we exclude the adoption of privatization policy, government spending and inflation rates, the rest of the variables tend to play a different role than the expected. Therefore, it can be said that these findings provide conflicting evidences on the factors affecting unemployment in Sudan during the period under consideration.

Based on the findings of this study, several recommendations to address unemployment problem in Sudan can be proposed:(1) currently, unemployment should properly be regarded as the most major economic and social problem facing policymakers in the country. Therefore, the clear policy message is that macroeconomic policies do have strong role to play in diminishing unemployment rates (since four out of seven explanatory variables are macroeconomic variables).

(2) Considering the short run negative impact of GDP growth on employability, it may become appropriate for policymakers to develop or encourage labor-intensive production with high-value added such as textile and spinning industries.

It is well recognized that these industries have a great capacity in absorbing a great number of workers and thus decreasing unemployment rates. (3) Also, the evidence suggests the need for carefully designed privatization strategy. More specifically, this strategy must be integrated with other economic policies. This can serve in upgrading the absorptive capacity of the economy and, thus, maintaining a low unemployment rate. (4) In the absence of a directive policy, the reduction of unemployment rates depends, to a large extent, on domestic advantages of labor market like educated labor force, political stability and improvements in infrastructure. Above all, in the current context of globalization and economic openness, Sudan needs to offer a skilled labor force with new technical skills, expand and encourage developmentally required education, build a sophisticated infrastructure, low business transaction costs, national treatment of foreign investors and stable transparent polices. (5) To maintain the positive role of inflation in reducing unemployment rates, government expenditures must target the areas where it could increase the absorptive capacity of the economy. (6) Finally, the government should always aim to offer a comprehensive policy package, not only to increase the level of employment by initiating jobs creation program such as graduates recruiting plan but also to generate maximum productivity from employed individuals.

Appendix

Table 1.1: Summery description for the variables used in the anlaysis

Variable Name	Variable description	Source	Time period coverage
UNE	Unemployment rate	IMF	1981-2011
INFL	Inflation rate	WB	1981-2011
OPEN	Trade ratio to GDP	WB	1981-2011
GDPG	Growth in GDP	WB	1981-2011
Edu	Average years of schooling	Baro & Lee	1981-2011
GOV	Government expenditure (% of GDP)	WB	1981-2011
Fdi	Foreign direct investment	WB	1981-2011
PRIV	The privatization policy	-	1981-2011
Oil	The period of oil production	-	1981 -2011

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