

Does Foreign Aid Promote Economic Growth in Sudan? Evidence from ARDL Bounds Testing Analysis

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Abstract

This study examines the relationship between foreign aid and economic growth in Sudan using autoregressive distributed lag (ARDL) bounds tests for co-integration. Relying on time series data spanned over the period 1980 to 2015, the findings reveal that there is a long run relationship between variables under consideration. Specifically, the findings show that foreign aid in the form of official development assistance (ODA) has a positive and statistically significant long run impact on economic growth in Sudan. However, the interaction between aid and corruption in public institutions is found to have a negative and significant long run impact on economic growth. Interestingly, this relationship preserves its negativity in the short run, indicating the harmful impact of corruption in reducing the feasible contribution of aid to economic growth. The findings also indicate that aid deters economic growth in the short run. This outcome may stand as indication that aid spurs economic growth via its contributions to human capital and improving infrastructural facilities both of which become rewarding in the long run. The paper concludes with the importance of utilizing aid in enhancing human capital capacities in order to boost economic growth.

Keywords: GDP, Growth, Foreign Aid, ARDL, Sudan

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1. Introduction

It has been widely acknowledged that the key target of the official development assistance (ODA) is to help developing countries exist the prolonged poverty and economic backwardness. Specifically, the ultimate goal of sending these resources is to provide these countries with financial and technical assistances in order to make them able to put their economies on the track of sustainable economic development. Theoretically, the contribution of aid in achieving these proclaimed targets also has been strongly emphasized. Many of the leading development scholars (e.g. Harod-Domar, Rosenstein-Rodan and Rostow), claim that aid, whatever the form it takes, establishes a great deal in filling the capital gap experienced by developing economies in which saving rates are very low. Furthermore, those scholars argue that a part from its contributions in capitalizing the undercapitalized developing economies, aid can boost economic growth through the opportunities it offers for building the capacities of local cadres, elevating healthiness of human capital and establishing better infrastructures.

Owing to these claims, huge amounts of aid have been transferred regularly to developing nations. During a one decade, for instance, the amounts of aid disbursed to developing countries increased 2.27 times, from US\$ 33.7132billion in the 1960 to US\$ 76.5664 billion in the 1970, to US\$ 83.7002 billion in the 1980 (twice that of the 1970) and to US\$ 74.8361 in the 2000. According to reports by Organization of Economic Cooperation and Development (OECD), real ODA inflows to these countries rose by 6.1% to 134.8 billion in 2013, reaching its ever recorded peak (OECD, 2013). However, although the disbursed aid falls short than those amounts hoped and called for by development scholars and leading international organizations, aid resources seem to be not performing effectively in achieving the desirable developmental targets. That is to say aid appears to be not functioning well in remedying the economic illnesses experienced by recipient economies. The high illiteracy rates, breakouts of diseases, severe poverty and extremely low standards of livings are still dominant in the majority of aid's recipient countries. The obvious ineffectiveness of aid is manifested in the failure to realize sustainable and reasonable levels of economic growth in these countries. This argument finds support in the paradoxical findings on aid-led growth hypothesis which represents one of the hotly debated issues in the contemporary literature on aid (Papanek, 1972; Bauer, 1976; Bauer, 1982; World Bank, 1985; Mosley et al. 1987; Levy, 1988 and Newlyn, 1990). These controversies were not restricted to whether aid does or does not have a positive effect on economic growth in recipient countries, but it surpasses that to question the contexts in which aid being allocated. Some scholars argued that the effectiveness of aid is likely to depend on the suitability of policies and institutional settings in recipient countries (Bauer,1991; Collier and Dollar,2002; Svensson, 1999; Burnside and Dollar, 2000 and Economides et al, 2004).

On the whole, it seems to be there is no agreement regarding the contribution of aid to the economic growth. This fact makes both donors and recipients in confusion. It is hard for donor nations to see their own resources spend without mitigating the miserable situation suffered by recipient nations. The economic and social indicators in recipient nations don't show concise signs of improvements in economic performance in general and economic growth in particular occurred due to the presence of aid.

Sudan, like other developing countries, has received and continues to receive considerable amounts of official development assistance from different donors. The stylized facts show that the real net ODA inflows Sudan, although fluctuated and appear to be conditioned by political and

humanitarian developments that the country has experienced, but keep on growing during the last decades. According to Nour (2011) Sudan occupies a position among the top ODA's recipient countries. Aid as a percentage of gross national income (GNI) grew dramatically from representing 2.44% in the 1960 to 6.16% in the 1975 to 8.88% in the 1980 and to 7.44% in 1990. During the last five decades (i.e. 1960 and 2014) ODA grew by an annual average of, approximately, 22%, demonstrating the generous assistance from donors to Sudan. These aid inflows, if utilized effectively, are supposed to contribute greatly in upgrading the economic performance to the level that could possibly free the country from poverty trap. Specifically, the effectiveness of aid in all fronts can be better materialized through its direct contributions in boosting GDP growth to the levels that allow the country to graduate from its current unfavorable positions in human development index (HDI) ranking. In fact, the country's economy remains stagnant, GDP rotates around moderate rates of growth and the labor market fails to absorb the army of unemployed. Arguably, since its independence in 1956, the country has suffered severe economic, political and social obstacles that have worked collectively in confining its economy in a vicious circle of lowest economic growth rates. These obstacles, however, wouldn't justify negligible contributions of aid to economic growth. In view of that, the question may arise here is that: does aid contribute in promoting economic growth in Sudan during last decades?

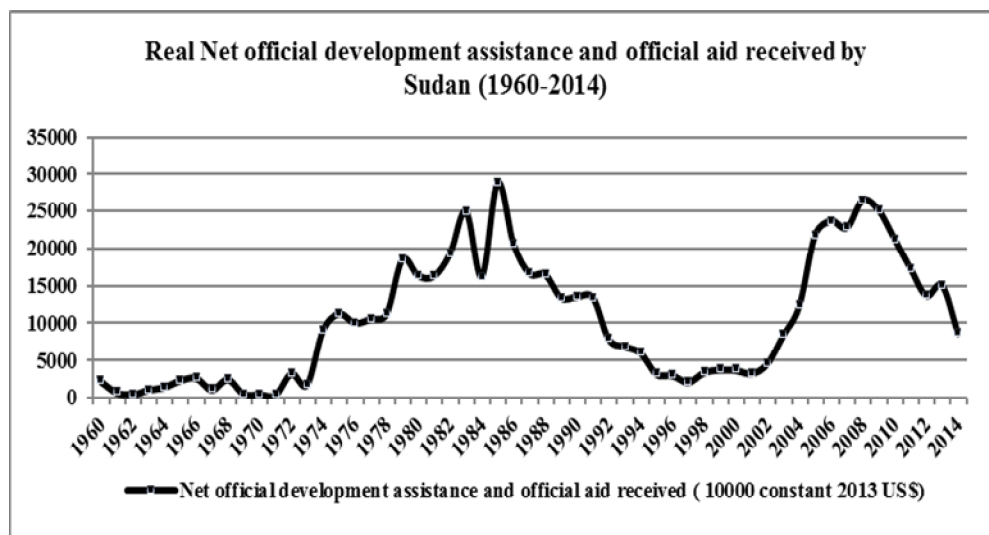
No doubt, this question is also motivated by the deep controversies in the existing literature regarding the role of aid in boosting economic growth in recipient countries. Given these concerns, this paper represents an empirical endeavor to investigate the contribution of aid in promoting economic growth in Sudan. Towards this aim, the paper applies the autoregressive distributed lag (ARDL) bounds tests for co-integration and utilizes a time series extend over the period 1980 to 2015 to carry out the intended empirical investigation.

The rest of this paper is organized as follows: Section 2 presents a detailed picture about the evolution of foreign aid inflows into Sudan with the emphasis on its interactions with the key economic parameters in the economy. Section 3 introduces the related literature. Section 4 sets the method on which the analysis is performed, while Section 5 discusses and introduces the empirical results. Finally, Section 6 concludes the paper and sketches some policy implications.

2. Patterns of Aid Inflows into Sudan Economy

Like the case of other countries, the patterns of ODA received by Sudan reflect, to a large extent, the economic, political and social circumstances that the country had undergone. Specifically, the amounts of aid received rise when the country exposed to economic, political and social instability and shrink when the reverse is hold. For instance, during the period followed the independence in which the country had enjoyed a relatively good economic performance, ODA inflows were at minimum. During the 1970s, although the economic performance was deteriorated compared to the 1960s period, the net ODA inflows decreased and, as Figure 1 indicates, troughed in the year 1970. Undoubtedly, the reason behind the contract in the ODA inflows was the dominance of the socialist believes that branded the first two years of May regime. However, after the abortion of coup arranged by communists in the 1971 and the elimination of communist cadres from government, ODA began to increase significantly. Moreover, the positive political developments at that time such as signing peace agreement with southern rebels in 1972 gave big push to the ODA inflows into the country.

Driven by donors' humanitarian concerns, the country's ODA record has improved significantly with the incidence of natural disasters such as, floods and droughts. The period of 1980s, particularly the years 1984 and 1985, the country was hit by one of the toughest waves of drought, has witnessed one of the historical peak of ODA inflows. Similarly, and as Figure 1 shows, ODA inflows appeared to be affected by the political developments prevailing in the country. For example, at the beginning of the 1990s when Sudan became vulnerable in its international relations, the ODA registered its lowest records. In contrast, in 2000s, when the country conducted national conciliations and attempted to pacify its connections with the rest of the world, ODA has increased considerably. Agreeing with this argument, the signature of the General Peace Agreement between government of Sudan and Sudan People Liberation Movement (SPLM) in 2005 qualified the country to be one of the notable destinations for the ODA in SSA region. As can be read from Figure 1, these changes in the political atmosphere led the country to register its second peak in terms of ODA reception. In general, it can be concluded that aid inflows into Sudan were coincided with the occurrence of natural disasters in 1980s as well as the political changes occurred in the 1970s, the 1990s and the 2000s.



Source: World Bank Indicators (2015), World Bank (2015)

Whatever the forms it takes and the magnitudes it amounts to, aid inflows are argued to elevate the economic performance in recipient countries. In the context of a country lagging behind in terms of physical and human capital such as Sudan, aid inflows are anticipated to do a lot in mitigating these shortcomings. However, the stylized facts on the country's macroeconomic indicators may don't support such assertion. Table 4.3 exhibits the interactions between some of the key macroeconomic indicators in Sudan economy and ODA during the period 1960 to 2014. Over these five decades, as the table shows, the overall correlations between aid presence and these indicators were not strong. Picking one, the reported figures indicate great divergences between ODA inflows and GDP growth rates. The exceptions were the 1960s and the 1970s, the periods in which there was a considerable conformity between aid presence and GDP growth. Specifically, during this period,

aid growth rose from an annual average of 10.9% during 1960 -1964 to an annual average of 11.80% during the period from 1965 to 1969. In the same time period, GDP growth rates rose from an annual average of 0.59% during 1960 -1964 to an annual average of 1.60% in the next five years, proving a considerable consistency in the performance of these two indicators. The decade of the 1970s also saw the same positive co-movements between ODA inflows and GDP growth. This consistency in the patterns of ODA inflows and GDP growth may, in part, arose due to the relative political stability that the country had perceived after the signature of Addis Ababa Agreement between the government and Sudan People' Liberation Army (SPLA) in 1972. Consequently, the ODA grew dramatically to achieve its historical peak in terms of growth (i.e. an annual average of 192%) during the period from 1970 to 1974. It is worth to mention that the ruling political system in Sudan at that period was not democratic. However, in addition to the presence of peace, the country gained good reputation in capitalistic western circles due to its tough attitudes towards the communist believes arose during that period.

As mentioned earlier, during the second half of the 1980s, the country has exposed to hard waves of drought that hit a large portion of population's livelihoods. Stirred by that event, donors surged a huge amounts of humanitarian assistance to mitigate the consequences of that disaster leading ODA growth rates to jump by 77% in a one year (i.e. from 1984 to 1985). However, these increases in ODA reception were not in a complete match with the GDP growth rates. Specifically, while GDP grew by 4.39% during 1985 -1989, ODA grew at an annual average of only 2.02%. Furthermore, the inconsistency between aid flows and GDP growth can be proven by the positive economic growth rates had been achieved in the 1990s, the decade in which ODA inflows have seen declined sharply. Specifically, the ODA growth rate shrank by -13.3 % and -2.37% while the GDP grew by 2.83% and 5.98% during 1990-1994 and 1995-1999, respectively. It is worth to mention that the high and positive growth rates achieved in Sudan economy during the late of 1990s and early 2000s are attributed mainly to oil exportation, which was the main driver of economic prosperity in the country during such period.

However, as the figures in Table 1 indicate, aid presence (ODA as percentages of both GDK and GNI) corresponds to some improvements in gross domestic capital formation (% GDP) particularly during the second half of the 1970s, the first half of the 1980s and the full decade of the 2000s. Apart from these periods, ODA (%GDP) and GDK (%GDP) displayed different patterns signifying that aid has failed to contribute to gross domestic capital formation.

Summing up, many interpretations can be proposed to justify the ineffectiveness of aid in stimulating economic progresses in Sudan. First, the positive impact of aid presence on indicators such as, economic growth and capital accumulation is likely to depend on the type of ODA received. In this regard, considerable portions of ODA received by Sudan were in the form of food and other in kind humanitarian assistance. Allocating ODA to these areas may delay its potential positive impact on economic growth. Second, the poor absorptive capacities characterized Sudan economy, particularly the aspects related to human capital development, may slow the digestion of benefits arising from aid presence. Looked at differently, this may support the supposition that in order for aid to be more effective, a minimum level of education and knowledge may need to be met by recipient countries. Third, the actual amounts of ODA inflows received may turn out to be negligible compared to the huge capital gap experienced by the country. That is to say in order to make these assistances impactful on the economy, a minimum amount of aid needs to be secured.

Fourth, the perception of corruption may also play a critical role in hindering the contribution of aid to economic growth. Aid as a kind assistance given by donors represents resources put at the hand of governments. Accordingly, the full utilization of these resources is likely to depend on the level of transparency and the equality of local institutions in Sudan. Unfortunately, the records of Sudan on the matters of transparency as well as the quality of public institutions are not enough developed to the level that makes aid function well in upgrading economic indicators. Yet, concluding that aid is ineffective in spurring economic enhancements in Sudan, as appeared from the above mentioned stylized facts, is largely subject to the doubts. Therefore, a sophisticated analysis performed via an advanced econometric technique can be called up to challenge this conclusion.

Table 1.2: GDP growth, gross domestic capital formation and ODA inflows into Sudan (1960-2014)

(1) Period	(2) GDP Growth	(3) ODA (%GDK)	(4) ODA (%GNI)	(5) ODA (% imports)	(6) ODA Growth (%)	(6) ODA per capita (current US\$)	(7) GDK/ (%GDP)
1960-1964	0.59	11.03	1.39	-	10.9	1.58	13.40
1965-1969	1.60	-	1.58	-	11.8	1.96	-
1970-1974	3.04	-	1.98	-	192	4.26	-
1975-1979	5.53	34.98 ^a	5.53	36.8 ^b	18.0	22.0	15.8 ^c
1980-1984	2.39	57.15	8.39	53.8	0.10	35.1	15.2
1985-1989	4.39	79.30	6.24	85.7	2.02	39.1	9.7
1990-1994	2.83	37.99	6.79	61.2	-13.3	22.9	17.1
1995-1999	5.98	12.63	1.98	16.9	-2.37	6.58	15.4
2000-2004	6.18	10.02	2.91	10.7	31.2	12.40	26.4
2005-2009	8.02	19.64	5.66	16.7	18.5	51.25	26.7
2010-2014	1.14	10.60	2.39	12.6	-17.5	37.70	20.9

Source: World Bank Indicators (2016), World Bank (2016), ^a calculated for the period 1976-1979, ^b calculated for the period 1978-1979, ^c calculated for the period 1976-1979.

3. Literature review

The relationship between foreign aid and economic growth has been extensively analyzed by researchers. Theoretically, the spectrum of this debate extends from viewing aid as a mask hiding the exploitation by the former colonizers for their past colonies (Frank, 1963; Taylor and Frank, 1971; Hayter, 1971; Stevenso, 1972; Hayter and Watson, 1985 and Hayter 2013), to advocating it as a kind assistance intends to assist developing nations to exist the miserable economic realities (Papanek, 1972 and World Bank, 1985). This theoretical disagreement found its ways to the empirical evidence. That is most of previous studies on the relationship between aid and economic growth have produced mixed results leaving the question on aid's effectiveness in mitigating the economic illnesses in recipient countries unanswered. On the one hand, several studies have reached to an outcome that aid encourages economic growth (Levy, 1988; Murthy et al., 1994; Fayissa and El-Kaissy, 1999; Gounder, 2001; Gounder, 2002; Gomanee et al., 2005; Karras, 2006; Njoupouognigni, 2010; Feeny and McGillivray, 2010; Fasanya and Onakoya, 2012; Mekasha et al., 2013 and Adams and Atsu, 2014). Studying the relationship between aid and economic growth in Solomon Islands, Gounder (2002) documented that aid exerts a positive effect on economic growth. In the same geographical setting, Gounder (2001) showed that aid, when disaggregated, plays an effective role in boosting economic growth in Fiji. The positive impact of aid has been also hold when GDP is disaggregated to the GDP per capita. The evidence reflecting this conclusion has been brought by Feeny and McGillivray (2010) who reported that foreign aid contributed effectively in

motivating growth in GDP per capita in Small Island developing states (SIDS). In the same vein, the effectiveness of aid in spurring economic growth has been replicated when the analysis includes countries with heterogeneous geographical and economic backgrounds. For instance, study by Karras (2006) advocated that aid has a sizable positive, permanent and statistically significant effect on economic growth in a sample of 71 aid-receiving developing economies. In the African context, Gomanee et al., (2005) found that aid speeds economic growth rates in Sub-Saharan African countries. Similarly, for the case of a single African country, Fasanya and Onakoya (2012) documented the existence of a positive relationship between aid and economic growth for the case of Nigeria. Recently, Adams and Atsu (2014) employed annual data spanned from 1970 to 2011 to investigate the effect of aid in heightening economic growth in Ghana. Their findings have also showed that aid exercises a positive short run relationship on the country's economic growth.

On the other hand, many researchers have found that aid is inversely related to economic growth in targeted countries (Griffin and Enos, 1970; Cassen, 1994; Dhakal et al., 1996; Nyoni, 1998; Burke and Ahmadi-Esfahani, 2006; Mallik, 2008 and Kimura et al., 2012). Quite earlier, Griffin and Enos (1970) found a stronger evidence indicating that foreign aid has hindered economic growth in a sample of fifteen African and Asian countries. Furthermore, these results have been replicated with a robust significance for twelve Latin American countries. Not far from this negative conclusion, some studies have concluded that aid has no role in stimulating or hindering economic growth. This argument has been delivered by Burke and Ahmadi-Esfahani (2006) who have found that aid has insignificant effects on economic growth in three of South East Asian countries namely, Thailand, Indonesia and the Philippines.

In the midst of this conflicting empirical evidence, several explanations have been picked up to justify the failure of aid in producing desirable outcomes on economic growth. First, numerous works have repeatedly reported that the potential contribution of aid to economic growth is conditioned by the political, the institutional and the economic settings prevailing in recipient countries (Durbarray et al., 1998; Burnside and Dollar, 2000; Collier and Dollar, 2002; Collier and Hoeffler, 2004 Collier and Dehn, 2001; Guillaumont and Chauvet, 2001; Svensson, 1999; Islam, 2003; Dalgaard et al., 2004 and Elbadawi et al., 2012). For instance, in their widely cited study, Burnside and Dollar (2000) advocated that aid can lead to growth in countries preserving good policies. By the same token, Elbadawi et al., (2012) indicated that aid contributed positively in fostering economic growth in SSA countries. However, as the authors indicated, these positive effects were somewhat weaker in countries with overvalued exchange rates.

On the whole, the central importance of good policies and institutions in maximizing the effectiveness of aid has been strongly confirmed in the existing literature. However, although some studies confirm the positive role of aid in spurring economic growth, they fail to detect the contribution of institutions and policies in deciding the exact thresholds of this effectiveness. Of these studies, Islam (2003) found that aid has a negative but weaker effect on economic growth in tinpot countries and a robust positive in totalitarian countries. The author went further by demonstrating that the returns to aid seem to be constant in tinpot countries and diminishing in totalitarian ones indicating the positive impact of "bad policies" or regime on aid effectiveness. Agreeing with Islam's study, Boone (1996) analyzed the effectiveness of aid in 96 recipient countries. His findings showed no significant differences between democratic and totalitarian regimes in managing aid ineffectively. In the same way, some studies have argued that aid

accelerates economic growth in countries with bad institutional environment and that the good policies has no effects on aid effectiveness (Guillaumont and Chauvet, 2001). Extending the period studied and filling the attrition in the data on which Burnside and Dollar (2000) have based their influential findings, Easterly et al., (2003) found that the results obtained by those scholars was not robust. This has been also supported by Dalgaard and Hansen (2001) who argued that while “good policies” may spur growth but they are likely to lead to simultaneous decreases in aid effectiveness. The authors defended their argument by showing that the econometric results obtained by Burnside and Dollar, which emphasizes the crucial role of the interactions between aid and good policies in accelerating economic growth process, were fragile and driven by data. Second, some authors linked aid effectiveness to a certain period of time. Agreeing with this line of argument, Mosely (1980) claimed that the positive association between aid and economic growth has occurred and disappeared in the decades followed 1970s.

Third, another strand of research contends that aid turns out to be ineffective in prompting economic growth when aggregated data has been used. Supporting this point of view, some authors argued that it is difficult to quantify the effect of aid on recipient economies at macro levels due to the incidence of fungibility (Mosley, 1987; Islam, 1992; Boone, 1994; 1996 Feyzioglu et al., 1998; Pack and Pack, 1993 and Devarajan et al., 1999). Islam (1992), for instance, studied the effects of aid on economic growth in Bangladesh. The author found that aid has no positive impact on economic growth when the data used in its aggregative form. On the contrary, when aid data disaggregated, the author found that economic growth responses positively for aid, especially the food aid. Similarly, many researchers have concluded that the impact of aid on economic growth may vary according to the composition and types of aid received (Clemens et al., 2004; Cordella and Dell'Ariccia, 2007, and Welle-Strand et al., 2012). Welle-Strand et al. (2012) studied the impact of aid allotted to electricity sector project on economic growth in 77 countries. The findings by authors confirmed that electricity rises GDP per working age person, indicating that aid directed to power sector has significant and positive impact on economic growth.

Summing up, the disagreement among previous studies on the nexus between aid and economic growth indicates that the empirical evidence is largely inconclusive. This indecisive relationship calls the attention to the falseness of drawing one conclusion for all countries particularly when the case of a single country is considered. Taking the aim of this paper into account, studying the case of Sudan is of a great importance for both policymakers and donors. To the best of authors' knowledge, the only cited empirical study on aid effectiveness in Sudan as a single country has been done by Nour (2011). Depending on data collected at micro level, the author investigated the contribution of Chinese resources (i.e. loans, grants and aid) to improve the performance of Sudan economy. Her results showed that these resources exercise both a negative and a positive impact on Sudan economy. Specifically, the positive impact results from the fact that the Chinese resources crowds in domestic capital and offer funds for developmental projects. In contrast, the negative effects emerge from the fact that these financial resources accumulate Sudanese foreign debts. Furthermore, the author argued that, compared to other conventional aid which mostly focuses on humanitarian aspects, Chinese aid is considered highly effective since it takes into account the aspects of sustainable development. However, the conclusions established by Nour (2011) face many limitations. First, her study limits its scope to one type of aid (i.e. project aid) and, thus, doesn't allow to induct a concise conclusion on the full impact of aid on economic growth in Sudan. Second, a part from this shortcoming, the study used project level data and restricted the

analysis to only donor, while Sudan used to receive a huge amount of ODA from different donors. Disaggregating aid in such manner would reduce the generalizability of the findings obtained. Finally, analyzing the impact of aid on economic growth using descriptive statistics and without resorting to sophisticated econometric methods would undermine the ability of the analysis to capture the marginal effects among the variables studied and, hence, raises doubt on the accuracy of the results obtained by this study.

4. Methodological Procedures

4.1 Model Specification

Both Lucas (1988) and Romer (1989) argue that the neoclassical growth model developed by Solow (1956) fails to explain a large portion of the growth in the output because it treats technological innovation and population growth as exogenous variables. This criticism, combined with other empirical drawbacks experienced by the model, gave birth to the endogenous growth model in which output growth has been set as a function of physical capital, labor as well as human capital. According to Rana (1987) and Tallman and Wang (1994), the basic neoclassical growth model of Solow (1956) and Swan (1956) can be expressed in an augmented aggregate production function as follows:

$$Y_t = A_t K_t^\alpha (H_t L_t)^\beta \dots (1)$$

Where Y_t represents the real aggregate output; L and K denote, respectively, labor (employment) and physical capital inputs; H represents the level of human capital; A is a measure of technology and exogenous knowledge; α is the share of capital; β is the share of labor and the subscript t represents time. Taking the natural logarithm for the underlying variables, the estimated form of equation 1 can be derived as:

$$\ln Y_t = \alpha \ln(K_t) + \beta \ln(L_t) + \delta \ln(H_t) + \ln(A_t) \dots (2)$$

Taking the aim of investigating the effect of aid on the economic growth into account, the aggregate capital (K_t) can be disaggregated into domestic and foreign capital in the form of aid. In addition, the variables that conventionally appear in economic growth model such as export, the availability of banking credit can be also added to the model under. Moreover, we see that the model we intend to investigate must take into consideration the changes that occurred in economic policies during the period being investigated as well as the level of institutional quality. Accordingly, a dummy variable is included to represent the adoption of privatization policy, while the institutional quality is measured by the interaction between public corruption index and the official development assistance. Applying these changes to equation 2, the final model can be rewritten as follows:

$$\ln GDP_t = \beta_0 + \beta_1 \ln LAB_t + \beta_2 \ln EDU_t + \beta_3 \ln K_t + \beta_4 \ln ODA_t + \beta_5 \ln(ODA_t * PUBCORR_t) + \beta_6 \ln REXP_t + \beta_7 CRD_t + \beta_8 PRIV_t + \varepsilon_t \dots (3)$$

Where $\ln GDP$, $\ln LAB$, $\ln EDU$, $\ln K$, $\ln ODA$, $\ln(ODA * PUBCORR)$, $\ln REXP$, CRD , and $PRIV$ are respectively, real GDP, labor measured by total labor force, average years of schooling, real gross domestic capital formation, real official development assistance, real exports, financial credit provided to the private sector by banks, and the interaction term between public corruption index and official development assistance all in natural logarithms. $PRIV$ is a dummy variable used to capture the effect of implementing privatization policy on economic growth and ε_t is disturbance term which is assumed to be normally distributed. The β coefficients of the explanatory variables, excluding the dummy variable, reflect the elasticity of the real GDP with respect to each of these variables. Therefore, the generated coefficients of the log explanatory variables represent the percentage change in the dependent variable resulting from a one percent change in the corresponding regressor. The financial credit provided to private sector by banks (CRD) which is expressed in ratios is interpreted as semi-elasticity where its generated coefficient is multiplied by 100 to give the percentage change in the regressed variable (Wooldridge, 2006).

Based on economic theory, a priory expectation is that $\ln LAB$ is likely to be associated with a positive sign ($\beta_1 > 0$) because increases in labor force lead to increases in economic activities and thus boost GDP growth. Similarly, the growth can be also expected to be influenced by the level of education. The higher the level of education, the higher the GDP growth rate (Barro and Lee, 1993; Barro, 1991 and Benhabib and Spiegel, 1994). Accordingly, the coefficient of the average years of schooling variable (EDU) is expected to carry a positive sign ($\beta_2 > 0$). Similarly, the amount of physical capital ($\ln K$) would have a major impact on the GDP growth as increases in capital input create a substantial rise in total factor productivity. Therefore, the estimated value of domestic capital coefficient is expected to be positive ($\beta_3 > 0$).

In the context of this study, aid represents the variable of interest. Aid, as a source of physical capital, can affect GDP growth. It has been included in the above equation so that its role in augmenting GDP growth can be captured. As an input in the production function, aid is expected to exercise a positive impact on total output thus the coefficient of the variable is expected to carry a positive sign. However, as stressed in the reviewed literature, the empirical evidence by previous studies points out that foreign aid could have a positive or negative effect on economic growth depending on the existence of some conditions in recipient economies. Therefore, the sign of its coefficient is anticipated to be undecided and waiting for empirical investigation ($\beta_4 > ?$).

The effect of ODA on the GDP is likely to be affected by the level of institutional quality that is the higher the quality of institution in aid recipient country, the higher the positive influence of aid on GDP growth. Studies have frequently postulated a positive relationship between institutional quality and the effectiveness of aid in boosting economic growth. As shown in the literature section, several studies have emphasized that the full utilization of aid resources requires a minimum level of institutional development in recipient countries. To include this complementary relationship between aid and institutional quality, the model has extended by including an interactive regressor $\ln(ODA * PUBCORR)$. The $PUBCORR$ represents the public corruption index which used to proxy the institutional quality in Sudan. The coefficient β_5 represents the

elasticity of GDP with respect to *CDA * PUBCORR* interactive term. The sign of its coefficient would depend on the level of corruption prevailing in the country and, therefore, remain undecided ($\beta_5 > ?$).

The previous research has overwhelmingly concluded that exports play an important role in advancing economic growth (Balassa 1985; Ram, 1985; Balassa, 1978; Bhagwati, 1988 and Fosu, 1990). Thus, the coefficient of the real exports variable is also expected to be accompanied by a positive sign ($\beta_6 > 0$).

Furthermore, there is a large body of theoretical and empirical literature on the role of the financial development in escalating economic growth. The availability of domestic credit may determine the extent to which domestic firms are able to borrow in order to extend innovative activities. Besides, the capable banks would attract and mobilize public savings and offer them to the other sectors at lower interest rate. More importantly, the liquidity always represents a major concern for investors, where it provides means for clearing up all contractual obligations on the due date. Accordingly, the coefficient of domestic credit variable is supposed to be associated with a positive sign ($\beta_7 > 0$).

Finally, the model also takes the adoption of the privatization policy that initiated in 1992 into account. The impact of adopting this policy on economic growth is delivered by the coefficient of the dummy variable (β_8). We see that it is feasible to include an exogenous variable to deliver the impact of privatization policy on economic growth. First, the privatization increases the level of accountability in the business environment, decreases the level of corruption in both public and private owned enterprises and, therefore, expands domestic businesses. Second, the presence of a successful private sector is likely to motivate the managers of publicly owned projects to adopt the same managerial and technical methods adopted by the private sector to achieve business success. Adopting such efficient managerial techniques can boost productivity and accelerates GDP growth. Moreover, the implementation of a privatization policy would probably widen the democratic steps in the country leading to more economic and political openness toward the rest of the world and, consequently, pushes GDP to expand.

4.2 Estimation Method and Data

We employ the autoregressive distributed lag (ARDL) cointegration procedures, as proposed by Pesaran and Shin (1999) and Pesaran et al. (2001), to investigate the effect of aid on economic growth in Sudan. We have chosen the ARDL co-integration technique because it possesses several superior econometric merits compared to other cointegrating techniques such as the Engle-Granger method (1987) and the Johansen (1988) and Johansen and Juselius, (1990). First, compared to these techniques, the ARDL bounds test facilitates obtaining consistent estimates even in small samples. Second, it permits dealing with both stationary and non-stationary variables, as long as their order of integration doesn't exceed one $I(1)$. Third, another merit of ARDL approach is that it overcomes both serial correlation and endogeneity problem among variables, allowing the estimation of both the short-run and long run coefficients simultaneously and with lagged dependent and predictors variables. Fourth, according to Marques et al. (2016), the asymptotic theory built in the ARDL bounds test method will not be affected even when one-zero dummy variables are included in the model being estimated. Fifth, the short-run adjustments can be added to the long-run equilibrium in

the ARDL bounds test by generating the error correction mechanism (Ali et al., 2016). The inclusion of the error correction term infers that the variations in the dependent variable occur from two sources namely, the disequilibrium in the cointegration relationship as denoted by the error correction term and changes in other explanatory variables (Jailani and Masih, 2015). Six, the main concern of this analysis is to examine aid effectiveness on economic growth in Sudan economy. As foreign aid doesn't materialize as a spot effect on GDP growth but also leads to long run effects, some studies, when modeling aid effectiveness, apply lagged forms of both dependent and independent variables as additional predictors. In the ARDL sense, this matter can be handled automatically since the approach is dynamic in nature and openly considers the behavior of the variable over measurable period of time.

To investigate the long relationship among the variables pertaining to equation 3, the ARDL bounds test for the cointegration can be specified as follows:

$$\begin{aligned} \Delta \ln GDP_t = & \alpha_0 + \sum_{i=1}^{n-1} \alpha_{1i} \Delta \ln GDP_{t-1} \\ & + \sum_{i=1}^{n-1} \alpha_{2i} \Delta \ln LAB_{t-1} + \sum_{i=1}^{n-1} \alpha_{3i} \Delta \ln EDU_{t-1} + \sum_{i=1}^{n-1} \alpha_{4i} \Delta K_{t-1} + \sum_{i=1}^{n-1} \alpha_{6i} \Delta \ln ODA_{t-1} \\ & + \sum_{i=1}^{n-1} \alpha_{5i} \Delta \ln (ODA_t * PUBCORR_t)_{t-1} + \sum_{i=1}^{n-1} \alpha_{7i} \Delta \ln REXP_{t-1} \\ & + \sum_{i=1}^{n-1} \alpha_{3i} \Delta CRD_{t-1} + \sum_{i=1}^{n-1} \alpha_{9i} \Delta PRIV_{t-1} + \beta_1 \ln GDP_{t-1} + \beta_2 \ln LAB_{t-1} \\ & + \beta_3 \ln EDU_{t-1} + \beta_4 \ln K_{t-1} + \beta_5 \ln ODA_{t-1} + \beta_6 \ln (ODA_t * PUBCORR_t) \\ & + \beta_7 \ln REXP_{t-1} + \beta_8 CRD_{t-1} + \beta_9 PRIV_{t-1} + \varepsilon_t \dots (4) \end{aligned}$$

Where Δ denotes the first difference operator of the respective variable; α_0 represents the drift component and ε_t is the error term. The dynamics for the error correction in the short run are denoted by the terms with summation symbols while the long-run relationship is represented by βs . The ARDL approach to cointegration involves two phases. In the first phase, the hypothesis of no cointegration is tested. Specifically, to detect the presence of cointegration relationship among the variables concerned, we test the null hypothesis that $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$ against the alternative hypothesis $H_a: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq \beta_8 \neq 0$ by implementing the join F-statistic suggested by Pesaran et al. (2001) and Narayan (2005). Then, the calculated F can be compared with the critical values given by Pesaran et al. (2001) for the cointegration test. Accordingly, when the computed F-statistic exceeds their upper bounds critical values, then the null hypothesis is rejected (there is evidence of cointegration). In contrast, the null hypothesis cannot be rejected if the F-statistic is below the lower bound critical value (there is no evidence of cointegration). The test will be inconclusive if the F-statistic lies between the lower and upper bound critical values. After confirming the existence of the cointegration relationship among the variables under examination, the second phase in the ARDL approach encompasses estimating the long run coefficients (Pesaran and Pesaran, 1997). Thus, the vector error correction model will be estimated to identify the causality direction between economic growth and aid presence. However, before proceeding with the ARDL bounds test, it is necessary to determine the order of integration of the

variables. This step is undertaken to ensure that the variables are not $I(2)$ stationary so as to avoid spurious results and, thus, allows the analysis to produce the optimal inference. Both Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP) tests are used for this purpose. The tests for unit roots with and without trend is performed on all variables included in the model in levels as well as in first differences. The lag length to be used to compute the Augmented Dickey-Fuller and Phillip and Perron is based on the Akaike (1973) Information Criterion and Newey-West, respectively.

4.3 The data

To investigate the impact of aid on economic growth in Sudan, a time series data set containing annual observations for the period 1980-2015 has been used. The majority of the data used is obtained from the World Bank Development Indicators (WDI) published by World Bank. Specifically, data on real gross domestic product, real exports, domestic banking credit made available to the private sector, and gross domestic capital formation are sourced from this source. The real official development assistance is obtained from OECD database. The basic source of data on labor force is the statistics on population and labor force issued by United Nation Conference on Trade and development (UNCTAD). The data on human capital, which is measured by average years of schooling, has obtained from Barro and Lee educational database. All monetary variables are in real values. The description of variables and data sources is summarized in Table A.1 in the Appendices.

5. Empirical results and discussion

Before proceed with estimating the ARDL bounds test, we start the analysis by examining the stationarity characteristics of the variables included in the model under consideration. The results of ADF and PP unit roots tests are summarized in Table 5.1. As the tests statistics indicate, except human capital variable ($\ln HC$) which seems to be of order $I(0)$ at level, the rest of the variables are found to have unit roots at levels when these two tests are conducted (i.e. with and without intercept and trend).⁴ Such results show that the variables under examination contain a unit root process or possess a common stochastic movement. However, after differencing the series once, all variables become stationary.

Having confirmed that the variables satisfy the stationarity conditions required to execute ARDL estimation, the next step is to run the bounds test to determine the levels of cointegration. The results reported in Table 5.2 show that the calculated value of F-statistic is 7.09 which is greater than the upper level of bounds critical values of 3.13, 3.50, 3.84 and 4.26 at the 1%, 2.5%, 5%, and 10% levels of significance. Obviously, this outcome implies that the null hypothesis of no cointegration cannot be accepted and there exists a cointegration relationship among the set of variables. However, these results represent, to some extent, a preliminary evidence for the existence of cointegration. Thus, the ARDL model can be further expanded by estimating the long and the short run in order to ratify this result.

⁴ Since the computed F-statistics provided by Pesaran et al. (2001) is based on the assumption that the variables are $I(0)$ or $I(1)$, finding that education variable is purely $I(0)$ at level and not at first difference wouldn't lead to spurious results. Instead, these dissimilarities in the order of integration of variables support the usage of ARDL as an appropriate cointegration technique to execute the empirical investigation.

Table 5.1 Summary of ADF and PP unit roots tests

Variable	Augmented Dickey-Fuller (ADF)		Phillips-Perron (PP)	
	Level		Level	
	With intercept but without trend	With intercept and trend	With intercept/no trend	With intercept and trend
LnGDP _t	0.356(0)	-3.133(7)	0.355(5)	-1.990(6)
LnLab _t	1.691(0)	-1.261(0)	1.741(1)	-1.261(0)
LnHC _t	-2.177(1)	-1.734(1)	-14.03(3) ^a	-3.195(3)
lnODA _t	-1.983(2)	-1.938(2)	-1.326(4)	-1.593(4)
LnREXP _t	-0.023(0)	-1.784(1)	-0.327(3)	-1.945(3)
LnK _t	-0.674(0)	-1.344(0)	-0.743(2)	-1.539(1)
CRD _t	-1.334(0)	-1.636(1)	-1.534(3)	-1.431(2)
PUBCORR _t	-1.409(0)	-1.246(0)	-1.409(0)	-1.537(1)
The first difference				
ΔLnGDP _t	-4.928(0) ^a	-4.957(0) ^a	-4.883(5) ^a	-4.911(6) ^a
ΔLnLab _t	-5.857(0) ^a	-6.055(0) ^a	-5.857(1) ^a	-6.125(4) ^a
ΔLnODA _t	-5.178(0) ^a	-5.110(0) ^a	-5.372(4) ^a	-5.301(4) ^a
ΔLnREXP _t	-4.305(0) ^a	-4.279(0) ^a	-4.289(2) ^a	-4.266(2) ^b
ΔLnK _t	-4.587(0) ^a	-4.516(0) ^a	-4.586(4) ^a	-4.517(4) ^a
ΔCRD _t	-3.456(0) ^b	-3.716(0) ^b	-3.456(0) ^b	-3.781(1) ^b
ΔPUBCORR _t	-3.733(0) ^a	-3.753(0) ^b	-3.673(3) ^a	-3.674(3) ^b

Lag order is shown in parenthesis based on SIC. ^{a, b and c} represents 1%, 5% and 10% level of significance, respectively.

Table 5.2: Results of bounds test

Null hypothesis :No co-integration		
Significance	Critical value	
	Lower bound	Upper bound
10% significance level	2.03	3.13
5% significance level	2.32	3.50
2.5% significance level	2.60	3.84
1% significance level	2.96	4.26
Computed F-statistic: 7.09, k = 7		
Decision: <i>Reject the null hypothesis at 1% significance level.</i>		

Note: the critical values are obtained from Pesaran et al. (2001). Table CI case III based on unrestricted intercept and no trend, p. 300.

The results of estimated long-run ARDL cointegration model (1, 1, 0, 2, 2, 0, 1, 0), which selected automatically from 20 models based on Akaike Information Criterion (see Appendix B), are presented in Table 5.3. As the reported results indicate, the long run coefficient of ODA variable (*lnAID*) is positive and statistically significant indicating that foreign aid boosts GDP growth in Sudan during the period under consideration. Specifically, the findings indicate that a one percent increase in ODA disbursement pushes GDP to grow by, approximately, 0.38 percent.⁵

In light of these finding, some theoretical aspects on the relationship between aid and economic growth need to be affirmed. Precisely, as argued by many scholars, aid has a potentiality to contribute directly and indirectly to economic growth. Directly, aid will probably expand the existing physical capital pushing GDP to grow beyond the levels that could otherwise be achieved

⁵ Apart from the variable of credit availability (*CRD*), the remaining variables included are converted into natural logarithms and, therefore, the estimated coefficients can be interpreted as GDP's elasticities with respect to each independent variable.

without aid inflows. Indirectly, aid improves human capital and, hence, boosts the absorption of new knowledge and modern business practices that are likely to spillovers from sources such as foreign investment and other domestic know-how sources. However, based on the argument purposed by exogenous growth theory, the direct contribution of aid can be only hold in the short run. That is aid, as a form capital, has no long run impact on economic growth. In contrast, the intangible contribution of aid in upgrading human capital, which is considered according to endogenous economic growth theory, has the ability to promote perpetual increases in economic growth rates. Moreover, the direct benefits of aid are expected to be confined to specific sectors and firms and mostly not disseminated evenly throughout the whole economy. The indirect effects of aid, on the other hand, are conveyed via human capital development and diffused across different sectors generating more increases in economic growth rates. It is worth noting that the contributions of foreign aid to human capital development in Sudan cannot be overlooked. The schools, universities, health care centers (i.e. hospitals, dressing points and diagnostic units) and other social overhead capital facilities are extensively spread throughout the regions constituting the country. The support of aid sometimes exceeds these pure humanitarian aspects to contribute to the direct infrastructural projects including establishing road networks, water supplies, power generation and sanitation.

However, regardless of the contribution gained from aid presence, there may be many hidden explanations behind its significant effect on economic growth in Sudan. First, this significant contribution may reflect the weakness in domestic capital formation. In other words, the negligible contribution of domestic capital to the total output may boom the share of aid in spurring economic growth. Second, the high dependency on aid increases the fragility of the country's economy by making it subject to the event of changes and fluctuations in the international relations. The ups and downs in aid inflows represent an obvious confirmation for such claim.

Interestingly, the coefficient associated with the interaction terms between ODA and public corruption variable is negative and statistically significant. This indicates that the spread of corruption in domestic public institutions undermines the contributions of aid in prompting economic growth. It is worth noting that in the last four decades, Sudan has experienced a severe deterioration in the quality of its public institutions. The nepotism, embezzlements, abuses against public properties, and other bad institutional practices became strongly institutionalized. Accordingly, in the midst of such untransparent and corrupt public environment, aid wouldn't be used effectively and, consequently, fail to enhance economic capabilities in a manner that sustain economic growth in the long run. Moreover, under such circumstances, aid resources might become fungible. That is to say lack of accountability is likely to make aid resources act as a substitute for public spending instead of supporting it leading to significant deterioration in economic growth. Many researches have frequently confirmed the existence of fungibility of aid particularly in institutionally less developed countries (Bauer, 1976; Khilji and Zampelli, 1991; Pack and Pack 1993, Feyzioglu et al., 1998; Djankov et al., 2005; Gottret and Schieber, 2006; Farag et al. 2009 and Ke et al, 2011).

Turning to the rest of the variables, the findings show that the coefficients associated with human capita ($\ln HC$), real export ($\ln REXP$), availability of banking credit (CRD) and the adoption of privatization policy ($PRIV$) variables are all correctly signed and statistically significant. Specifically, the coefficient of human capital variable is positive and statistically significant indicating that the enhancements in the capabilities of human cadres via increasing years of schooling lead to progressive increases in economic growth. In particular, increases in average years of schooling among population, say by one percent, rises GDP growth rates by 0.73 percent, other things being equal.

In tune with the well-established proposition that economic liberalization increases economic growth, we find that implementing the privatization policy generates significant increases in GDP. Specifically, the adoption of this policy increases GDP by 0.61%. Excluding human capital variable, the magnitude of the coefficient associated with the privatization variable exceeds that of other controls ratifying the fact that the adopted policy put Sudan economy on the true track of economic growth.

As expected, the coefficient of the real exports variable is positive and statistically significant indicating that the returns from exports have a significant contribution to economic growth. It is worth mentioning that oil, which represents the lion in Sudanese exports, provided Sudan economy with huge amounts of hard currencies. Although these invented resources are claimed for ineffective allocation, they undoubtedly lent a great support to economic growth during the last two decades.

Similarly, and in line with prior expectations, the coefficient of banking credit availability variable is positive and statistically significant. It demonstrates that the provision of barrowing facilities via banking system contributes positively to accelerate economic growth. This outcome is expected since the country suffers from a prolonged gap between national savings and the actual demand for capital.

Conversely, the results indicate that GDP has a negative elasticity with respect to the expansion in labor force. As the coefficient in front of labor force variable ($\ln LAB$) indicates an increase in labor force by a one percent, decreases GDP growth rates by 0.37 percent. This endorses that aggregate production function in Sudan economy exhibits decreasing returns to scale with respect to labor input. This outcome can be justified by the fact that the capital input in the economy is proportionally smaller than the labor force. Accordingly, regardless of the proportions of other inputs, increases in labor force are expected to add less to the GDP giving birth to decreasing returns to scale in the long run. This outcome agrees with argument by Arthur Lewis in which he has stated that most of the labor working in developing countries, particularly in rural areas, is either has a zero or even negative productivity.

Table 5.5: Estimates of the long run coefficients- ARDL (1, 1, 0, 2, 2, 0, 1,0)

Dependent variable	Log(GDP)			
Variable	Coefficient	Standard Error	t-ratio	P-value
LnLab _t	-0.366***	0.054	-6.698	0.000
LnHC _t	0.729***	0.163	4.467	0.000
LnKt-1	0.075	0.101	0.741	0.468
LnODA _t	0.376**	0.158	2.381	0.027
LnREXP _t	0.214**	0.084	2.553	0.019
Ln ODA _t *BUCOR _t	-0.327**	0.156	-2.102	0.049
CRD	0.019*	0.0106	1.814	0.085
PRIV	0.613***	0.161	3.799	0.001
Constant	18.851***	1.562	12.07	0.000

Note: ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively.

The results on the estimates of the error correction representation don't diverge significantly from those obtained for the long run. As Table 5.4 shows, the short run coefficients of human capital variable ($\ln \Delta HC$), real exports ($\ln \Delta REXP$), banking credit availability (ΔCRD) and implementing

privatization policy (**PRIV**) variables are all preserving their long run positive and statistically significant signs. In contrast, the short run coefficient appears in front of aid variable turns out to be negative and statistically Significant (**ln Δ ODA**: [beta] = -0.216, p = 0.001). This indicates that the ODA shift from the positive contribution to economic growth has been observed in the long run to become contributing negatively in short run.

Different from the long run result, the growth in labor force appears to have a negative and significant short run impact on GDP growth (**ln Δ LAB**: [beta] = -0.066, p = 0.021).

The coefficient of the lagged error correction term (**ecm_{t-1}**) is negative and statistically significant lending further support to the existence of cointegration between variables under consideration. Its coefficient is -0.39 demonstrating that in each year, about 39% of shocks in the equilibrium can be adjusted to restore the long run equilibrium.

As Table 5.4 indicates, the coefficient of the privatization variable is positive and statistically significant (**Δ PRIV**: [beta] = 0.238, p = 0.0000) demonstrating that neither the long run nor the short run effects of this policy undermines the progression in GDP.

Table 5.4: Estimates of the Error Correction Representation -ARDL (1, 1, 0, 2, 2, 0, 1,0)

Dependent variable	Log GDP			
Variable	Coefficient	Standard Error	t-ratio	P-value
Δ LnLab _t	-0.066**	0.026	-2.509	0.021
Δ LnEdu _t	0.283***	0.078	3.623	0.002
Δ LnK _t	0.054**	0.024	2.255	0.036
Δ LnK _{t-1}	0.093***	0.029	3.205	0.005
Δ LnODA _t	-0.216***	0.052	-4.126	0.001
Δ LnODA _{t-1}	-0.053***	0.017	-3.199	0.005
Δ LnREXP _t	0.083**	0.034	2.452	0.024
Δ Ln ODA*BUCOR	0.210**	0.052	4.069	0.001
Δ CRD _t	0.007*	0.004	1.908	0.072
Δ PRIV _t	0.238***	0.043	5.533	0.000
ect _{t-1}	-0.388***	0.068	-5.691	0.000
R-squared	0.90	Mean dependent var		0.044
Adjusted R-squared	0.87	S.D. dependent var		0.044
S.E. of regression	0.0159			
Sum squared resid	0.006134			
Log likelihood	101.6979			
Durbin-Watson stat	2.495479			

Note: ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively.

As suggested by Brown et al. (1975), we investigate the stability of the model by using Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ) tests. As can be read from Appendices A.3 and A.4, the straight lines plots of both Cumulative Sum of Recursive Residuals and Cumulative Sum of Squares of Recursive Residuals are situated between the two dashed lines. Since these two dashed lines signify that both test stay within 5% levels of significance it can be inferred that the relationship between the variables concerned is stable and the model is correctly specified.

To give the results obtained more robustness additional diagnostic tests on the residuals are carried out. Interestingly, as Table 4.21 indicates, the model under consideration passes all these diagnostic tests. Specifically, the model passes the residuals Normality test (Jarque-Bera), autoregressive-conditional heteroscedasticity (ARCH and White heteroskedasticity tests), serial correlation (Breusch-Godfrey Serial Correlation LM Test) and Residuals stability test (Ramsey RESET test).

Table 4.21 Residuals diagnostic tests

Diagnostic test	Estimated Value	P-value
Normality Test(Jarque-Bera)	5.216	[0.0736]
Breusch-Godfrey Serial Correlation LM Test	[2]:F(02,17) = 1.912	[0.1781]
ARCH heteroskedasticity test	[1]:F(01,32) = 0.0273	[0.8699]
ARCH heteroskedasticity test	[2]:F(02,30) = 0.0400	[0.9608]
ARCH heteroskedasticity test	[3]:F(03,28) = 0.2425	[0.8659]
ARCH heteroskedasticity test	[4]:F(04,26) = 0.2328	[0.9132]
Breusch-Pagan-Godfrey heteroskedasticity test	F(15,19) = 0.9973	[0.4405]
Geljser heteroskedasticity test	F(15,19) = 1.5911	[0.1684]
White heteroskedasticity test (without cross terms)	F(15,19) = 0.9633	[0.5223]
Residuals stability test (Ramsey RESET Test)	[0]:F(01,18) = 0.5509	[0.5885]
Residuals stability test (Ramsey RESET Test)	[1]:F(01,18) = 0.3035	[0.5885]

6. Conclusion and Policy Implications

Driven by the current debates on the effectiveness of foreign aid in mitigating economic and social illnesses in recipient countries, this study aims at investigating the impact of aid on economic growth in Sudan. To make this aim reachable, the intended study applies the ARDL cointegration technique to a time series data set pertain to Sudan and spans over the period from 1980 to 2015.

The result of ARDL F-statistic bounds tests conclusively reveals the existence of cointegrating relationship between variables under consideration. Accordingly, the study proceeds to estimate the error correction model to verify the short and the long run relationships. Expectedly, the results show that foreign aid in the form of ODA has a positive and significant long run influence on GDP growth. This result is consistent with the voluminous number of previous studies arguing that aid presence spurs economic growth in recipient countries. In the same vein, it challenges the findings brought by a strand of well-established studies rejecting the contribution of aid to economic growth. Interestingly, the results also show that the interaction between aid and corruption in public institutions debilitates economic growth in Sudan.

As predicted, improvement in human capital, the expansion in exports, making banking credit available to private sector, implementing privatization policy are all found to be positively and significantly related to economic growth. In addition, the results show that domestic capital formation has no long run significant impact on GDP. This finding agrees with the new classical growth theory which argues that the contribution of capital to economic growth can be only hold in the short run. With respect to the short run impact of aid, the results reveals that aid decreases economic growth, meaning that aid resources needs a maturation period in order to offer its desirable benefits to Sudan economy.

The results obtained by this study have a number of policy implications for both Sudan and other developing countries. Firstly, Sudan as one of the highly aided countries needs to lighten its reliance on foreign aid as a key promoter for economic growth. This is because the dependence on such unguaranteed resources has severe negative consequences on the future economic

performance of the country. For instance, aid, particularly when it turns out to be conditioned or fluctuated, would draw government to take some measures that may oppose nation's higher economic goals. Second, policymakers should spend aid resources on soft infrastructures such as, expanding and upgrading educational facilities, health care services provision and rebuilding the capacities among domestic cadres rather than spending them on final consumption. Adopting such policy action would intensify the effectiveness of aid in multiplying the welfare benefits arising from aid. Third, the above findings may be indicative for the severity of corruption in public institutions on the country's economic performance. Yet, there is much evidence that high institutional quality, through strengthening accountability and transparency in the public institutions, increases the desirable impact of foreign aid on the national economy. This is so because both aid and institutional quality are interlinked and that the ability of the economy to absorb aid resources effectively is likely to be influenced in part by the level of institutional development. Accordingly, policymakers should work on establishing a transparent public environment. Specifically, the levels of accountability in the public institutions must be enforced and sustained. This would help maximize the contributions of aid in accelerating and sustaining economic growth in the long run. Moreover, adopting such measures decreases the likelihood of aid fungibility. In other words, sustaining high level of accountability makes aid complement public health spending instead of substituting it. Accordingly, both aid and government spending would work collectively to achieve the nation's development goals.

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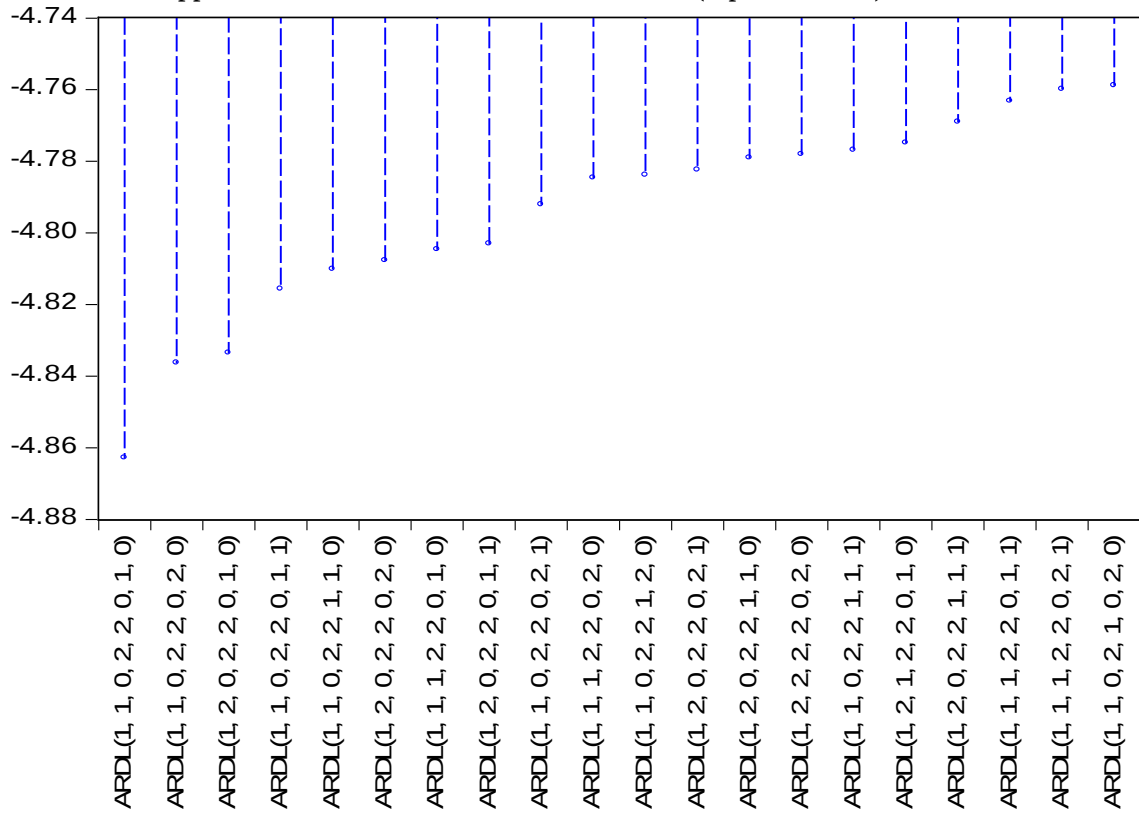
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Appendices

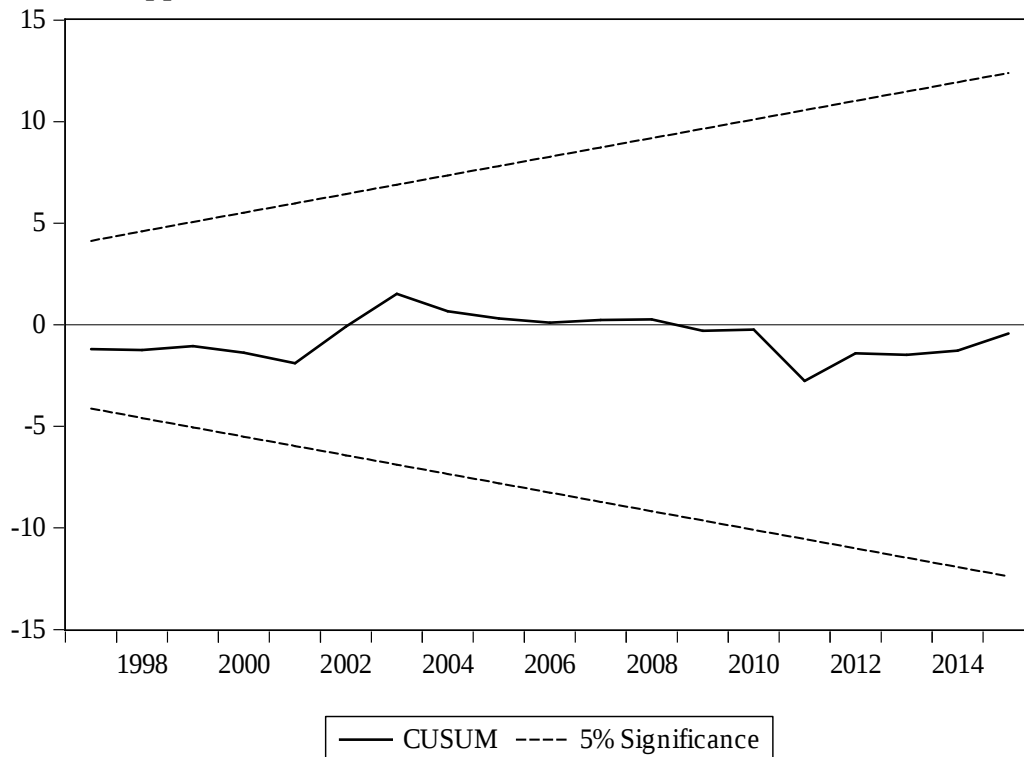
Appendix A.2: Variables, measures and data sources

Variable	Measurement	Data source
LnRGDP	Natural logarithm of real gross domestic product (constant 2010 U.S. dollars)	World Development Indicators (http://databank.worldbank.org)
LnREXP	Natural logarithm of real exports (constant 2010 U.S. dollars)	World Development Indicator (http://databank.worldbank.org)
LnK	Natural logarithm of real gross domestic capital formation (constant 2010 U.S. dollars)	World Development Indicator (http://databank.worldbank.org)
CRD	The banking credit made available to private sector as a percentage of GDP	World Development Indicator (http://databank.worldbank.org)
LnODA	Natural logarithm of real total net official development assistance (ODA) (constant US dollar 2015)	OECD , Table DAC2a (http://stats.oecd.org)
LnHC	Average years of schooling	Barro & Lee international database (version 2014).
BUCOR	Public sector corruption index measures the extent to which do public sector employees grant favors in exchange for bribes, kickbacks, or other material inducements, and how often do they steal, embezzle, or misappropriate public funds or other state resources for personal or family use.	Varieties of Democracy Data (V-Dem) database
Priv	Dummy variable takes value of 0 before year 1992 and value 1 starting from the year 1992 and onward	Authors' own elaboration

Appendix A.2: Akaike Information Criteria (top 20 models)



Appendix A.3: Plot of Cumulative Sum of Recursive Residuals



Appendix A.4: Plot of Cumulative Sum of Squares of Recursive Residuals

