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UNDERSTANDING AND AVOIDING
THE OIL CURSE IN SUDAN

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Abstract

This paper examines the impact of the oil boom, as a blessing or curse, on Sudan's economy, analyzes the key features of the country's growth experience before and after the oil boom and articulates Sudan's underlying political and economic issues. The results show that, the contribution of oil to real growth has been strong; however, the effects 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 the RER; have caused an overall loss of competitiveness measured by the negative contribution to TFP growth; also oil dependence has led to greater export concentration undermining long-run economic diversification. Moreover, the regime of politics and economy engendered by the elites' distributive politics tends to magnify the impact of shocks and has worsened the procyclicality of fiscal policy and contributed to excessive currency appreciation. In the end the combined effects of these factors led to the crowding out of private investments, diluting the economic and social impact of largely oil-driven growth and further weakening state institutions. The policy implications of these findings are indicated.

ملخص

تبحث هذه الورقة أثر"الرً وجة النفطية"، نعمة أم نغمة، على الاقتصاد السوداني؛ وتُحلِل السمات الرئيسية لتجربة النمو في البلاد قبل وبعد النفط؛ وُوضح قضايا الإقتصاد السياسي الكامنة وراء ذلك. بَيَّنت النتائج أن مساهمة النفط فى النمو الحقيقي كانت فاعلة، ولكن الآثار المترتِبة على الإبداعات التكنولوجية ضئيلة. أيضاً إتَّضح أن المرض الهولندي والروابط المالية هي الآليات الرئيسية التي فاقمت الآثار السلبيَّة للرً وجة. على وجه التحديد، كانت الإختلالات في سعر الصرف الحقيقى المترتبة عن ذلك سبباً في فقدان القدرة التنافسية مُقاسـة بالمسـاهمة السـالبة لنمو إنتاجيـة إجمالى العوامل؛ أيضا أدى الإعتماد على النفط لزيادة تركيز الصادرات الذى من شأنه تقويض التنويع الإقتصـادي فى المدى البعيد. علاوة على ذلك،إتضح أن نظام الإقتصاد السياسي الذى أوجدته سياسة النُخب التوزيعيَّة من شأنه تضخيم أثر الصدمات ولقد أدَّى إلى مُفاقمة لتقلُّبات الدورية للسياسة المالية، وساهم في الُمغالاة المُفرطة لقيمة العملة. لقد أدَّتـمُحصـدّلة الآثار المجتمعة لهذه العوامل لإزراحةالإستثمارات الخاصة وتمييـع الآثار الإقتصادية والإجتماعية للنمو المدفوع لحد كبير بالنفط و إضعاف متزايد لمؤسسات الدولة. سوف يُشار لدلالات هذه النتائج على السياسة.

1. Introduction

1.1 Problem statement

From its independence in 1956 until 1999, Sudan was dependent primarily on agricultural exports for foreign exchange earnings. However as of 1999, this has shifted to crude oil. Between 1956 and 1998, the average contribution of cotton, sesame and gum arabic to exports was 42.7%, 10% and 11%, respectively. In the period between 1999 and 2010, however, the contribution of oil to national exports was on average 82.3%. This dramatic change in exports is explainable by the Sudanese oil sector boom brought on by the global surge of oil prices in the early 1990's to 2000's. This was a result of the rise in global aggregate demand driven by rapidly growing Asian countries, mainly China and India. The emergence of these new markets raised the value of Sudan's oil reserves, which were discovered in mid 1970s. This has provided opportunities for development and contributed to unprecedented economic growth. Real GDP per capita growth increased more than seven-fold in 1999-2010 compared to meager 0.6% average growth for 1961-98.

State-owned companies and other multinational firms dominate oil production in Sudan. The state decides the utility of oil revenues, distribution, and depletion. The rise in oil production has coincided with a successful IMF-Staff moderated program since 1997 and the Comprehensive Peace Agreement sealed in 2005. The combined effect of these developments had sustained a decade long stable growth episode. Notwithstanding these positive developments, Sudan's economy has been transformed into an oil-dependent economy. This is true even after the separation of South Sudan, which owns about 75% of the former nation's productive oilfields. The resulting change in the country's exports is reflected in an adjustment to the share of traditional stalwarts (agricultural products and minerals) rather than a change in export sophistication. This could indicate that the Sudanese economy has contracted Dutch Disease; whereby the sector that previously drove growth begins to decay as a result of the exportation of discovered mineral resources. Moreover, the resultant shift of the public finance revenue base from taxes to oil revenues could pose significant challenges for macroeconomic management including the negative political economy implications of oil windfall.

Both theory and evidence confirm that natural resources provide opportunities for income growth, but continued dependence on resource rents (especially oil windfalls), presents serious concerns. Generally, these concerns arise from a number of factors including: the perceived erosion of the terms of trade for commodities, the volatility and declining trend of commodities prices, the negative externalities of specialization on extractive industries and the downsides of the political economy of the resource rents. See for example, Gelb (1988); Auty (1990); Karl (1997); Sachs and Waner (1999); and Corden and Neary (1982), among others.

It is possible that the decade long oil-driven growth in Sudan also conceals serious constraints that become more binding following a drop in the oil price or supply. There is a need for a better understanding of the transformative role of oil in Sudan including the impact on macroeconomic performance, economic diversification and socio-political development, so that relevant policies for enhancing sustainable growth can be envisioned.

1.2 Objectives of the paper

Since discovery in 1999, oil revenues dominated Sudan's export earning and public finance. The broad objective of this paper is to explore the effects of oil dependency on real growth and examine the outcomes of the fiscal response to the oil boom. More specifically, the following questions would be addressed:

- How has oil shaped the Sudanese economy?

- How challenging has oil economic management been? What are the main features of fiscal and exchange rate regimes and how do they reinforce or counter the oil cycle?
- How has oil dependency complicated economic diversification in the longer run?
- What are the underlying political economy issues behind the chosen policies and development strategies and how have they been influenced by oil dependency?
- What are the relevant policies to address oil dependency and to deepen the agendas of a progressive development path in Sudan?

The analytical framework ties the peculiar features of oil to selected theoretical explanations drawn from the literature on natural resources. This is to understand the key channels for transmission of the oil impact to the rest of the economy. The method of investigation utilized a combination of growth accounting and time series analysis to identify the key features that distinguish the growth experience before and after the oil boom and the associated policy responses. The degree to which oil-dependency shaped the choices of the political elites is examined in terms of historical budgetary allocations. As in the revealed preference approach, the elites' preferences implicit in the budget allocation are broadly interpreted as reflecting their strategic priorities for development. The complexity of identifying a system of dependent variables to capture the multidimensional aspects of the oil impact is duly acknowledged.

The results show that, the contribution of the oil to real economic growth has been strong, but the effects on technological innovations and dynamism, approximated by the TFP growth are insignificant. Notwithstanding, the existence of an oil curse is confirmed for Sudan. The Dutch Disease channel and fiscal linkages are found to be the main mechanisms for the transmission of the negative effects associated with the oil boom to economic innovations and real growth. It is also shown that, the RER misalignments, a key transmission channel of the Dutch disease, have resulted in an overall loss of competitiveness measured by a negative contribution to TFP growth. Moreover, the shift towards greater export concentration further complicates macroeconomic management and can thwart long-run economic diversification. Although, three special fiscal institutions are introduced to insulate the economy from the oil cycle, it is found that the allocation of oil revenues through government spending has resulted in strong procyclicality. Moreover, the government institutions that deal with allocation and taxation tend to be considerably more estranged after the oil boom reflecting that many actors with divergent and conflicting agendas heavily dominate the public sector. The credibility of the government, as indicated by credible budgeting process and credible commitment to maintain low inflation and a stable exchange rate, turns out to be very low which further obscures macroeconomic management. These findings suggest that the quality of the fiscal institutions is very poor and the technology of commitment is underdeveloped due to the proliferation of rent seekers and the prevalence of the rentier mindset. In addition, the distributive consequences of the political elites' policy choices, as reflected by budget prioritization, are inconsistent with job-creating growth, private investments and poverty reduction. The result of this is a narrow market that tends to worsen when times are bad.

Sudan faces the multiple challenges typically found in a badly managed oil dependent economy. There is a small oil bourse with declining prospects (at least in the near future) due to the separation of South Sudan. Nonetheless, oil and other minerals could potentially spearhead development through the enhancement of rent appropriation combined with an efficient tax system and state image building, on the one hand, and through the utilization and distribution of rent (while addressing the resource curse) on the other. Given the evidence on the weak positive fiscal linkages of oil and the need for an effective countercyclical policy, a more flexible exchange rate regime could be adopted in tandem with the use of an efficient indirect monetary instrument to enhance macroeconomic management. More importantly, growth-enhancing reform requires a well-designed ownership structure of the resource sector

and the commodity-based sovereign wealth fund. This could be the most effective way to promote democracy and economic development.

The rest of the paper is organized as follows: the following section provides an overview of economic performance in order to provide background information on Sudan. Section III briefly reviews the literature on natural resources and outlines the methodology. Section IV presents the results and discussions, and the final section contains the concluding statement.

2. Overview of Economic Performance

Sudan's economic performance has improved over the last decade, benefiting from the rise of oil, which mirrored the advent of the Gezira cotton Scheme. Real GDP per capita grew on average by 4.5% between 1999 and 2010, compared with 0.6% in 1961-98, when the Gezira Scheme was the driver of this growth. The cumulative nominal value of the GDP grew 13 times over these respective sub-periods, whereas the average annual CPI inflation dropped from 35% to 10%. Per capita income, which is an indicator of average individual welfare, increased by 61.7%, in constant 2000 US$, between 1999 and 2010 compared to 16.9% between 1960 and 1998 (Figure 1).

It appears Sudan has reversed pre-oil weak economic performance, which witnessed serious economic turmoil, especially over 1980s and mid 1990 with double-digit inflation and negative real GDP growth. Macroeconomic management has improved tremendously. Following successful stabilization policies during the oil boom resulted in very low inflation and a decade-long growth episode (Figure 1).

With the rise in oil exports, Sudan is increasingly integrating into the global economy. Sudan's combined ratio of exports and imports to GDP increased by about 22 average percentage points during 2000-10. This is up from a 17% average over 1970-99. The ratio of foreign direct investment to GDP has also surged from negligible historical records to 5.5% average for 1998-2010 (Figure 2).

Notwithstanding these positive developments, Sudan's economy has become highly dependent on the oil sector. Although, the share of this sector in the GDP averaged about 10.5% (since its inception in 1996 through 2010) it quickly displaced cotton, which was the leading export crop. The share of oil in total exports steadily increased, benefiting from the introduction of the pipeline in 1999 as well as rising prices. In early 2008, it reached 95% before declining to about 90% following the global economic crisis, (Figure 3). The nominal per capita GDP has closely tracked development in the oil sector, but the non-oil per capita GDP showed an only marginal response. This suggests that the oil-driven growth has not been broad enough to reduce poverty and improve the welfare of the majority of the population (Figure 4).

Figure 5 clearly shows 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 percent for 2010. The appreciation of the exchange rate since 2000 following the oil boom seems to be the primary cause of this poor performance. The favorable effect of the globally surging commodity price is not enough to compensate for the negative effect of exchange rate overvaluation. For example, as indicated by Figure 6, despite the increasing free market price of cotton since 2004 the quantity exported exhibited historic decline. This could essentially be due to an unfavorable exchange rate response, which remains overvalued for cotton cultivation. Elbadawi (1997) and Elbadawi and Kamar (2006) confirmed that Sudan had experienced long episodes of massive exchange rate overvaluation even before the introduction of oil money into the economy.

The decay of cotton, which was a strategic export crop, is a clear indication of the depression facing the non-oil economy, and that Sudan has contracted the Dutch Disease. Cotton is the

main produce of the Gezira scheme (a US$ 4 billion project). The scheme, at its prime, was not only thought of as a system for crop exports, but as a monument and a demonstration for technological innovation and diffusion geared towards modernizing Sudan (Bernal 1997). The Gezira scheme was replicated in other cotton, sugar and mechanized sorghum projects. However, after oil, cotton has been a waning industry. Cotton not only contributed less to total exports, but also weakly performed among the traditional agricultural exports. As seen in figure 7, the category labeled "others" (comprised of mostly livestock products) is emerging as the main export sub-sector since the early 1990s dominating all crops including cotton. Sesame also leads the oil seeds subsector over the last decade as the share of groundnuts was on the decline since mid 1980s.

The decline of cotton production implies a severe loss of jobs among 120 thousand tenants and over 2 million workers, respectively, who used to be the regular direct and indirect employees of the scheme (MoFNE 2011). The depression of cotton production has clearly flattened the contribution of agriculture to exports and signals a serious loss of economic diversification. As appears in Figure 8, the average contribution of services, agriculture and manufacturing to real growth is 3.1%, 2.5% and 0.5%. That is, services; which are largely non-tradable, drive most growth (as opposed to agriculture and manufacturing). This is a clear indication of the shift of production from a broad-based and growth oriented structure towards a narrow and less inclusive growth structure.

Figure 9 shows that the share of oil revenue in the budget has surged from 8% with the advent of oil to reach 66% in 2008 before receding to an estimated 50% by 2010. Tax effort in Sudan (the ratio of total tax to GDP) has been decreasing over time even before oil. For example, between 1970 and 1998 it declined by about two thirds and averages about 6% over the oil decade. Revenues from direct and indirect taxes, mirrors this weak performance. In particular, the ratio of direct tax to GDP dropped from 1.3 to 0.64% for 1999-2010.This largely reflects shrinkage of taxable private wealth properties, which could be due to the effect of a Dutch Disease mechanism. It is noticeable that the size of the public sector keeps growing, despite the very low revenue earnings over 1984-98. As reflected by a rising trend in the stocks of publically guaranteed external debts, 5.8% of the GDP is through foreign borrowing (Figure 10).

The evolution of the government expenditure is shown in Figure 11. Government spending has experience a huge increase over the oil decade, rising from about 7% of GDP in 1999 to 17.5% for 2010. Another notable feature of the structure of government spending is the increasing share of transfers to the sub-national states. Sudan has adopted fiscal federalism since the mid 1990s, further accelerated by of the arrangements of the Comprehensive Peace Agreement (CPA 2005). It is also notable that there is a significant squeeze on goods and services spending following the fiscal reforms implemented under the IMF monitored program since 2007.

According to Figure 12, growing government expenditures have contributed to the deterioration of the budget position. A significant overall deficit has emerged, especially since 2003, similar to that of the turbulent performance of the 1980s. The government often resorts to domestic financing and non-concessional foreign borrowing for deficit financing, which are both problematic. The dependency of Sudan's macroeconomy on oil is clearly reflected by the effect of the oil price reversal following the global crisis in 2008 (see Figure 13). The fiscal deficit has widened by 3 percentage points of GDP in 2009, mostly financed by money printing. Inflation surged to 14% in 2008 following eight years of consecutive single digit inflation (see figure 1). The failure of expenditures to adjust sufficiently during the downturn of oil prices could be due to pressure on the political economy to increase spending.

Figure 14 pictures the GDP and non-oil GDP growth against the ratio of expenditure to revenue. The spending to revenue ratio appears stable up to 2005, reflecting fiscal synchronization, however, and the swings in the ratio since then largely reflects the fiscal response to the volatility of oil prices. Although the 2011 budget is prepared assuming unity, the country has lost 50% in revenue from South Sudan's oil in the second half of 2011, which immediately negativily impacted revenue. Given the emerging stickiness of government expenditures to revenue, fiscal sustanability in Sudan is seriously called into question.

The preceding review of economic performance suggests that Sudan's economy has become uni mineral by shifting export-dependence from a relatively diversified agricultural basket towards oil, which is a point resource. Despite the fact that, the real economic growth showed a strong response to the advent of oil, the structural shift of exports as well as the channeling of oil income through the public sector had brought a number of macroeconomic management challenges to the fore. Firstly, it appears that, the government largely spends oil revenues, and the emerging downward rigidity in public expenditure tends to complicate the macroeconomic response. Second, the exchange rate continues to appreciate during the oil period despite the oil price bust of 2008-09. Expansionary fiscal policy and growing aggregate demand driven by the oil boom also appear to be translated into non-tradable inflation and further exchange rate appreciation. Third, oil driven real economic growth does not seem to be sufficiently broad-based. Generally, due to this exclusion of the masses, rents can accrue to the elites. Such narrow-based growth can neither be sustainable nor can it serve as catalyst for innovative economic activities and more economic diversification.

Although, sustaining a relatively stable decade long oil-led growth episode in a post-conflict county setting is rare, (World Bank 2009), the economic performance exhibits symptoms of the resource curse. This is reflected by the increased dependency on mineral resources, high government spending, exchange rate appreciation, deteriorating budget deficit and increased inflation. These symptoms indicate major distortions in economic equilibrium arising from aggregate demand manipulation and market rigidities (i.e. government failure). This clearly indicates the conflict of a natural resources political economy. It would be more informative to further test for the channels transmitting the effects of oil to the rest of the economy including an assessment of the political economy curse. The outcome from this analysis is expected to help in the identification of pertinent policies to address the oil curse, particularly in the context of the structural shift caused by the withdrawal of South Sudan's share from the oil bourse. The next section gives a brief review of the literature on the resource curse that motivates the conceptual framework and method of the analysis.

3. Literature Review, Theoretical Framework and Methodology

3.1 The resource curse: theory and literature review

There is voluminous and sophisticated literature on the link between natural resources and growth as well as on the link between natural resources and conflict. However, the analytical framework would tie the peculiar features of oil to selected theoretical explanations drawn from this literature to understand the key channels for transmission of the oil impact to the rest of the Sudanese economy.

It is a long-standing observation that, possession of natural resources or mineral wealth, particularly oil may not lead to improvement in the population's welfare. The experience of top performers with no exportable natural resources; for example, the East Asian countries, is often cited in contrast to the economic performance of less developed countries (LDCs) that are natural resource exporters, especially, in sub-Saharan Africa. There is growing debate regarding whether natural resources are a curse or blessing, and how the abundance or dependence on natural resources could be a curse. Gelb (1988); Auty (1990); Karl (1997); Sachs and Waner (1999 and 2001); and Corden and Neary (1982), among others, have

provided articulated theoretical arguments and empirical work on these questions. Much of this work confirms the inverse correlation between economic growth and natural resource exports.

Oil is often viewed as different from other materials and natural resources based on at least three points. First, oil is the singularly strategic energy source in the world, and advanced countries are strategically dependent on less developed oil exporters. Second, oil is the largest multinational business with leading multinational firms directly and indirectly involved in oil trade and investment. Finally, the wedge between per unit cost of production and market price is very large, implying huge economic rent (Amuzegar 2011 and Al-Moneef 2006). Thus, the ownership of oil resources and the distribution of oil rents are critical for national interest and welfare.

Gelb's (1988) explanation of the resource curse is very pertinent for understanding the transformative role of oil; the author articulated a theoretical framework drawing from four strands of literature: the linkage theory; the neoclassical growth theory; the export instability theory and the Dutch Disease theory.

The linkage theory provides explanation for the role of the natural resource sector as a catalyst for growth. Gelb differentiates between three key linkages: the production, consumption and the fiscal linkages. The production linkage looks at forward and backward linkages. Forward linkages consider the potential stimulating effects from the leading sector that feed into the rest of the economy as intermediate inputs. Backward linkages look at supply industries, which involve provision of input factors, technologies, materials and services for the leading sector. In the case of oil, the effect of forward linkages could be substantial for industrialization, and hence the ability to diversify in terms of energy input and the derivative industries that provide business solutions. However, backward linkages could be weak due to specialized production technology.

The consumption linkage refers to the impact of the expenditure of resource revenue on the economy. Generally, resource income is initially more likely to be spent on new imports. Once a sufficient demand for these imports is established, it might eventually result in import substituting industries, which in turn contribute to the expansion of the productive base in the local economy, (Hirschman 1977). However, Gelb (1988) warned of the opposite impact: that higher spending on imports might compete successfully against local industries by inducing a crowding out effect. Local industries could be displaced due to a rising demand for scarce factors of production (especially skilled labor), by emerging extractive industry.

The fiscal linkage relates to whether the resource rent is state owned, with revenues being directly appropriated by government, or taxed at the export point. Hence, the actual effect of the fiscal linkage depends on (i) the size of the rent accruing to the government, which in turns depends on the bargaining power of the state and the resource extracting company; and (ii) the productive utilization of the appropriated or taxed funds to diversify the economy away from resource dependence.

The neoclassical growth theory uses comparative statics analysis based on the assumption of utility and profit maximization as well as on stable relations between inputs and outputs. Economic growth is characterized as a process of augmenting the production frontiers by enhancing the quantity of factor inputs and their efficient allocation. In many LDCs, lack of capital limits growth due to foreign exchange, savings, and fiscal revenue constraints. In this context, resource rents help to relax these constraints. However, major distortions to the equilibrium situation arising from exchange rate appreciation and inflation might shift the productive structure towards non-tradable goods and increase the dependency on natural

resources. These can be a result of government deficit, foreign exchange controls and monetary growth, (Gelb 1988).

The export instability theory considers the short run gains of high income from resources against the costs of income volatility due to fluctuations in the free market price of these resources. The stability of the income stream is especially important when the resources rents are key inputs into investments. In such cases, the volatility of the resource price can seriously compromise the saving investment link and hence economic growth. Crain and Devlin (2002) have shown that the costs associated with the inability to predict revenue fluctuations were enormous. In several cases, the huge gains accrued to resource exporting countries during booms have been engulfed during downswings.

According to the Dutch Disease theory, Gelb (1988) pointed out that, unlike other theories, a boom of the natural resource sector beyond the initial favorable impact of the resource discovery can cause a serious reallocation of resources in the domestic economy. This results in the coexistence of surging and declining sectors. Essentially the resource boom can affect the economy through two channels, (see Corden and Neary 1982). The first channel works through spending (the demand side), where the higher income resulting from the boom is spent on traded and non-traded goods leading to higher prices for non-tradables. The resulting appreciation of the exchange rate can induce imports, which make local production of these goods less profitable. The spending effect can also cause reallocation of factors of production out of the tradable sector, which will be hampered by imports, into the production of non-tradable goods, Gelb (1988). The second channel works through the supply-side due to resource movement triggered by high returns in the booming sector. Factors of production move out of non-booming activities, notably agriculture and manufacturing into the booming resource sector. In the case where there is less than full employment, competition for factors of production tends to raise inflation leading to exchange rate appreciation and a further dampening of the non-booming activities, (see also Corden and Neary 1982). This process can eventually result in greater dependence on natural resource for earning foreign exchange (Gelb 1988).

Recently Elbadawi and Gelb (2010), after reviewing the vast literature on oil and non-agricultural resources argued that, there is no all encompassing theory that best explains the fundamental phenomenon of the resource curse, the channels through which it operates, and the heterogeneity of a country's experiences. At least it takes all four approaches combined to explain the oil curse in the Arab countries (Elbadawi and Gelb 2010, 41).

The discussion in the preceding section implies that attaining beneficial production linkages could be very limited in Sudan. This makes fiscal linkages the most important determinant of the ultimate benefits from oil revenues. Generally, weak production linkages in resource rich countries are associated with political economy issues such as rent seeking, corruption, abuse of resource income for financing armed conflicts rather than investments, and neglecting the building of state institutions and professionalism. It is widely argued that resource-abundant countries are more likely to engender a political state that is factional or predatory, which distorts the economy and hampers growth in the pursuit of rents and personal gains (Auty, 2000, 2001 and 2003, Ross 1999 and Renner 2002).

Essentially the political economy approaches elaborate the 'rentier state' paradigm, which incorporates three basic mechanisms relating to the rentier effect, the repression effect and the modernization effect, (Mahdavy 1970; Beblawi and Luciani 1987 and Ross 2001). The rentier effect refers to two basic linkages working through the taxation effect, the spending effect, and the patronage networking effect. The taxation effect is at the heart of the bargain between rulers and the citizenry. In an oil dependent country, rulers may feel less need to tax their citizens because they have enough easy oil income; the citizens in turn would have

less incentive to demand accountability from their governments. The governments become less transparent, accountable and responsive to citizens. The 'spending effect' relates to the use of budgets that are exceptionally large and unconstrained to pay for the patronage and the building of loyal groups. The repression effect is concerned with the ability and interest of elites in the rentier state to use repression to pacify opposition groups and keep citizens in check though the use of military, police and security (including media control and censoring). Ross (2001) argues that rentier elites inhibit democratization through a 'modernization' effect by retarding for example, greater occupational specialization and professionalism that tend to produce more accountable governments.

Lam and Wantchekon (1999) argued that, rent seeking is not only an occupational choice, but also a political choice that affects the nature of political regimes. They investigate how economic growth, income distribution and allocation of political power simultaneously evolve when resources are discovered; and showed that an increase in the elites' distributive influence generates autocratic regimes and aggravates the decline of the economy; a phenomenon they term "political Dutch Disease."

Following the emergence of the rentier state' paradigm in the 1970's a wide and growing literature debates the conditions under which political elites prey on citizenry or promote growth and development. Wintrobe (1998) proposes a general equilibrium framework that linked political power and economic activities, to describe the choice between loyalty and repression that confront non-democratic rulers. He showed that, the equilibrium of power is determined by the dictator's preference for power, the capacity to turn money into power and the effects of the dictator's power on the economy. Accordingly, dictatorship is classified into four types: totalitarians (high repression, high loyalty); tyrants (high repression, low loyalty); timocarts (low repression, high loyalty) and tinpots (low repression, high loyalty), Wintrobe (1998). In this framework, the dictator can manipulate the budget; the more power he commands, the higher the budget. At the extremes in repression and loyalty space, a dictator can be a pure power maximizer i.e. a totalitarian or a pure personal-consumption maximizer, a tinpot. Ali and Elbadawi (2012) used a sequential non-delegation game theoretic model in which the dictator's budget depends on the value of his economy's natural resources per capita, while 'loyalty and repression' describe his preferences rather than being inputs into the power objective function as in Wintrobe (1998). This model assumes that the dictator can use resource rents to buy population loyalty though expanding public sector employment, but can also finance state security organs to repress dissent. The equilibrium solution of the model derives the relationship between natural resources per capita and the size of the public sector labor force that are consistent with the dictator's choice to remain in office. Specifically, possible reactions of power maximizing dictators depend on a given level of natural resources per capita such that the dictator sets up public employment for all levels of natural resources above this given level and chooses to repress citizenry for all levels below it. They provide empirical support for this theory, concluding that elites in less populous natural resource dependent countries tend to use public employment to buy loyalty, while those in populous resource dependent countries set up a repressive state apparatus (distributing less through the labor market).

The quantitative literature on the theories of natural resource development and conflict of distribution largely use cross-sectional global data aimed at assessing ultimate utility from resource rents. In almost all the empirical models, the results confirm the resource curse for commodity exporters (see Van der Ploeg 2006; Rodrik 2003 and Rosser 2006 and Frankel 2010 for surveys). This paper utilizes a case study approach to identify the key features that distinguish Sudan's growth experience before and after oil and to test for possible transmission channels for the oil curse (including the political economy curse).

3.2 The methodology

Most studies testing the resource curse hypothesis have been conducted in the context of a growth framework, (Sachs and Waner 1995; Manzano and Rigobon 2003; Neumayer and Papyrakis and Gerlagh). Generally, the results imply direct causation from resource dependence to low growth and little or no long-term technological dynamism for the resource dependent economies. This paper assumes that, the oil boom in Sudan influenced economic growth indirectly through its impact on the contribution of production factors and total factor productivity (TFP). Thus, the growth enhancing effect of oil is examined in terms of its contribution to technological innovations in the economy, approximated by TFP. As noted, many channels transmitting the effects of resource rents have been proposed in the literature, however, the fiscal linkages channel and the Dutch Disease channel are considered important in Sudan. Hence, the feedbacks from these channels are examined in a reasonably specified model of the determinants of TFP in the context of a before and after oil method of analysis. The credibility of the government's policies and the distributive implications of these policies are also assessed.

The following simple growth accounting equation, which assumes that, the Cobb-Douglas relation, which describes the aggregate production, is used in measuring TFP:

$$Y_t = A_t K_t^{\alpha} L_t^{(1-\alpha)} \tag{1}$$

Where, Y is the level of aggregate output, K is the level of physical capital, L is the level of labor input, A is an index for the aggregate state of technology, or total factor productivity (TFP), α and $(1-\alpha)$ are parameters measuring respectively the elasticities of capital and labor, and t is the time index. Log-differentiating Equation 1 with respect to time gives an expression for the growth accounting equation.

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \alpha \frac{\dot{K}}{K} + (1-\alpha)\frac{\dot{L}}{L} \tag{2}$$

The respective quotients denote output, capital, labor and TFP growth over time. Assuming the economy is sufficiently competitive so that factor earnings are proportional to their productivities and that the technical progress is Hicks' neutral; then α and $(1-\alpha)$ equal the factors shares in aggregate output.

Aggregate output is measured by gross domestic product (GDP) and the estimation of capital stock is based on the perpetual inventory method. Hall and Jones' (1999) method is followed to calculate the initial capital stock with a fixed depreciation rate of 9% and a gross capital formation rate of 4%. The quantity of labor is proxied by the number of actively employed, the TFP ($\frac{\dot{A}}{A}$) and α are typically statistically estimated. Equation 1 can also be log-linearized and expressed in per worker terms as;

$$\ln y_t = \ln A_t + \alpha \ln k_t, \quad y = \frac{\dot{Y}}{L}, \quad k = \frac{\dot{K}}{L}, A = \frac{\dot{A}}{A} \tag{3}$$

Where α is the long run contribution of capital to output; in this case, the growth in output per worker can be decomposed into two components relating to capital deepening and TFP growth, as in Equation 2.

The TFP by construction subsumes the effects of various factors on growth relating to the quality of inputs and long-term technological dynamism; e.g. the skill and education of the workforce, innovations and institutions. There is extensive literature on the determinants of TFP (see Isaksson 2007 for a survey). However, treating TFP as non-constant, allows the determination of pure technological parameters in the production function together with the structural factors affecting how factors of production are combined. The degree of deviations

from this long-term trend would depend on short-term factors, such as macroeconomics and expectations, (see Armando 1998). Assuming that the determinants of both TFP and the production function are non-stationary, Equation 3 can be reparameterized in the following simple vector error-correction model (VECM):

$$\partial \ln A_t = \beta_0 + \sum_{i=0}^{2} \beta_{1i} \partial k_{t-i} + \beta_2 \partial KI_t + \beta_3 \partial CGD_t + \beta_4 \partial TR_t + \beta_5 \partial KGR_t + \beta_6 \partial MY_t + \sum_{i=0}^{1} \beta_{7i} \pi_{t-i} + \beta_8 \partial misRER_t + \beta_9 \partial AD_t +$$

$$\beta_{10} \partial EXYR_r + \beta_{11} \partial FDIYR_t + \beta_{12} \partial TOT_t + \delta[y - \gamma_1 k - \sum_{i=2}^{10} \gamma_i X_i']_{t-1} + \beta_{13} D_t + \varepsilon_t$$

(4)

Equation 4 contains the determinants of the TFP in level and rate of growth including the system variables of Equation 3 and other variables. Generally, the following non-system variables are considered important. The ratio of capital imports to total imports, KI, which measures the degree of technological transfer. More import of intermediate goods allows further division of labor and hence TFP growth (Epifani 2003). The Sudanese government's share in capital imports is relatively large; hence, high KI also indicates the positive contribution of public saving to economic innovations. The ratio of net foreign direct investment to GDP, FDIYR, is also added to estimate the effect of technological transfer. The government policy is represented by three variables: the central government's overall deficit (CGD), the tax rate (TR), measured by tax effort and the government capital expenditure to GDP ratio (KGR). Higher deficit and/or tax can reduce TFP, while higher KGR augments TFP growth. MY is the ratio of M2 to GDP, it could be that greater financial deepening leads to better risk pooling and fund allocation, which increases investment and TFP growth. Inflation rate is represented by π and is expected to negatively affect TFP (Miller and Upadhyay 2001). Exchange rate overvaluation, (misRER) is included, as is the case in the wide literature on growth, to proxy misallocation of resources and trade policy distortion; an increase in the exchange rate overvaluation is expected to negatively affect growth. AD is the aggregate demand growth added on the expectation that aggregate demand growth may stimulate investment and hence TFP (Cornwall and Cornwall 2002). As suggested in the export growth-led literature, the ratio of export to GDP, EXYR, is included to indicate the impact of export growth on TFP. The ratio of non-oil export to non-oil GDP is also used. High capital labor ratio (k) is expected to increase TFP. The β's are short run coefficients and δ represents the speed of adjustment to the long run output path. D_t, a dummy variable, equals one over the oil production period and ε_t is IID errors.

The long run part of the equation is estimated by Johansen (1988, 1992)'s cointegration method and the dynamic part is the estimated by the OLS method. In order to avoid potential simultaneous equations bias, the dynamic model is estimated with two lagged terms on capital per worker as well as with a lagged term on inflation and the ratio of the government capital expenditure to GDP.

The results from growth decomposition are used to review the contribution of factor inputs and technological change to economic growth before and after the oil boom. The oil dummy D_t is interacted with each right hand side variable of Equation 4 to account for the regime-shift (controlling for the effect of the given predictor). Thus, the equation provides a framework for analyzing the effects of the fiscal linkages and the Dutch Disease on technological innovations and real growth. The presence of positive fiscal linkages due to channeling of oil income through the public sector is expected to increase government saving (reduced deficit), decrease inflation, enhance financial deepening, prevent real appreciation of the exchange rate and the loss of competitiveness. This would require the coefficient on the

regime shift dummy as well as the coefficients on the CGD_t, π_t and MY_t interacted with this dummy to enter significantly positive. Significant negative coefficients on these variables would indirectly lend support to the rentier state hypothesis. That is, the allocation of oil money is driven by political spending sprees, leading to a systematically unbalanced budget over the business cycle and eventually translating into less growth and innovations in the economy. In order to avoid the problem of multicollinearity, the interaction terms are tested iteratively. The test statistics are evaluated for the individual coefficients on the interaction terms and for the regime shift dummy.

The presence of the Dutch Disease mechanism is tested by the interaction terms on the real exchange rate misalignments; inflation; the fiscal deficit and non-oil exports. Significant negative effects of these variables on TFP growth would provide evidence of the presence of the disease. As shown in Rickne (2009), the real appreciation of the exchange rate and the risk of the Dutch Disease increase with the degree of oil dependence, but good governance and institutions weaken this relation.

However, the political economy variables are not directly controlled for. It is generally hypothesized that fiscal laxity, budgetary indiscipline and spending myopia, which are usually associated with bad governance of an oil based economy dominated by patronage politics, would result in a strong countercyclical budget balance and procyclical spending and revenues.

In such a loose institutional setting, the credibility and consistency of government policies would be seriously undermined. Kydland and Prescott (1977) have used a game theoretical approach to frame the credibility problem of government policy as a problem of time inconsistency. Generally, the inconsistency between the 'policy plan' and 'policy outturn' worsen when the government does not have credible technology of commitment, and the private sector has a rational expectation about the government's policy (Cho and Matsui 2005). Nonetheless, three simple tests are applied to assess the 'credibility' of a fiscal response to the oil boom in order to highlight the associated fiscal management challenges. First, the 'credibility of the budget' as defined in the Public Expenditure and Financial Accountability (PEFA 2005), framework is used to discern the strength of the Public Financial Management (PFM) system. A firm PFM system is essential for fiscal discipline, efficient resource allocation and for the implementation of policies and plans consistent with achievable developmental objectives. Credible budgeting remains an important tool in this process; however, due to data limits, the first and the third performance indicators within the PEFA-PFM framework are used to assess, in aggregate, whether the budget is realistic and implemented as planned. Significant deviation of budgetary outturns from the originally approved budget, on both the revenue and spending sides, indicates low credibility of the budget and weak fiscal discipline and institutions.

Second, Granger causality between revenue and spending is applied to determine the extent to which the volatility of oil prices drives the economic cycle through government expenditures. Evidence on causation from revenue to expenditure suggests that the fiscal policy reaction to oil price changes amplify the business cycle in an economy (see Fasano and Wang 2002). The following simple error-correction model (ECM) is used:

$$\Delta \mathrm{R}_t = \delta_0 + \alpha_0 \Delta \mathrm{E}_{t-1} + \gamma_0 \Delta \mathrm{R}_{t-1} + \kappa_0 [\mathrm{R}_t - \beta_0 \mathrm{E}_t]_{t-1} + \mu_t \tag{4}$$

$$\Delta \mathrm{E}_t = \delta_1 + \alpha_1 \Delta \mathrm{E}_{t-1} + \gamma_1 \Delta \mathrm{R}_{t-1} + \kappa_1 [\mathrm{E}_t - \beta_1 \mathrm{R}_t]_{t-1} + \varepsilon_t \tag{5}$$

Where, R_t is revenue; E_t is expenditure; δ, α, γ and κ are coefficients, μ and ε are IID errors. The terms in the square brackets refer to the cointegrating vectors of revenue and expenditure and the confidents κ's represent the disequilibrium errors measuring the short-run speed of

adjustment to long-run revenue and expenditure in the respective equations. Significant estimates of the α_0 and κ_0 in equation 4 and γ_1 and κ_1 in equations 5 can indicate the direction of causation either (from expenditure to revenues or from revenues to expenditure). For example, statistically significant coefficients on either ΔE_{t-1} or the error correction term, κ_0, or both indicate that revenue causes expenditure, hence, supporting the revenue-spend hypothesis. Similarly, from equation 5 significant coefficients on either ΔR_{t-1} or the error correction term, κ_1, or both suggest that changes in government expenditure causes changes in revenue, confirming the spent-revenue hypothesis (Peacock and Wiseman 1961). In case the relevant coefficients from equations 4 and 5 are both significant, the fiscal synchronization hypothesis is confirmed (Musgrave 1966). Absence of causality suggests that the authorities set revenue and expenditure by rule of thumb reflecting the institutional separation of allocation and taxation functions of the government (Hoover and Sheffrin 1992). Both ΔR_{t-1} and ΔE_{t-1} are interacted with a dummy over the oil period to account for a possible shift in the constant and the slopes. The variance decomposition analysis is also used as a robust check for detecting the direction and strength of causality between revenue and expenditure over the whole sample.

Third, as credibility is a critical factor for any government policy, it would be informative to test whether the recently introduced exchange rate–based rule succeeded in anchoring inflation. Since 1970, the Sudanese authorities continued to intervene in the foreign exchange markets with various motives, but maintaining low inflation and a stable exchange rate are often emphasized as achievable goals. After the experience of three-digit inflation over 1991-97, the authorities focused more on fighting inflation through exchange rate-based stabilization. Of course, the inflow of oil income made the realization of this objective viable, but the government may be tempted to engage in excessive spending sprees (for example to manipulate political popularity); the public response would result in high actual and expected inflation. Thus, the success of the exchange rule in anchoring inflation depends on the public perception of its credibility, which, in turn, determines agents' expectations about future inflation (Edwards 1998). Following Elbadawi (1997) and Edwards (1998) a model free measure based on Cochrane's variance ratio statistic is developed to test whether the degree of inflation inertia declined after the introduction of the anchor.

Cochrane's variance ratio measures the importance of the random walk for a given time series, and is defined as;

$$Var(k) = (1/k)\{\text{var}(\pi_t - \pi_{t-k})/\text{var}(\pi_t - \pi_{t-1})\} \tag{6}$$

That is, if the series is generated by random walk process, the variance of its k-differences would be k times the variance of its first difference. While point estimate of the variance-ratio is used the variance ratio test statistic (a Z-statistic) proposed by Lo and MacKinlay (1988) for testing the null of random walk, is also calculated for various k's.

The political economy implications of oil rent distribution are explored in terms of budget allocation. As in the revealed preference approach, actual budget allocations before and after oil are assumed to reveal the elites' preferences for trading-off loyalty for repression. Specifically, more allocation to public employment (e.g. high public wage bill), as well as to state governments and public services are interpreted as favoring loyalty; whereas less allocation to these categories and more security spending implies predilection for repression.

4. Results and Discussion

4.1 The effects of oil dependency on growth

The result of the growth accounting decomposition for Sudan using the primal approach of Equation (3) is presented in Table 1. The nonlinear estimation of α using Equation 1 is 0.21, which is positive and statistically significant, but is low; hence following the literature α is set at 0.3. The periodization shown in the table is adopted from Table 6 in Ali and Elbadawi (2003) for comparison's sake. The results in both tables are very similar in terms of the order of magnitude, notwithstanding the differences in the definition and measurements of the variables. Two observations could be made from the table. First, the growth of real GDP is very low and volatile alternating between periods of positive and negative growth.

Second, although the TFP growth improves overtime, it remains broadly negative for the whole sample implying that economic growth in Sudan is mainly driven by physical capital per worker. The positive TFP growth over 1975-79 and 1990-97 corresponds, respectively, to the high inflow of capital in connection with the breadbasket strategy and the commercial production of oil. The strong average growth spell after the rise of oil, 1997-2010, compared to the sub-period before oil, 1961-96, seems to be largely explainable by the TFP growth and capital accumulation; the contribution of labor is 0.1 percentage point lower, implying that the oil-sub period has witnessed, on average, less growth in employment. See Ali and Elbadawi for further analysis of the growth patterns and performance corresponding to major economic and political changes marked by the opening of each sub-period.

Table 2 presents the results of the estimation of the dynamic equation of the TFP. The Augmented Dickey Fuller test, not reported, confirmed that all the individual variables included in the long-term part of the TFP equation contains unit roots except the ratio of the fiscal deficit to the GDP (CGD), which turns out stationery. An unrestricted vector autoregression with two lags is used for cointegration analysis with the CGD, the TOT and the ratio of FDI to GDP (FDIYR) entered as exogenous; the rest of variables are endogenous. The results reveal that there is more than one long-run relation in this system of variables. However, rather than estimating the full VECM, a single equation is used in the context of an open system, which assumes there is one cointegrating vector and all the other variables are weakly exogenous to the variable of interest (Johansen1992). While the single equation is theoretically and asymptotically less rigorous; it has its own practical appeals in terms of avoiding the problems of small sample size and high dimensionality as well as the problems of interpretations due to the challenges of building a theoretically consistent full VECM for the included variables. It is important to note that the insignificant error correction term in the TFP equation indicates that the contribution of the evolution of the long-run fundamentals to economic innovations is very insignificant, (see Armando 1998 for a similar result).

In order to check for the statistical robustness of estimated determinants of the TFP, Equation 4 is also estimated as a growth equation noting that both dynamic models are obtained from a common VECM. Both estimated models passed serial autocorrelation, heteroscedasticity and normality diagnostic testing. In addition, all the regressors are also checked iteratively in rate of growth for multicollinearity, in all the runs the estimated variance inflation factors are less than four. The results of these tests imply that the estimated equations reasonably track the data. As seen in column 1 in the table, all the estimated coefficients for TFP have the expected signs, however their individual statistical significance varies. The growth of capital per worker enters significantly up to the third lag in TFP equation, the sum of the dynamic coefficients is 0.131, indicating that capital deepening is an important source for innovations in Sudan. There are also strong positive feedback effects through aggregate demand suggesting that spur in aggregate demand enables producers to better utilize the spare and excess capacity and hence expand both productivity growth and employment. Similarly, the

growth of capital imports in total imports, the rise of the share of government spending on infrastructure and the growth of FDI positively contribute to TFP growth, however their estimated coefficients are not statistically significant. The effect of the growth of tax and deficit as well as the misalignments of the exchange rate, the changes in the terms of trade, financial deepening and inflation are negative, however their respective coefficients are statistically insignificant. The oil dummy is estimated positive, confirming an upward shift of the TFP function resulting from the rise of oil production (but this too is insignificant).

The estimation results of the growth equation, column 2, are very close to those obtained from the TFP equation. Some insignificant determinants of TFP are more significantly estimated in the output growth; for example, the coefficient on the budget deficit is estimated at 0.555 indicating that a one percent increase in the deficit significantly reduces real output growth by about 0.6 percentage points per year. The negative correlation between the budget deficit and real growth in Sudan may be due to the high crowding out effects of private investment through reduced access to bank credit. In addition, the effect of the financial deepening (M2/GDP) on real growth is estimated to be negative and significant. This could be due to the negative effects of continued government intervention in the process of financial intermediation. The banking sector in Sudan is largely state-owned and government intervention goes beyond ownership to include: direction of credit, bank regulation and supervision, direct lending and subsidization of troubled banks (as in the case of Omderman National Bank) (see IMF 2010). These practices tend to hinder access to financial intermediaries, reduce their contribution to growth and turn them into quasi-fiscal instruments.

The intercept shift dummy is positive and significant implying that real growth has been much stronger following the oil boom. The short-term demand is also an important determinant of economic growth (in line with the Keynesian view of aggregate demand-led growth). The contribution of exports to real growth is positive, but insignificant. The growth equation is also estimated with non-oil exports rather than total exports; the result is reported in column 3. In this model, the coefficient of non-oil exports turns out to be negative, but insignificant; and the real exchange rate misalignment becomes significantly negative. This result implies that, appreciation of the real exchange relative to its equilibrium path negatively affected non-oil exports and hurt growth, and that RER misalignments appear serious in Sudan. This clearly indicates the inconsistency of macroeconomic policies.

The oil dummy is interacted with each right hand side variable of the TFP equation. This is in order to account for the shift in the slope of the given predictor due to the oil boom. The results are reported in the last column of Table 2.

The coefficient of the interaction term on the fiscal deficit, CGD_t, is estimated to be positive. The imposition of joint zero restrictions on this coefficient and the oil dummy, as well as a zero restriction on the slope reject, suggests that the fiscal deficit has been reduced over the oil period. This is reflected by the significant positive contribution to TFP growth. However, the interaction term on taxation is negative and the joint zero restriction rejects implying significant increase of tax burden on TFP growth. It appears that, the improvement in the budget balance is due to the appropriation of oil revenues through the state rather than reflecting improved fiscal prudence. In fact, tax effort has declined by about 2 percentage points over the oil sub-period, while tax burden on TFP growth has become even more significant. The proliferation of rent seekers lobbying for tax exemptions may provide one explanation of this paradox. Tax exemptions have substantially increased after the advent of oil relative to the period before. The IMF estimates show that Sudan has lost over US$ 207 million in 2002 alone because of tax exemptions (Sudan PANA 2002). It is arguable that, relaxation in tax holidays without, for example, evidence of positive spillovers in innovations

and growth largely reflects the abuses of these tax exemptions by rent-seekers (particularly the political elites who bargain for trailed tax cuts). The other explanation is that, low tax effort reflects weak tax administration and substantial evasion; taxes may be evaded out of greed, or due to the grievance and resistance of the taxpayers to fund a government they consider badly governed and corrupt. Of course, both explanations may apply in the case of Sudan.

The interaction term on the financial deepening is estimated negative, but insignificant. The joint zero restrictions on this coefficient and the intercept accept shift. However, the coefficient on financial deepening turns significantly negative when the interaction terms are included for tax and government deficits. This result support the earlier claim that, the commercial banks in Sudan are 'quasi-fiscal' and that the distortive effects of fiscal operations crowd out private investments through reduced access to bank credit.

Inflation growth entered the TFP equation negatively; both contemporaneously and with lag; the interaction term is also negative, although none of these coefficients is statistically significant at the conventional level, the findings show that inflation runs loose in the economy. This implies that, unless macroeconomic management substantially improved, growth will not be sustainable in the long run.

Although capital per worker positively contributes instantaneously and with lag to TFP and real growth, the instantaneous contribution of government spending on public capital is estimated to be significantly negative in both equations, and the lagged effect turns out to be positive and insignificant. The interaction term on this variable is negative and statistically insignificant. This result may be due to the specialized nature of public capital, or that its provision is largely driven by the myopia of the state politicians. In both cases, public capital needs time to be readapted to business needs.

Overall, the positive fiscal linkages of oil are weak in Sudan. Channeling oil income through the state sector though has enhanced government saving and contributed to real growth. It also concealed serious macroeconomic mismanagement due to high inflation, relaxed and inefficient taxation, very low financial deepening and less coordinated provision of public capital; all of which negatively affect TFP and real economic growth. Moreover, the shift towards greater export concentration further complicates macroeconomic management. The interaction coefficient on the terms of trade (in both the TFP and real growth equations) turns negative and near significant over the oil sub-period, while the coefficient for the pooled sample becomes positive. This could indicate that, export concentration due to oil reduces the capabilities of the government to manage the external volatility of the terms of trade, which is transmitted into negative TFP and real growth. Given the negative interaction coefficients on aggregate demand and on the ratio of capital imports to total imports, further evidence on procyclicality, that is spending grew more than output growth, is expected to seriously reduce TFP growth.

The impact of Dutch Disease mechanisms on the TFP equation is less obvious. The results show that overvaluation of the RER is relatively moderate after oil than before, hence a positive, though insignificant, interaction coefficient on RER misalignments. This suggests that competitiveness, as reflected by the country's overall economic efficiency; use of productive resources is not affected. The buildup of foreign reserves made possible by oil has enabled the Central Bank to undertake serious reforms regarding the foreign exchange market. The multiple exchange rate arrangement was abolished and a managed (intermediate) exchange rate regime was introduced to control inflation. However, it appears that the sharp depreciation of the official exchange rate made by authorities to unify the exchange rate systems has increased the domestic price of imported capital, which, as shown, is very important for TFP growth. However, after introducing the interaction term for RER

misalignments; the contribution of capital deepening to TFP growth becomes significantly negative, the sum of the dynamic terms is -0.01 implying 0.123 percentage points loss compared with its contribution in the benchmark model. Thus, the feedback-effects of the RER misalignments have resulted in a loss of competitiveness as reflected by the net reduction of overall technological efficiency in the economy. Moreover, the negative impact of inflation on TFP indicates continued distortion of the relative price signals.

The next section reviews the credibility of the fiscal stance, as indicated by credible budgeting, sufficient countercyclical fiscal policy, and credible commitment to maintain low inflation and a stable exchange rate. It also considers the political economy related issues underlying budget allocation.

4.2 The fiscal management challenges

Sudan's macroeconomic performance has become highly dependent on oil due to the channeling of oil revenues through the public sector. This contributed to, on average, 48% of total revenues in 1999-2010. The critical issue is that the allocation of oil income through the budget usually imparts the volatility of oil prices to the rest of the economy, thus posing serious fiscal management challenges. Examples include less synchronized revenue and expenditure decisions, strong procyclical expenditures, low credibility of the budget and government plans and serious distribution conflicts between politicians and the Sudanese polity. The following issues are briefly reviewed: the credibility of the budget, the degree of pass-through of the oil cycle, credibility of the rule based exchange rate stabilization introduced since 1998, and political economy implications of the budget.

4.2.1 The credibility of the budget

An overview of the public financial management systems and institutions is presented in order to provide background information on the management of the public finance in Sudan.

Background: The Interim National Constitution (1998) and the Comprehensive Peace Agreement (2005) provide the overall framework for Public Finance Management (PFM). The Medium Term Economic Program (MTEP), effectively adopted through 2005-2010, is based on these two documents. It continues to furnish a comprehensive outline for fiscal management and is updated annually.

The institutions of public finance have a long history in Sudan, and are product of legal, political and administrative mechanisms. The legal and constitutional bases of the PFM are enshrined in the Financial Accounting and Procedures' Law of 1977, which was amended in 2006 to accommodate the CPA financial provisions. Some government units perform some fiscal functions without legal basis due to the long history of financial management in the country (Badawi 2008).

The budget planning, execution and monitoring are based on different articles and chapters of the 1977 Procedures' Law. The Ministry of Finance and National Economy (MoFNE) is entrusted with budget preparation. MoFNE follows nine steps in the budget process, starting in mid-July up to mid-December each year. The process involves the formulation of macroeconomic committees, preparation of a macroeconomic framework, initiation of the budget proposal, discussion of the proposal, completion of the budget draft, approval of the draft, discussion with representatives from the civil society, submission of the budget to the council of ministers, submission to the national assembly and finally the approval of the budget by the parliament. However, not enough time is allocated to each stage (Badawi 2008).

Historically, the budget followed economic classification by sectors and categories. Eleven sectors are included, and are further aggregated into four spending chapters. Chapter one includes wages and salaries; chapter two encompasses spending on goods and services;

chapter three provides transfers to states and chapter four contains development spending. The MoFNE started to adopt the cash based Government Financial Statistics Manual (GFSM) in 2007. Despite the move to deepen (GFSM), the existing system of budget classification is not consistent with categorization of spending by functions and hence complicates the link of the budget to macroeconomic and other national targets (Badawi 2008).

Different departments of the MoFNE coordinate execution of the expenditure side of the budget. Recurrent spending is carried-out by the Directorate of Budget and Finance; the Directorate of Development is entrusted with development spending and the monthly cash disbursements are administered by the Cash Management Unit.

Budget monitoring and accountability is coordinated and supervised by three institutions, the National Audit Chamber (NAC), internal Auditing and the National Legislature. The NAC sets the accounting standards for the whole country, and is appointed by the President of the Republic with the approval of two-thirds of the National Assembly.

Three special fiscal institutions are created to assist in the management of oil revenue: these are the Oil Revenue Stabilization Account; Fiscal guidelines and Fiscal Responsibility Legislation; and the Benchmarking of oil price for the budget envelope. The efficient budgeting of oil (especially insulation of the economy from the oil-cycle) is set as top priority.

Assessment of the credibility of the budget: Sudan yet has not completed a PEFA assessment, which requires comprehensive measurements of the following dimensions of the PFM: credibility, comprehensiveness and transparency of the budget; policy based budgeting; predictability and control in budget execution, accounting, recording and reporting; external scrutiny; and audit. Notwithstanding, a partial review of the first dimension of the PFM is presented in Table 3 for the first and third performance indicators of budget credibility. The result is not based on a standard format, but would give a sense of the overall budget performance in terms of PEFA scoring.

Part A, of the table relates the aggregate expenditure out-turn to the original approved budget. This reflects the ability to implement the budgeted expenditure as a crucial factor in supporting the government's ability to deliver public services for the year as expressed in policy statements, output commitments and work plans. The rating of the first three years, 2002-04 would score D, whereas the scoring for 2005-07 and 2008-10 could be C and B respectively. This indicates improvement over time. Part B shows the aggregate revenue out-turn compared to the originally approved budget. Accurate forecasting of domestic revenue is a critical factor in determining budget performance, since budgeted expenditure allocations are based upon that forecast. The performance of revenue over time is in sharp contrast to that of expenditure where the scoring declines from A for the first three years to C for the other sub-periods respectively. Low quality revenue forecasts have led to considerable deviations between actual and budgeted revenue leading to expenditure rationing. This indicates that the special fiscal institutions (created after oil) are ineffective in managing oil revenue. Overall, the budgeting process lacks realism, which is attributable to weaknesses of the fiscal discipline, expenditure control, and budgetary planning.

4.2.2 The fiscal response to the oil cycle

The fiscal response is largely concerned with the changes in government revenue and spending that affect economic activities. It is known that the allocation of oil revenues through government spending usually imparts the volatility of oil prices to the rest of the economy. In addition, the low credibility of the budget would further complicate the fiscal response to the oil boom due to weaknesses in the fiscal institutions.

As seen all the variables are very volatile; the GDP cycle tends to dominate revenue and spending up to mid 1980s, afterwards revenue and spending become more volatile and begin to dominate the business cycle. The instability of both series remarkably increased over the mid-1980s to late1990s, reflecting the effects of highly turbulent events during this period, which include a series of government changes, outbreak and intensification of the civil war and successive drought episodes. These factors combined have resulted in serious economic bottlenecks, inefficiencies, social frustrations and tensions. It is notable that the fluctuation of the three series tends to stabilize following the start of oil production; and further dampened around 2005 (the year of sealing the CPA). Then, high instability (similar to that of the mid-1980s) ensued. The positive growth of revenue and spending far exceed that of output in 2004-08, suggesting that the fiscal variables amplify the business cycle rather than move countercyclically as expected. It is difficult to infer direction of causation from the figure, however as suggested earlier, Equations 4 and 5 are used to test for the direction and strength of causality between revenue and expenditure; the result is shown in Table 4.

According to the ADF test (not reported), the log level of revenue and spending contains a unit root, however according to Johansen testing, the null hypothesis of no cointegration cannot be rejected. This may be due to structural changes in the cointegrating vector. Hence, the oil dummy is added as an exogenous forcing variable to allow for this. The cointegrating vectors are estimated with an unrestricted constant and trend. The result is shown in the last row of the table. The imposition of over identifying restriction on the revenue equation; i.e. $\beta_0 = 1$ rejects, (Chi-square 8.306 with a p-value of 0.004). This implies for the full sample that, government expenditures will always be greater than revenue; the deficit is weakly sustainable and the government will not be able to clear its long run debt without compromising its long-run development objectives. As noted by Hakkio and Rush (1991), $\beta_0 = 1$ is necessary for the government to remain solvent.

The estimated error-correction models for revenue and spending reasonably pass the standard diagnostic tests and confirm bi-directional causality between revenue and expenditure for the full sample (see first column for each equation). The variance decomposition is calculated to further ascertain the direction of causation; Table 5 presents the result. As seen from the expenditure equation, more than 80% of variation in expenditure is accounted for by past revenue, whereas 42% is accounted for by own innovations. This pattern is consistent throughout the sample except for the first two years. However, for the revenue equation, it is clear that own innovations accounted for over 94% of forecast error variance for long time, while about 20% of variation is accounted for by past expenditure. The result from variance decomposition analysis supports the conclusion that the revenue-spent hypothesis persists in Sudan. Such inconsistency of the causality test and variance decomposition may be due to a structural break. As suggested earlier, the ECMs are re-estimated including the oil dummy and the interaction terms; the result is shown in the second column for each equation. The bi-directional causality disappears and none of the coefficients of interest is statistically significant. This finding indicates the existence of a considerable institutional separation between the allocation and taxation functions of the government. More importantly, it reveals that actors with divergent and very conflicting agendas dominate the state-sector (Hoover and Shefrin1992).

It should be noted that, the framework of Equations 4 and 5 does not account for issues of control and fiscal sustainability. However, the data tracking reveals that revenue and expenditure decisions are more mutually causal for the full sample than over the oil sub-period. The deterioration of the fiscal foresight after oil is mainly due to a lack of coordination among fiscal institutions and greater separation of revenue and expenditure decisions, which reflect the dominance of the state-driven myopic spending. It is also

expected that the weak fiscal performance and strong procyclicality of spending would cause the oil cycle to spillover to the real exchange rate. The extent to which this process affects the credibility of the on-going rule based exchange rate as a stabilizing intervention is indirectly tested in the next section.

4.2.3 The credibility of the exchange rate regime

Sudan adopted fixed exchange rate regime in 1957, which at the time was a prerequisite to access to the IMF. This arrangement remained effective for about two decades, however due to the balance of payments crisis that followed the collapse of the breadbasket strategy and mounting pressures on the foreign exchange market, a new era of multiple exchange rates and exchange controls started in late 1970s. The advantages of the multiple exchange system turned out to be less proportionate to its costs. This was due to incompatibilities between fiscal and monetary policies and the illegal leakages between floating and fixed exchange markets. A series of exchange rates unifications, effected through devaluations, were attempted in 1979, 1987, 1992 and 1997, but were largely unsuccessful. The difference between official and free market rates continued to widen and the value of local currency continued to deteriorate, reflecting major distortion in the economy. In 1998, another unification policy was introduced and the foreign exchange rate controls were relaxed. The rise of oil money and the buildup of foreign reserves have made this policy more successful in comparison to previous attempts. The Central Bank started to use 'Foreign Exchange Operations' for liquidity mopping up operations due to the absence of indirect monetary instruments following the adoption of Islamic banking in 1983. A dedicated chamber for foreign exchange dealing was established in 1999 for this purpose.

Notwithstanding the rule-based exchange rate stabilizing intervention, inflation appears instable as reflected by its negative effects on the evolution of TFP and real economic growth. In addition, the preceding descriptive review of the macroeconomic performance reveals that the exchange rate overvaluation continues to grow over the oil period. This is despite its relatively moderated effect on TFP growth. These conclusions raise concerns about the effectiveness of the nominal anchor and about the optimal exchange rate regime for Sudan, especially in view of the evidence on strong procyclicality of fiscal variables. Generally, the optimality of the exchange rate regime in an oil-based economy is largely determined by its capacity to support an effective counter-cyclical policy to insulate the non-oil economy from oil price volatility and medium-to long-term cycles (Boughrara and Elbadawi 2011).

The credibility of the exchange rate based- anchoring of inflation is tested using Equation 6; the result is portrayed in Figure 16. The periodization roughly corresponds to three different patterns of inflation developments. The sub-period 1970-89 is dominated by moderate double-digit inflation; then there was a process of low triple-digits inflation over 1990-1998 before it receded to single and low double digits growth for the oil sub-period 1999-2010 (Suliman 2010).

Broadly, the plots confirm the importance of the permanent component of inflation for Sudan. The Z-statistic and heteroscedasticity correct Z, not reported, confirm the random walk hypothesis for inflation for all sub-periods (i.e. inflation is I(1)). The relatively high values for $V(k)$ over 1990-98 reflect three digit inflation episodes. Since the exchange rate-based anchoring policy is only relevant for 1999-2010, it appears that there is no strong evidence on the success of the anchor in reducing inertia. The persistence of inflation is even higher during the sub-period compared, for example, with 1970-89; thus, the exchange rate-based stabilization did not sufficiently reduce inertia. This result is also consistent with earlier findings on the low credibility of the budgetary process. Given the evidence on narrow and weak fiscal linkages of oil, and the need for effective counter-cyclical policy, a more flexible

exchange rate regime could be adopted in tandem with the use of an efficient indirect monetary instrument.

The political economy of oil rent distribution: The impact of oil on the Sudanese political economy deserves a separate investigation, notwithstanding, the political economy implications of oil rent distribution are explored in this paper in terms of budget allocation. Though, the budget is not credible enough as argued above; it reveals the elites' preferences for trading-off loyalty against repression. As seen in Table 6, security spending as a percentage of GDP surged by an average 1.6 percentage points during the oil decade (1999-11) up from 2.6% before oil (1989-98). Additionally, the wage bill (a proxy for public employment), states transfers and public services increased in percent of GDP, respectively by 1.2, 2.6 and 0.2 percentage points, between these sub-periods. Despite that the growth of transfers to state governments is higher in percentage terms than the other spending categories; it is the lowest in terms of volume; declining by about 134 percentage points, whereas the volume growth of security spending, the wage bill and public services dropped, respectively, by about 56, 61 and 130 percentage points.

This confirmed that the share of security spending is high and shows the strongest volume growth inertia over time. One major explanation for such high security spending growth is the civil conflicts that beset Sudan. This cause, however, might provide explanation only up to 2005 whereby the CAP is sealed. The voluminous growth of security spending in post CAP suggests that peace dividend had not materialized in Sudan and clearly reflects the continued involvement of the military in the political system, which in turn, compromises the ability of other competitors for rent seeking. Accordingly, prioritization of government spending does not favor public employment or provision of public goods and services that complement the markets and provide access to all. The share of the public wage bill in the government budget is small and continues to decline in volume over time. Spending on public services, which includes, among others, infrastructure, education and health is volatile and exhibits negative volume growth for 2010-11. It is known that, prioritization and upgrading of these services are at the heart of accelerating the achievement of the MDGs. Similarly, the volume growth of transfers to state governments continues to decline over time and becomes negative in 2011. Such a pattern of transfer is not consistent with the envisaged constitutional transfers that require 'equalization grants from National Revenue Fund (to have been) been promptly transferred to respective state governments' (Elbadawi and Suliman 2010). Moreover, transfers to states show the highest volatility (measured by coefficient of variation) reflecting a patron-client relationship between the federal and state governments, whereby transfers are determined by the loyalty of state governors rather than by constitutional mandate.

Prioritization of security spending is clearly reflected in the 2011 budget despite the 36% revenue loss due to South Sudan's separation, which is a serious fiscal shock. Security spending is up 1.4 percentage points from its share in 2010. In the face of this, growth volume of GDP allocation to public sector employment, states transfers and public services turns out to be negative amounting to -7.2%, -1.8%, -4.1% and -99.5%, respectively. This result suggests that the state elites prefer repression when tides are worsening. It is clear that, the distributive consequences of the political elites' power maximization or power loss minimization as reflected by budget prioritization are inconsistent with job-creating growth, investment promotion, deepening market penetration, and poverty fighting and hence are unsustainable in the long-run.

Security expenditures may swell in response either to neighborhood arms races or to patronage demands of politically powerful military establishments (Collier 2006). Elbadawi et al (2008) use a game theory model to frame the arms races between North and South

Sudan. Their findings show that excessive militarization is a rational response for both countries, neither of which can credibly commit to lower security spending under imperfect information. They showed that these credibility issues could be resolved by democratization. Collier and Hoeffler (2002) develop and estimate a model regarding the risk of civil war. After controlling for the risks of internal and external conflict, their results show that security spending in military dictatorships is much higher, at 2% of the GDP, compared to democratic governments. This is suggesting that such spending is essentially driven by patronage rather than motivated by purchase of efficiently delivered services. Notwithstanding the motives for military spending growth, Knight et al (2006) found that, on average, a one percent reduction in military spending increases the growth rate for a period. This eventually leads to an increase in income of 8.3 percent. For LDCs, this positive effect of military spending cut on income is probably even higher than the global average.

The oil rent distribution strategy chosen by the state elites is consistent with the theory and empirical analysis of Ali and Elbadawi (2012), which shows that governments with low natural resources per capita, as in the case of Sudan, tend to set up state security organs and keep public employment low. The opposite is true for governments with high natural resources per capita. It appears in the case of Sudan that, the political monopoly generated by the elites' distributive influence results in job-less growth; exacerbates the needs for restructuring in the face of shocks; crowds out private investment; drives down value addition growth and further undermines the prospects for institution building and sustainable growth.

5. Conclusions and Policy Implications

This paper drew selectively from the theoretical explanations discussed in the literature on natural resources in order to understand the key channels for the transmission and propagation of the impact of oil on the Sudanese economy.

The method of investigation utilized a combination of growth accounting and time series analysis to identify the key features that distinguish growth records before and after oil and to test for possible transmission channels of the oil curse in Sudan including an assessment of the underlying political economy related issues behind the chosen distributive policies. The complexity of quantifying the multidimensional aspects of the oil impact, blessing or curse, is duly acknowledged. The following conclusions are drawn from the results of the analysis:

First, the contribution of the oil boom to real economic growth has been strong; however, its effects on the TFP growth (which is an important indicator for 'deep-seated' technological innovations and dynamism) are insignificant. The Dutch Disease channel and fiscal linkages are the main mechanisms for the transmission of boom's negative effects to economic innovations and real growth in Sudan.

Second, the misalignments of the RER (a key transmission channel of the Dutch disease), have resulted in an overall loss of competitiveness approximated by the negative contribution to TFP growth. Moreover, the impact of inflation on economic innovations and real growth both before and after oil is negative, reflecting the continued distortions of the signaling. In this context, the authorities' attempts to anchor inflation expectations using rule-based exchange rate stabilization are largely unsuccessful.

Third, the depression of cotton cultivation due to the rise of oil production signals a serious loss of economic diversification. The resultant export concentration reduces the capabilities of the government to manage the external volatility of the terms of trade, which negatively affects economic innovations, real growth and can severely damage economic diversification in the long run.

Fourth, the allocation of oil revenues through the public sector has presented many fiscal management challenges. The budgeting process tends to be more dominated by bargaining

and conflicts of distribution, which results in high discretionary expenditure (with the purpose of increasing resource leakages) and a strong procyclical response to the business cycle. In addition, the dominance of conflicts of distribution over the budget appears to have resulted in a greater separation of the institutions of the allocation and taxation functions of the government after oil than before.

Fifth, the credibility of the government, approximated by the credibility of the budget and the government announced commitment to maintain low inflation and a stable exchange rate, is very much reduced after the oil boom; which further complicates the macroeconomic management with obvious implications for long-term growth sustainability.

Finally, oil rent has significantly reshaped the incentives and constraints facing the political elites in Sudan. Notwithstanding that oil boom has supported growth, the perverse political incentives generated by the regime's survival behavior result in job-less growth, aggravate the needs for restructuring in the face of shocks, crowd out private investment and undermine value addition. Such polity is not sustainable in the long-term.

These conclusions imply that institution building, political liberalization and pluralism, and prudent fiscal, monetary and exchange policies for macroeconomic management are imperative for growth enhancing reform.

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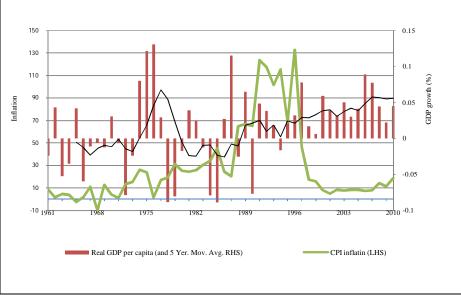
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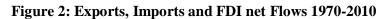
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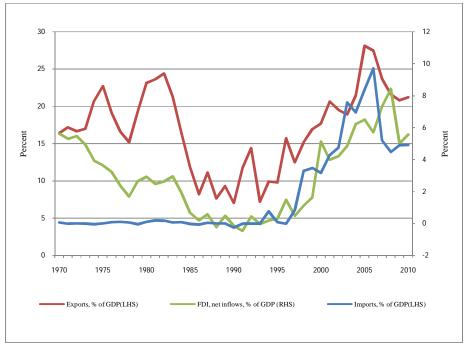
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Figure 1: Real GDP Growth, Inflation 1960-2010

Source: Sudan Central Bureau of Statistics and World Bank database

Figure 2: Exports, Imports and FDI net Flows 1970-2010

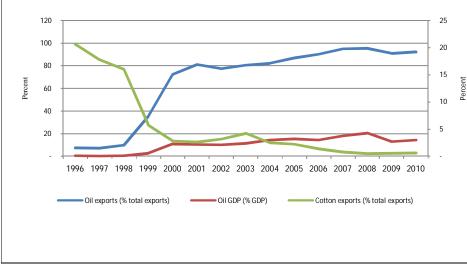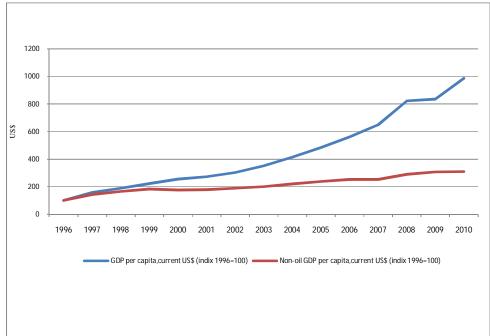Source: Sudan Central Bureau of Statistics and World Bank database.

Figure 3: Contribution of Oil and Cotton to Exports and Oil GDP 1996-2010

Source: Sudan Central Bureau of Statistics and World Bank database

Figure 4: Per Capita Income 1996-2010

Source: Sudan Central Bureau of Statistics and World Bank database

Figure 5: Non-oil Exports, Crops Exports and RER Overvaluation 1996-2010

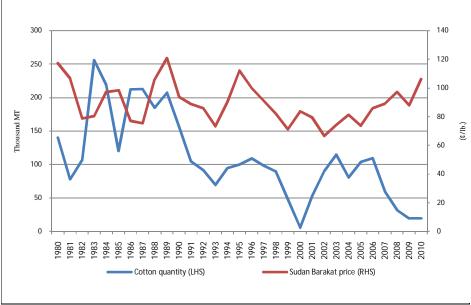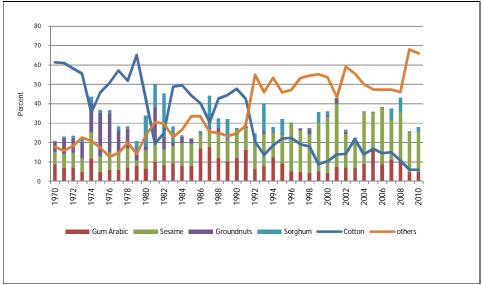Source: Bank of Sudan and World bank

Figure 6: Quantity of Cotton Exported and Free Market Price 1980-2010

Source: Bank of Sudan

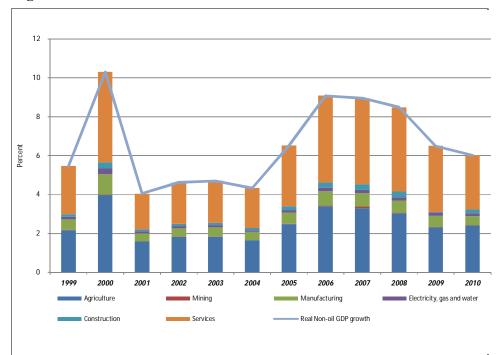**Figure 7: Agricultural Exports 1970-2010**

Source: Bank of Sudan

Figure 8: Non-oil GDP: Contribution to Growth 1999-2010

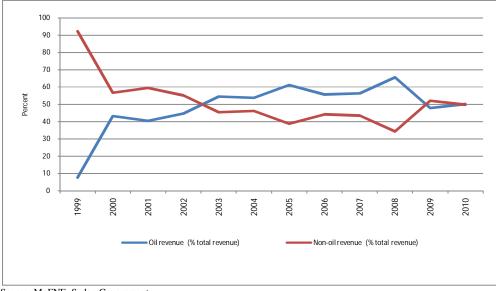Source: Central Bureau of Statistics, Sudan

Figure 9: Oil and Non-oil Revenues (percent of GDP) 1999-2010
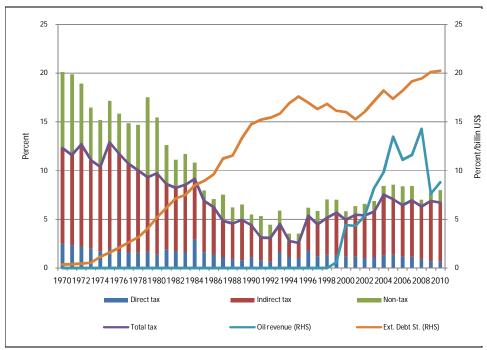

Source: MoFNE, Sudan Government

Figure 10: Tax, Non-tax and Oil-revenue (percent GDP) 1970-2010

Source MoFNE, Sudan Government, World bank
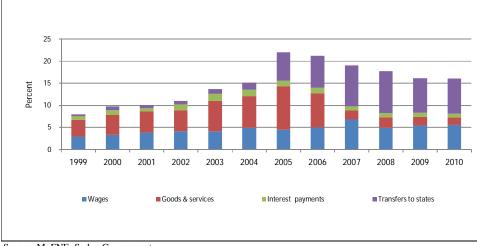
Figure 11: Government Expenditure (percent of GDP) 1999-2010

Source: MoFNE, Sudan Government

Figure 12: The Budget Position, (percent of GDP), 1999-2010

Source: MoFNE, Sudan Government

Figure 13. Oil Price Index 1999-2010

Source: UNCTAD

Figure 14: GDP, Non-oil GDP Growth and Ratio of Expending to Revenue 1998-2010

Source: Bank of Sudan and the World bank

Figure 15: Cyclical Revenue, Expenditure and Output for Sudan 1970-2010

Source: Economic Survey, MoFNE, and the Budget Speech for various years.

Figure 16: Cochrane's Variance Ratio, (Several Samples)

Source: Sudan Central Bereau of Statistics.

Table 1: Growth Accounting Decomposition for Sudan 1961-2010*

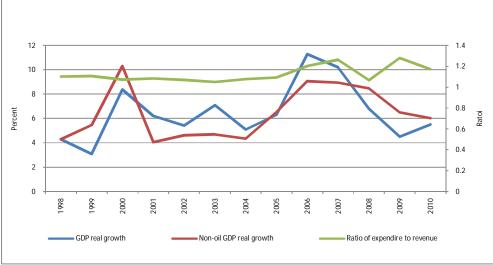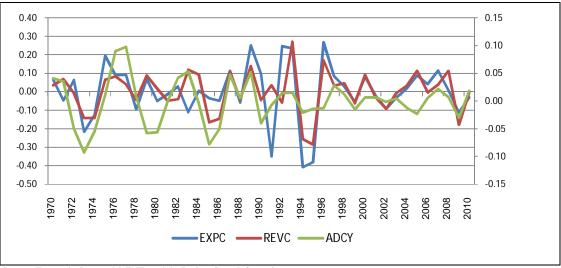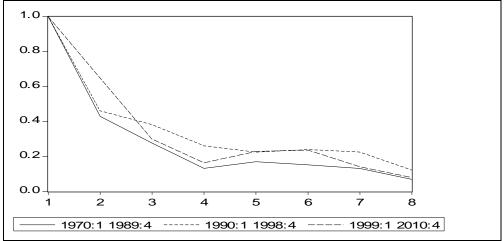| Sub-period	Growth of real GDP per worker	Contribution of capital per worker	Contribution of labor	TFP
1961-64	-1.0	4.2	1.3	-6.5
1965-69	-1.4	2.2	2.2	-5.8
1970-74	-2.1	1.1	3.7	-6.9
1975-79	5.6	5.3	0.1	0.2
1980-84	-0.1	1.0	1.8	-2.3
1985-89	1.6	-0.1	2.5	-0.1
1990-97	3.2	1.6	1.0	0.8
1998-2010	3.9	2.2	1.7	-0.01
1961-2010	1.8	2.0	1.7	-2.0
1961-96	0.9	2.0	1.8	-2.9
1997-2010	4.3	2.1	1.7	0.4

Notes: * The Contributions of capital per worker and the TFP are obtained from Equation 3, while the reported contribution of labor is obtained using Equation 2.
Source: Author calculation based on data from Sudan Central Bureau of Statistics and World Bank indicator database.

Table 2: The Determinants of TFP Growth for Sudan

Regressors		TFP	GDP per capita (Eq. 1)	GDP per capita (Eq. 1 2)	Interaction term (TFP equation)
Capital per worker	(∂k_t)	0.566***	0.474***	0.443***	
		(3.445)	(5.301)	(5.135)	
Capital per worker	(∂k_{t-1})	-0.532***	-0.181*	-0.213**	
		(-2.927)	(-1.823)	(-2.143)	
Capital per worker	(∂k_{t-2})	0.097*	0.062**	0.054*	-0.147
		(2.073)	(2.338)	(2.079)	(3.488/[1])
Imported capital	(∂KI_t)	0.027	0.073	0.102	-0.011
		(0.207)	(1.053)	(1.488)	(3.389)
Fiscal deficit	(∂CGD_t)	-0.230	-0.555*	-0.577*	2.031**
		(-0.407)	(-1.801)	(-0.408)	(6.350)
Tax rate	(∂TR_t)	-0.110	-0.060	-0.024	-0.168*
		(-1.130)	(-1.136)	(-1.136)	(4.783)
Spending on Capital	(∂GKG_t)	0.018	0.013	0.003	-0.024
		(0.667)	(0.867)	(0.187)	(3.649)
Financial deepening	(∂MY_t)	-0.212	-0.223***	-0.246***	-0.049
		(-1.654)	(-3.241)	(-3.549)	(3.436)
Inflation	$(\partial \pi_t)$	-0.013	-0.035	-0.027	-0.071
		(-0.156)	(-0.767)	(-0.605)	(3.770)
Inflation	$(\partial \pi_{t-1})$	-0.040	-0.024	-0.027	
		(-0.532)	(-0.572)	(-0.679)	
Miss-alignment	$(\partial misRER_t)$	-0.034	-0.021	-0.032*	0.081*
		(-1.017)	(-1.361)	(-1.723)	(5.275)
Aggregate demand	(∂AD_t)	0.187**	0.154***	0.172***	-0.088
		(2.189)	(3.306)	(3.679)	(3.816)
Export GDP ratio	$\partial EXYR_t$	-0.018	0.003	-0.051	0.003
		(-0.286)	(0.081)	(-1.189)	(3.384)
Foreign investment	$\partial FDIYR^{-4}$	0.013	0.012	0.001	0.024
		(0.605)	(1.032)	(0.467)	(3.746)
Terms of trade	(∂TOT_t)	-0.071	-0.018	-0.038	0.205
		(-0.528)	(-0.248)	(-0.546)	(3.846)
Error correction	(EC_{t-1})	-0.029	-0.020	0.011	
		(-0.301)	(-0.392)	(0.196)	
Oil dummy	(D_t)	0.050	0.059***	0.065***	
		(1.349)	(2.920)	(3.329)	
Constant		--0.228	-0.171	0.025	
		(-0.371)	(-0511)	(0.068)	
R^2		0.696	0.831	0.843	
F- statistic		2.555**	5.493***	5.982***	
DW- statistic		1.918	2.164	2.042	

Notes: 1/ p value from (χ^2) for the joint zero restriction tests.
Source: Author calculation based on data from the Sudan Central Bureau of Statistics; Economic Survey, MoFNE, the Budget Speech for various years; and the World Bank indicator database.

Table 3: Aggregate Revenue and Expenditure out-turns Compared to Original Approved Budget

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Part A									
Budgeted expenditure (in billion SDG)	5.98	6.96	6.89	11.29	17.20	17.60	22.44	21.95	25.11
Actual expenditure (in billion SDG)	5.18	7.16	7.94	10.04	14.71	15.99	22.72	20.70	24.16
Difference between actual & budgeted spending	-0.80	0.20	1.05	-1.25	-2.49	-1.61	0.28	-1.25	-0.95
Difference as percentage of total	-13.4	2.9	15.2	-11.1	-14.5	-9.1	1.2	-5.7	-3.8
Part B									
Budgeted revenue (in billion SDG)	4.82	5.87	8.21	12.75	17.09	18.25	21.50	18.37	23.71
Actual revenue (in billion SDG)	4.72	7.04	10.02	12.17	15.08	17.94	24.71	20.05	20.74
Difference between actual & budgeted revenue	-0.10	1.17	2.03	-0.58	-2.01	-0.31	3.21	1.68	-2.97
Difference as percentage of total	-2.1	19.9	24.7	-4.5	-12.3	-1.7	14.9	9.1	-12.5

Source: Economic Survey, MoFNE, and the Budget Speech for various years.

Table 4: Causality Test Based on ECM

Regressors	Revenue equation/1 (1)	Revenue equation/1 (2)	Spending equation/2 (1)	Spending equation/2 (2)
Revenue (∂R_{t-1})	-0.404*	-0.404*	-0.102	-0.110
	(-1.828)	(-1.757)	(-0.385)	(-0.371)
Expenditure (∂E_{t-1})	0.4170**	0.238	-0.021	-0.074
	(2.441)	(1.294)	(-0.104)	(-0.312)
$(\partial R_{t-1}) * (D_t)$		-0.434		-.0224
		(-0.617)		(-0.247)
$(\partial E_{t-1}) * (D_t)$		0.883		0.591
		(1.079)		(0.560)
ECM_{t-1}	0.171	-0.102	-0.320**	-0.260
	(1.270)	(-0.571)	(-2.383)	(-1357)
Oil dummy (D_t)		0.169		0.008
		(1.566)		(0.064)
Constant	0.199	-0.019	0.0001	-0.006
	(0.542)	(-0.477)	(0.006)	(-0.131)
Normalized cointegrating vectors/4		LR - 0.846*LE		LE - 1.192*LR
		(0.030)		(0.039)

Notes: 1/. Model (1). T = 40 (1970 -2010); $R^2 = 0.17$; $\tilde{\sigma} = 0.21$ and DW = 1.918. F-stat: F(9,32) 2.054 (0.087). AR $\chi^2(1)$ 0.321(0.571): Test for serial autocorrelation of residuals (H$_0$: no autocorrelation) Xi*Xj $\chi^2(1)$ 0.471 [0.983]: Test for heteroscedasticity (H$_0$: no heteroscedasticity) Normality $\chi^2(2) = 1.177$ [0.555]: Test for normality of distribution of residuals (H$_0$: normality). 2/. Model (2). T = 40 (1970 -2010); $R^2 = 0.16$; $\tilde{\sigma} = 0.25$ and DW = 2.052. F-stat: F(3,35) 2.311 (0.093). AR $\chi^2(1)$ 1.231 (0.267): Test for serial autocorrelation of residuals (H$_0$: no autocorrelation) Xi*Xj $\chi^2(1)$ 1.980 [0.159]: Test for heteroscedasticity (H$_0$: no heteroscedasticity) Normality $\chi^2(2) = 5.931$ [0.052]: Test for normality of distribution of residuals (H$_0$: normality). 3/ Asterisks ***; ** and * denotes significance at less than1%; 5% and 10% level respectively. The t-statistic in parentheses. 4/ numbers in parentheses are symptomatic standard errors.
Source: Author calculation based Economic Survey, MoFNE, and the Budget Speech for various years.

Table 5: Forecast Error Variance from Revenue and Expenditure Equations PP-Period Ahead[1]

One standard error shock in:	Number of periods	Expenditure (E_t)	Revenue (R_t)
Expenditure (E_t)	0	1	0.32
	1	0.89	0.53
	2	0.74	0.67
	3	0.61	0.75
	4	0.51	0.80
	5	0.43	0.82
	6	0.38	0.85
Revenue (R_t)	0	0.32	1.00
	1	0.26	0.99
	2	0.22	0.98
	3	0.19	0.97
	4	0.17	0.96
	5	0.16	0.95
	6	0.15	0.94

Notes: 1. The forecast error decomposition provides a decomposition of the variance of the forecast errors of the variables in the cointegrated VAR at different periods ahead, (PP). The generalized forecast error variance decomposition is used to explicitly allow for the contemporaneous correlation between the orthogonalized shocks and the shocks to the other equations in the VAR system.

Table 6: Budget Allocation by Selected Spending Categories

	1989-98	1999-11	1999-05	2006-11	2010	2011/[2]
Public sector wage/[1]	3.43 (0.09)	4.66 (0.21)	4.15 (0.11)	5.42 (0.15)	5.2	5.5
Wage volume growth	82.43 (0.56)	21.46 (0.88)	23.20 (0.51)	19.44 (1.34)	16.48	-1.81
Security spending (SS) /[1]	2.60 (0.35)	4.15 (0.28)	3.87 (0.30)	4.47 (0.26)	5.1	6.5
SS volume growth	83.96 (0.76)	27.97 (2.12)	32.98 (2.47)	22.12 (0.86)	37.61	16.50
States Transfers (ST) /[1]	0.06 (0.86)	2.69 (0.79)	1.24 (0.82)	4.38 (0.17)	4.3	4.4
ST volume growth	220.82 (1.94)	86.48 (1.70)	141.53 (1.31)	21.62 (1.83)	10.48	-4.07
Public services (PS) /[1]	3.15 (0.56)	3.34 (0.80)	1.99 (0.78)	4.92 (0.60)	5.8	0.03
PS volume growth	193.52 (1.62)	63.10 (3.56)	102.99 (2.92)	16.56 (5.25)	-0.21	-99.52
GDP volume growth	84.36 (0.52)	15.33 (059)	16.79 (0.24)	13.62 (0.96)	18.7	-7.16

Notes: 1. Percentage of GDP; coefficients of variations are shown in brackets. 2. In the second half of this fiscal year Sudan lost 20%, 75% and 36% of population, productive oil fields and revenues, respectively, due separation with South Sudan. Source: The public sector wage bill and transfers to state governments and public services are compiled from the Economic Surveys of the Ministry of Finance and National Economy; the budget documents and Annual Reports are compiled from the Bank of Sudan. Security spending is compiled from the SIPRI Military Expenditure Database; World Bank Indicators (Jan 1990-Jan 2004); IHS Jane's Sentinel Security Assessment (Jan 2005-Jan 2008); Research and Market Report Q1 2011 (Jan 2009-Jan 2011) and Annual Reports, Bank of Sudan (Jan 1988-Jan 1989). It is not clear from these sources whether these expenditures also include civil defense, police and paramilitary forces, dual-purpose forces such as military and civilian police, and pensions and social security contributions for military personnel. Labor force and unemployment is obtained from Sudan's Ministry of Labor.