The Causality Effect of Foreign Direct Investment on Economic Growth in Sub Saharan Africa: An Empirical Evidence from Chad Using ARDL Approach

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Abstract

Foreign direct investment (FDI) towards developing nations is eventually intended to help host countries attain sustainable economic growth. As such, the recipient country ultimately achieves poverty reduction and improved human development. Over the past decades, the justification for increasing foreign direct investment to developing and under developing countries have constantly grabbed the attention among scholars and researchers. However, despite inflow of FDI towards the Sub Sharan African (SSA) countries, economic growth is still inconsistent in these regions. And even though foreign direct investment in Chad has grown in the recent years, the country still faces development constraints. This study aims to assess the effect of FDI on economic growth in Chad using time series data collected from the World Bank from 1980 to 2019. The autoregressive distributed lag (ARDL) and error correction (ECM) models were estimated among the variables. Hence, both the long run and short run dynamics regression estimates revealed that FDI has a significant effect on economic growth in Chad within the period. Nonetheless, there is a strong sign of convergence towards long run equilibrium as the speed of adjustment is significantly high at -122.7133%. The findings explain evidence of a uni-directional causality (one-way) running from FDI to economic growth. Furthermore, the paper recommended that both public and private foreign investors should invest in specific needs and exhaust every prudential step in making sure the inflow of FDI is efficiently used for the target aimed to boost the overall economic growth of the country especially by enhancing infrastructure, openness, and inflation target.

Keywords: Foreign direct investment, Economic growth, ARDL, ECM, Republic of Chad.

Introduction

Economic growth is referred to as the increase in the output per capita of an economy (Ivic, 2015) whereby, an increase in per capita output under the growth of GDP not only increases the total volume of production, but a simultaneous increase in the total population as well. Therefore, capital output will also increase over time to maintain the same growth rate (Gueme et al., 2020). On the other hand, foreign direct investment (FDI) often to the physical investments and purchases made by a company in a foreign country, typically by opening plants and buying buildings, machines, factories and other equipment in the foreign country (Altzinger & Bellak, 1999). As such, FDI can be classified in two categories namely direct and indirect (Varghese, 2015). These types of direct investments generate much more benefits since they are generally considered as long-term investments and help strengthen the economy of the foreign country. While the indirect investments include the equity instruments such as stocks, and also debt instruments such as bonds (Altzinger & Bellak, 1999; Kalotay, 2012). More often, FDI is undertaken by multinational firms and it is undeniable that foreign direct investment is a major catalyst to development towards increased growth (Carbonell & Werner, 2018). Moreover, it is also an integral part of an open and effective international economic system (Patmawati & Maimunah, 2013).

Most of the flows of FDI originate from OECD countries with developed countries contributing to advancing this itinerary. Considering the importance of FDI to the implementation of less developing countries' economies, it is primordial to understand its contribution and significance towards the economic growth of both developing and under developing countries. Since these countries play a role in facilitating developing countries to access the international markets as well as the technology (Fahad, 2014; Adegboye, 2017; Ma *et al.*, 2018). However, unlike developed economies, developing countries and other poor countries with limited resources such as Chad must still dependent on foreign intervention. It has been known for decades that Foreign direct investment (FDI) is undeniably recognized as a catalyst for stimulating growth, especially in many developing countries that have limited capacity to promote domestic investment and finance long-term development (Gichamo, 2012; Senkuku & Gharleghi, 2015; Kadiatou, 2017). Decades of economic stagnation and declining standard of livings have turned the Sub-Saharan Africa among the world's poorest region in the globe.

Beside, economic growth is often failing to reach those who are more in need along different social dimensions (UNCTAD, 2019; The Global Fund, 2018) as FDI is an important channel for the transfer of technology between countries, due to the fact that it promotes international trade through access to foreign markets, A number of empirical studies have mainly focused on the relationship between economic growth and foreign direct investment (for e.g. Masry, 2015; Loots & Kabundi, 2017; Carbonell & Werner, 2018). In order to investigate the effect of FDI on economic growth in Sub Sahara African (SSA) countries by selecting GDP per capita as the dependent variable, a panel data of 32 SSA countries during 2008 to 2014 were collected using static panel regression techniques. The dynamic panel estimates were employed to assess the causal relationship between population size and the effect of

the 2009 European debt crisis. As such, the implications of foreign direct investment towards economic growth remains a topic of great concern among researchers (Nations Encyclopedia, 2019).

Although FDI in Chad has increased significantly over the years, it is yet to be visible due to its concentration towards the non-primary sector of the economic growth of the country (agriculture). And because agriculture is the primary sector of the economic growth of the country, the huge concentration of FDI in other sectors made it difficult to boost up the economy. On the other hand, the services sector has lately attracted telecommunications and banking sectors where the country's main investors are Nigeria, France, the United Kingdom and South Korea (Nordea Trade, 2019). furthermore, the value of announced greenfield FDI projects in Chad increased by 319% during 2014. Nevertheless, Chad's ranking in the "where to invest in Africa Report" dropped from 33 in 2014 to 34 in 2015 due to a deteriorating operating environment. With poor rankings in the "Ease of Doing Business Survey" in 2015, the consumer price index (CPI) are ranging at 3% and 12% (Nations Encyclopedia, 2019).
Therefore, does FDI significantly affect economic growth in SSA countries and especially in Chad?

It is no doubt to consider there is countless extensive literature about the role of FDI for developing economies. More often, foreign direct investment increases the stock of capital of a country and generates public revenue through taxation, but the main channels for FDI are to improve economic growth. For example, the evaluation of the SSA (Sub Saharan African) countries has shown that agriculture has a big share in the GDP (with the majority of the population working in the primary sector), however agricultural FDI remain extremely low and it only accounts for 2% to 3% of the total FDI volume (Dike, 2018).

Additionally, the theoretical arguments on the contribution of FDI to host economies have been extensively articulated, with the overall benefits broadly categorized into the direct and indirect macroeconomic effects (Haller, 2012). The direct effects of macroeconomic factors of foreign direct investment occur when there is increase in the investment level of the host economy. For instance, the increase in tax revenues can generate government spending, creating employment and increasing foreign exchange receipts. Furthermore, the indirect effects or micro level in regard to FDI contribute to the long-term growth and development which occur through technology spillovers to the domestic firms (Fagan et al.,2016; Abd Rahman Ahmad et al., 2019). More particularly, it has been proven that FDI can accelerate growth through increases in total factor productivity, and thus overall efficiency of resource use in the host countries (Kargbo & Dunne, 2017). Therefore, the main aim of this paper is to investigate the effects of foreign direct investment on economic growth in Chad using the ARDL, and ECM approaches as well as the causal effects of the variables.

Literature Review

The Effect of Foreign Direct Investment on Economic growth

To confirm the source of growth in Ghana, Antwi et al (2013) proved that foreign direct investment (FDI) has been a vital source of growth by bringing in the capital investment, technology, and management knowledge needed for the country's growth. As such, these finding embrace practical implications for policy makers and investors as well (Oshodi, 2018). Besides, in order to assess FDI inflows as a percentage of GDP (FDI ratio) and economic growth (GDP growth rate) in Tanzania, a study conducted by Senkuku & Gharleghi, (2015) tested the cause-and-effect relationship between variables selected for period from 1970 to 2007. The study employed the granger causality test procedure which refers to an innovative econometric methodology and more effective for testing the direction of causality between variables. The results based on the Granger causality criterion clearly shown that there exist a bilateral or bidirectional causality between FDI inflows and economic growth. This means that FDI stimulates growth and that growth stimulates FDI, which shows that in Tanzania foreign direct investment inflows have led to economic growth and that GDP growth has attracted inflows of FDI (Senkuku & Gharleghi, 2015).

Adegbite & Ayadi (2011) conducted a similar study in Nigeria in order to obtain the best unbiased linear estimators, the study used several econometric tests based on the model using ordinary least squares (OLS) regression analysis and yielded the best linear non-linear estimators. The results of the study confirmed the beneficial role (relationship) between FDI and growth. However, Adegbite & Ayadi (2011) found that the role of FDI on growth could be limited by human capital. The study concluded that if FDI promotes economic growth, then more attention is needed for infrastructure development. Since Sebnem *et al* (2006) confirmed that other local conditions such as human capital and market structure are among the important factors that have effect of FDI on economic growth. On the other hand, Koyuncu & Ünver (2016) have proven that population growth and inflation do not have statistically significant effect on FDI. It is essential to ensure a sound macroeconomic environment and to develop human capital to boost productivity and FDI flows (Adegbite & Ayadi, 2011). In the meantime, Sayek et al. (2006) suggested that holding the extent of foreign presence constant often allow the financially well- developed economies to experience growth rate situated at almost the double of those economies as compared to those with poor financial markets. And secondly,

they (Sayek et al., 2006) also suggested that increase in the share of FDI or relative productivity of the foreign firm leads to higher additional growth in financially developed economies as compared to those in poor countries. Similarly, another study conducted in Australia by Pandya & Sisombat (2017) using the regression analysis between FDI and different measures of growth found that FDI inflows are considered to be a vital source of economic growth and it play an immense role in growth regarding the gross domestic product (GDP), infrastructure improvement, employment creation, trade performance and export. On the other hand, the mining and quarrying sector have been identified as an attractive sector which contributed to 7% of the GDP of the country' s large amount of capital invested and employing intensive labour. The findings provide insight from the critical information to Australian policy decision makers to sort an informed decision with regard to attracting investment sectors and policies in encouraging foreign investors to invest in the country.

Similarly, Jugurnath, Chuckun, & Fauzel (2016) have investigated the effect of FDI on economic growth in Europe and have found that despite its negative impact on economic growth, the inclusion of the 2009 Euro zone crisis did not diverge the results based on static random effects. Which shows that the contribution of FDI is observed to be relatively higher than domestic investment despite its negative effect (Jugurnath, Chuckun & Fauzel, 2016). For instance, Sebnem et al. (2006) stipulated that financial markets usually allow the inverse relationship between foreign and domestic firms to turn into FDI spillovers since the effect is not significant. Overall, both results from Adegbite & Ayadi (2011); and Chuckun, & Fauzel (2016) suggested that FDI does have a positive and significant relationship with economic growth and therefore consistent with literature with respect to developing countries. Moreover, the relationship between FDI and economic growth in Spain with data collected from 1984 to 2010 show that there is no evidence for FDI towards stimulating economic growth in Spain (Carbonell & Werner, 2018).

From the review, there exist a relationship between FDI and economic growth from various dimensions. And then, the nature of the relationship is either negative of positive. The studies show that for the Sub Saharan Africa (SSA) region, most of the finding have negative effect between FDI and economic growth due to the absence of proper application of the factors affecting economic growth which led to a lower FDI.

Data and Methodology

A systematic way of systematically solving a research problem can be done through methodology. By doing so, methodology allows us to achieve the answer to the main objective of the research. As earlier pointed out, the current study sought to investigate the effect of foreign direct investment on economic growth of Chad. Thus, quantitative methodology was employed in this study in which annual time series data were collected from 1980 to 2019. The data are being estimated using the autoregressive distributed lag model (ARDL) and the Granger causality test. The Augmented Dickey-Fuller method was used to test the unit root of the variables whether at first difference or at level (I (0) or I (1). Next, the bound test for cointegration was employed to determine whether there is a long run relationship between the variables according to Pesaran *et al* (2001).

The process of using ARDL includes lag determination, the bound-test for cointegration including the long-run and short-run estimation of the variables' coefficients. Many recent studies have shown that the ARDL approach to cointegration is more reliable than other approaches such as Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990); Gregory and Hansen (1996). One of the reasons that favour the ARDL approach is that it is applicable irrespective of whether the regressors are integrated of the same order or not. Thus, the ARDL model boycott the problems resulting from non-stationary time series data at different level (Pesaran *et al.*, 1996; Pesaran *et al.*, 2001). Which means under the ARDL method, both the long run and short run coefficients in the model are estimated simultaneously. And from there, the model can be developed and utilised for cointegration test even if all the variables are not stationary after the first difference at I (1) or at level at I (0); as long as none is integrated at the second difference at I(2). Therefore, the necessary condition is that some variables are integrated at I (1) and or at I(0) but none at I(2). ARDL model can be developed when this condition is met (Ugwuanyi et al., 2017). Thus, the description of the variables in this study are illustrated in Table 1.

Table 1: Data description

Variable description	Unit of Measurement	Source
GDPG growth (GDPG)	Gross Domestic Product growth (annual %)	
Foreign direct investment	FDI net inflows (% of GDP)	

Inflows (FDI)		World Bank Development Indicators
Gross capital formation (GCF)	Gross capital formation (% of GDP)	
Inflation (INF)	Inflation, consumer prices (annual %)	
Openness (OP)	Trade Openness (%GDP)	

Economists have used both theory and empirical research to explain economic growth. As a result, economic growth is measured as a percentage increase in real gross domestic product (GDP) (Fouthe & Ndedi, 2017). The variables in this study are presented in Table 1 where, real GDP growth is used as the dependent variable and FDI inflow as the independent variable. While gross capital formation, inflation, and openness are employed as the control variables in the model. The data on FDI inflows and real GDP growth as well as the control variables come from the World Development Indicators and measured as the net FDI inflows of investment and GDP Growth prior to literature (Sun, 2002; Mengistu & Adams, 2007; Antwi & Poku, 2013; Blonigen, 2019).

Theoretical Framework

The economic theory of development shows many ways in which FDI could contribute to the growth of the real income of the host country. First, the classical and neoclassical theories of capital movements or foreign investment reveal the restrictive constraint of national savings through the inflow of foreign capital. More specifically, international capital flows involve a flow of investment funds from countries where capital is relatively abundant for countries and where capital is relatively scarce (Fouthe and Ndedi, 2017). For example, the evidence from the statistical analysis of Jugurnath et al (2016) suggested that cumulative FDI had a significant positive effect on economic growth. More specifically, in the long run, Dike (2018) confirmed the existence of a long-term relationship between FDI inflows and economic growth. Apart from this, FDI often plays a unique role in job creation (employment) and modernization of host countries. Indeed, many countries, especially developing countries, view FDI as an important element of their economic development strategy (Samuel, 2009) including economic growth. According to Ricardo's classic theory of growth, an increase in capital and labor would lead to growth in output. In the Harrod Domar growth model, the change in the capital stock (investment) and the additional capital / output ratio (ICOR) determine the growth of national income (GNI). For a given ICOR, an increase in investment will result in an increase in output. For example, Adams (2009) found that FDI had a significant positive effect on economic growth and overall, FDI tend to improve and encourage domestic investment.

Conceptual framework and hypothesis development

Literature particularly for developing countries have shown that the flow of FDI is moving towards a country especially where rapid economic growth has been recorded. For example, when FDI contributes significantly to economic growth, faster economic growth attracts more FDI. Because it increases the confidence of foreign investors in the economy, which further pushes the rate of growth (Blonigen, 2019; Owusu-Antwi et al., 2013). However, in the least developed countries like Chad, studies have shown that FDI is in fact tracking, rather than a form of initial growth or at least a promise of growth (Sun, 2002). Therefore, the proposed framework has blended and modified the existing economic theories to effectively fit the role of FDI towards economic growth.

The following hypotheses are established to examine the various relationships between foreign direct investment factors and economic growth factors in the Republic of Chad.

H_1: Foreign direct investment has a significant influence towards economic growth in the Republic of Chad.

> H_{1a}: There is a significant relationship between FDI inflow and GDP Growth in Chad.
> H_{1b}: There exist a directional causality between FDI and GDP growth in Chad.

Model Specification

In an econometric model, the relationship between economic variables is not precise. Firstly, the theory and assumptions must be consistent with the available data and the problem specification. Secondly, it is essential to make statistical inferences from a particular dataset (estimation and test models); and lastly, draw appropriate conclusions, including forecasts and policy implications, from the estimated model (Ogunyinka & Tang, 2013; Wakyereza, 2017). The role of foreign direct investment and economic growth by Osano & Koine (2016) in Kenya have shown an evidence of a strong relationship between foreign direct investment variables and economic growth. Tus, the applied

model for this paper follows the primary linear model which attempted to ascertain if FDI inflow is effective in improving economic growth then, the single linear regression equation is modified from Acquah (2016); as follow;

$$EG_t = \alpha + \beta FDI_t + e_t \tag{1}$$

More specifically, Equation (1) will be modified to reflect the peculiarity of the study and the selected variables. The long run model is therefore expressed as;

$$GDPG_t = \alpha + \beta FDI_t + e_t \tag{2}$$

Where t indicates the country and time (year); α is the constant number (the intercept) $\neq 0$; FDI represents the FDI inflow; EG represents economic growth; GDPG defines GDP growth; e_t is the error term; and β represent the parameter estimates. Hence, equation (1) will be modified to reflect the peculiarity of the study and variables selected. The ARDL model with error correction parameter and short-run dynamic model can be derived from equation (2) and presented as;

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=1}^{p} \delta_i \Delta x_{t-i} + \sum_{i=1}^{p} \varepsilon_i \Delta z_{t-i} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \lambda_3 Z_{t-1} + u_t \tag{3}$$

The first part of the equation with β, δ, and ε represents the short run dynamics of the model. The second part including λs represents the long run relationship. The null hypothesis in the equation is $\lambda_1 + \lambda_2 + \lambda_3 = 0$, which means non-existence of long run relationship; and Δ represents the first differing operator.

The error correction model (ECM) illustrated in the equation (4) and (5) integrates the short-run dynamics together with the long-run equilibrium without losing long-run information, since ECM illustrates the speed of adjustment towards the long-run equilibrium from the short-run after the shock. The error correction models for Y_t, and X_t are as follows:

$$\Delta Y_t = \mu_Y + \alpha_Y \varepsilon_{t-1} + \sum_{h=1}^{I} \alpha_{1h} \Delta Y_{t-h} + \sum_{h=1}^{I} b_{1h} \Delta X_{t-h} + u_{Yt} \tag{4}$$

$$\Delta X_t = \mu_X + \alpha_X \varepsilon_{t-1} + \sum_{h=1}^{I} \alpha_{2h} \Delta Y_{t-h} + \sum_{h=1}^{I} b_{2h} \Delta X_{t-h} + u_{Xt} \tag{5}$$

Where, μ_{Yt} and μ_{Xt} are stationary with noise processes for some number of lags l and the coefficients in the cointegration equation give the estimated long-run relationship among the variables and coefficients on the ECM describe how deviations from that long-run relationship affect the changes on them in next period.

Likewise, causality among the variables are to be employed for the direction of granger causality between FDI, and economic growth. The necessary condition to perform the causality test is that if the bound test for cointegration revealed that the series are cointegrated then the study will employ the error correction model estimation for the equation (6) in the model as follow;

$$EG_t = \sum_{i=1}^{n} \alpha_i FDI_{t-i} + \sum_{j=1}^{n} \beta_j EG_{t-j} + u_{1t} \tag{6}$$

Thus, the results of the study are presented below in order to achieve the objective of the study.

Results and Discussion

Trend Analysis

Figure 2 below illustrates the trend analysis for Chad between the year 2000 to 2019 shows that between these periods, the economic growth in Chad is fluctuating. Whereby, the country experience high growth rate from 2003 to 2006 where it starts to dramatically decline and slightly raise; then kinky shaped curve until 2019. Seemingly, FDI in Chad

has experienced a systematic increase from 2000 and sharply started to decline between year 2005 to 2006. Which then experienced a sharp fluctuation until 2018 then experience a slight increase from mid-2018.
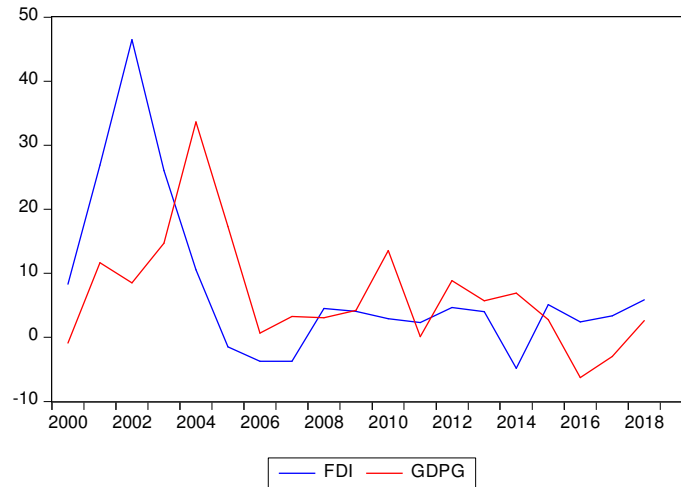
Figure 2: Trend Analysis of FDI and Economic growth of Chad

Hence, between 1961 to 2018, the average value of economic growth in Chad varied between 3.48 % to -21.44% in 1979. With a maximum of 33.63 % average value in 2004 after the country become an oil producer (African Development Bank Group, 2019). According to the African Development Bank Group (2019) the average growth rate of Chad is approximately 2 to 3 % a year. Hence, a significant and strong growth rate of an economy should consistently grow in minimum at nearly 5 % a year or more in a year, which can imply a substantial rate of economic growth. The Group also suggested that a 7 to 8 % of economic growth rate is extraordinary which means the country is performing well. However in Chad, the scenario is totally different and still at low growth rate (African Development Bank Group, 2019). As a result, poverty continues to afflict a large proportion of the population (Khalil Kaya et al., 2020).

Since oil production has been the largest target of foreign direct investment in Chad and since 2003, the petroleum sector has dominated the economic activities of the country. Nevertheless, the majority of the population are dependent on livestock breeding and agriculture as the major and important economic activities and sector of employment. As such, the government has prioritized these sectors in order to diversify the economy and to maximize non-petroleum tax receipts due to the decrease and fluctuations in the overall global oil prices (Nour & Rahman, 2017). Which have led to low oil revenues (which account for over 70 percent of government revenue) (Nour, 2015). Though Chad net FDI inflows fluctuated substantially in recent years, it tended to increase through 1999 - 2018 period ending at 662 million US dollars in 2018. For instance, in 2018, net FDI inflows was 662 million US dollars and during that period, the average value was 3.74 percent with a minimum of -4.85 percent in 2014; and a maximum value of 46.49 percent in 2002. The latest value from 2018 is 5.87 percent (World Bank, 2019). According to the World Bank (2019); and Nour (2015), foreign direct investment in Chad in 1995 was only $7 million, or 0.6% of GDP, but from 1997 to 2000, the range was $15 million to $16 million.

Descriptive Statistic Results

The skewness and kurtosis of each of these variables from the normal distribution, the probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis. Whereby a small probability leads to the rejection of the null hypothesis of a normal distribution. The results of the descriptive statistics are illustrated in Table 2.

Table 2: Descriptive statistics

	GDPG	FDI	GCF	INF	OP
Mean	6.71	7.57	19.9	3.60	61.80
Median	4.22	4.05	20.7	3.51	53.80
Maximum	33.63	46.49	60.2	41.72	126.4

Minimum	-6.26	-4.85	2.73	-13.0	20.1
Std. Dev.	8.96	12.64	13.1	9.77	21.86
Skewness	1.38	1.88	0.99	1.58	0.65
Kurtosis	5.36	6.01	4.13	7.72	3.26
Jarque-Bera	10.44	18.31	8.40	48.37	2.91
Probability	0.005	0.0001	0.01	0.00	0.23
Sum	127.42	143.79	775	129.4	2471
Sum Sq. Dev.	1445.8	2876.6	6530	3339	18628

Note: Symbols are used to represent variables for convenience (i.e. GDPG, FDI, GCF, INF, OP are GDP growth, FDI Inflow, Gross capital formation, Inflation, Openness respectively).

Therefore, the probability value of the descriptive test results from Table 2 show that GDPG, and FDI values are less than 5% (< 5%) and are significant, which imply the data are not normally distributed for these variables. While among the control variables, only the p-value of openness was not significant and implies normal distribution.

Unit Root Test results

Table 3 results show that FDI, GDPG, and INF are stationary at first difference I(1). While GCF, and OP are stationary at level I (0) with trend and intercept at 1% and 5% significance levels.

Table 3: Unit Root Test Results

		Level			1^{rst} Difference		Results
Variables		ADF		ADF			
	Constant	Trend & Constant	No trend & intercept	Constant	Trend & Constant	No trend & intercept	
GDPG	-5.604	-5.529	-1.856**	-2.823**	-1.739	-5.737	I(1)
FDI	-3.808	-3.789***	-4.755	-4.565**	-4.502*	-3.238	I(1)
OP	-1.519**	-2.017**	0.072**	-5.397**	-9.277	-2.873**	I(0)
GCF	-2.751**	-3.571***	-0.571**	-5.288	-5.304	-5330	I(0)
INF	-6.373	-6.270*	-5.856	-6.43***	-6.399	-6.549**	I(1)

*Notes: ***, **, * denotes rejection of the null hypothesis of a unit root at the 1%, 5%, and 10% significance level. No asterisk indicates that the series is non-stationary*

In addition, since some variables are stationary at I(0) and others at the I(1), and others are both of each of the specified models, is it therefore appropriate to employ the bound test for cointegration relationship between FDI and economic growth in Chad. Therefore, the ARDL representation of the equation (3), (4), and (5) are formulated as follow:

$$\Delta GDPG_t = \alpha_0 + \sum_{i=1}^{n} \beta_{1i}\,\Delta GDPG_{t-i} + \sum_{i=1}^{n} \beta_{2i}\,\Delta FDI_{t-i} + \sum_{i=1}^{n} \beta_{3i}\,\Delta GCF_{t-i} + \sum_{i=1}^{n} \beta_{4i}\,\Delta INF_{t-i}$$
$$+ \sum_{i=1}^{n} \beta_{5i}\,\Delta OP_{t-i} + \lambda_1 GDPG_{t-1} + \lambda_2 FDI_{t-1} + \lambda_3 GCF_{t-1} + \lambda_4 INF_{t-1} + \lambda_5 OP_{t-1}$$
$$+ u_t \tag{7}$$

The first part with the difference (Δ) sign represents the ECM (error correction model) for the short run representation; while the second part with the lambda (λ) sign represent the ARDL long run relationship part. Hence, before carrying out the co-integration test, it is very important to choose an appropriate lag length for the specified models.

Lag Length Criteria

Several criteria can determine the optimal lag length such as the Likelihood Ratio (LR) test, Akaike Information Criterion (AIC), Schwartz Bayesian Criterion (SBC), Final Prediction Error (FPE), and Hannan Quinn criterion (HQC). The study firstly focusses on the optimum lag length selection which entails the Vector Auto Regression (VAR) model by building the models and taking into consideration the dynamic time series properties.

Table 4: Lag Determination criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-127.3245	NA	13893.35	15.2147	15.3127	15.2243
1	-115.0959	20.1413	5314.986	14.2466	14.5406	14.2758
2	-105.3531	13.7544*	2782.223*	13.5716*	14.0611*	13.6197*

The results from Table 4 shows that the numbers in * indicates lag order selected by the criterion employ the vector autoregressive (VAR) based on the Akaike information criterion (AIC) for both the FDI and GDPG selected lag (2,2) for the model since AIC indicates the smallest value (13.5716). Thus, the relationship between FDI inflow and GDP growth using the ARDL model using Lag (1,1) as best suited for the consistency of the results for both the long run and short run models.

Bound Test Results

The ARDL cointegration approach was developed by Pesaran and Shin (1999) and Pesaran *et al* (2001). This test was carried out on the models to examine the existence of a long run relationship between the specified variables with the aid of the previously selected lag length.

Table 5: ARDL Bound test for cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	4.87113	10%	3.02	3.51
		5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

The dependent variable from the result is unrestricted constant and no trend. F statistic value = 4.87113 which is greater than (>) the upper bound I(1) and the lower bound I(0) at both 5%, and 10% levels of significance. Therefore, there is co integration between the variables and the null hypothesis of no long run relationship is rejected. Hence, the next step consists to determine the long run and short run relationship models of the variables.

Long Run Estimation

After establishing that the series in the models move together in the long run, an ARDL (1, 0, 1, 0, 0) was chosen for the FDI and economic growth model in order to achieve the objective this the study. The results of the estimated coefficients in Table 6, along with the F-statistic for GDPG and FDI equation model show the variations of the selected independent variables explained certain changes of the dependent variable. Furthermore, the inclusion of the control variables (e.g.: gross capital formation, inflation, openness) in the model help to explain more clearly the occurrence of changes and effect of FDI to GDP growth.

Table 6: ARDL Long run estimation

Variables	Coefficients	T-statistics

GDPG(-1)	0.054733	(0.330613)
FDI	0.322211	(1.567083)**
GCF	-0.589652	(-2.176759)**
GCF(-1)	0.585898	(2.840158)***
INF	0.353197	(2.432647)**
OP	0.051525	(0.446822)
C	-0.818306	(-0.173005)

Note: *, ** and *** denote statistical significance at 10, 5 and 1 percent respectively. Symbols are used to represent variables for convenience (i.e. GDPG, FDI, GCF, INF, OP are GDP growth, FDI Inflow, Gross capital formation, Inflation, Openness respectively). Figures in parentheses beside the coefficient values are the t-statistic values.

The estimated outputs suggest that foreign direct investment inflow FDI (-1) coefficient is statistically significant (p-value< 5%) at the 5 % level of significance. Interestingly, FDI (-1) positively affect GDPG, thus FDI promotes economic growth. And a unit change in FDI leads to 32.22% increase in economic growth (GDPG). In addition, among the control variables the first lag of gross capital formation as a proxy of physical infrastructure (GCF) is positive and significant at 1 percent level. The results show that when gross capital formation (CCF) increases by 1%, GDPG tend to decrease by nearly 58.96%. When openness increases by 1 percent, GDPG tend to increase by 5.125 percent. It implies that an increase in infrastructure encourage openness to FDI which tend affect economic growth. Further statistical test from the control variables (inflation rate) reveal a strong positive evidence of INF on GDPG at 5 percent level. A unit increase in inflation has led to 35.32 increase in economic volatility which prevent growth. Hence, this higher and significant inflation rate indicates a volatile climate of investment that will eventually inhibit real growth. Therefore, infrastructure (GCF) has a significant positive effect on economic growth which means that improved infrastructure will allow the increase in inflow of FDI in the country. Nevertheless, if infrastructure is negative but significant it means that the country level of infrastructure needs expansion in order to attract investors. Therefore, since infrastructure is not enhanced in Chad in the long run, openness (OP) has not significant effect on economic growth (GDPG).

Short Run Estimation

Table 7 display the error correction model representation for the selected ARDL (1,1,1,2,0,1,0,1) for the short run representation of FDI and economic growth model (4.1).

Table 7: Short run estimation ARDL (1,1,1,2,0,1,0,1)

Variable	Coefficient	t-statistics
Δ (GDPG(-1))	0.211490	(1.380421)
Δ (FDI(-1))	-0.732466	(-3.866563)***
Δ (GCF(-1))	0.799185	(3.954409)***
Δ (GCF(-2))	0.296049	(1.724984)
Δ (INF)	0.364926	(4.316050)***
Δ (INF(-1))	0.039223	(0.372003)
Δ (OP)	-0.002368	(-0.035267)
C	-0.623083	(-0.650510)
ECM (-1)	-1.227133	(-5.397273)***

Note: *, ** and *** denote statistical significance at 10, 5 and 1 percent respectively. Symbols are used to represent variables for convenience (i.e. GDPG, FDI, GCF, INF, OP are GDP growth, FDI Inflow, Gross capital formation, Inflation, Openness respectively). Figures in parentheses beside the coefficient values are the t-statistic values.

The outcome obtained for the ECM estimation for FDI and economic growth revealed that almost all the independent variables have been proven to be significant and adjusting variables for the short run equilibrium of the dependent variable (GDPG). Among all the variables, foreign direct investment inflow (FDI (-1)), gross capital formation (GCF(-1)), and inflation rate (INF) turned out to be significant; whereas openness (OP) is insignificant. However, the insignificance of openness has a negative effect on GDPG and a unit increase in OP lead to a decrease in GDPG by -0.2368% which is make FDI to have a negative significant effect on GDPG by a decline of -73.2466. Interestingly in the short run, 1% increase in GCF (-1) significantly increases GDPG by 79.9185%; 1% increase in INF significantly increases GDPG by 36.4926% in relation to economic instability which imply the significant influence of the economic activities by the explanatory variables in the short run model. Furthermore, the error correction term (ECT) coefficient (-1.227) has a negative sign and highly significant, reflecting the joint significance of the long run coefficients indicating a high speed of adjustment to disequilibrium in the short run at -122.7133%. Next, the Granger causality test is employed in the following section in order to find which variable causes the other to change.

Granger Causality Result

The result of the Pairwise Granger causality test among the variables is employed to examine the direction of causality between FDI and economic growth are presented in the Table 8.

Table 8: Pairwise Granger Causality result among the variables

Null Hypothesis	P-value at level of significance (F-test)	Results
FDI does not granger cause GDPG	12.2937***	rejected
FDI does not granger cause GDPPG	11.0561***	rejected

Note: 10%, 5% and 1% level of significance are represented by *, ** and *** respectively. Null Hypothesis: there is no Granger Causality.

The results reveal that there is evidence of causality running from foreign direct investment inflow (FDI) and economic. Thus, the outcome of the direction of causality show that there exists a uni-directional causality (one-way) between FDI to economic growth but it does not go the other way. As such, the findings indicate that FDI is dominant and have huge impact on the economic growth in Chad. It means when FDI inflow is significant and boost the economy, then implying that GDP growth tend to considerably grow as a result of the importance and the high influence of FDI to Chad which then improve infrastructure, openness and stabilizing inflation rate.

Diagnostic Tests Result

Several diagnostic tests were conducted to determine the suitability of the ARDL and the ECM models in this study in order to determine the relationship between the variables are presented in the following Table 9.
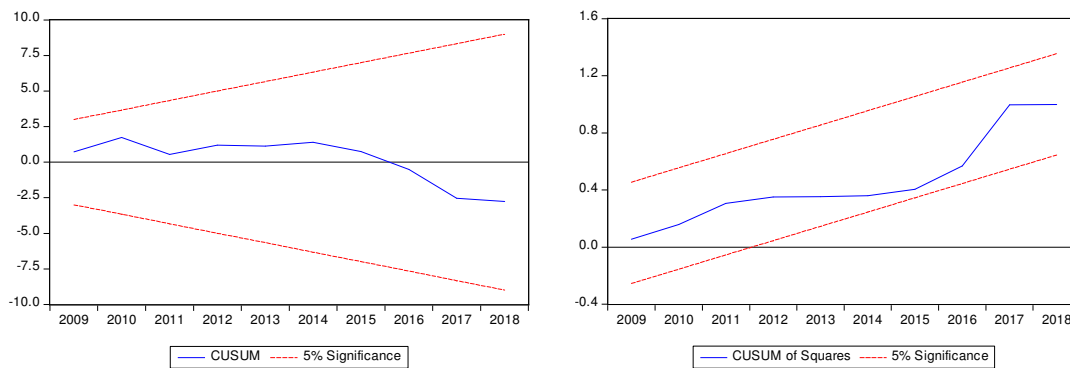
Table 9: Diagnostic test results

Tests	Statistics	Probability
a. Jarque-Bera (normality test):	1.9273	0.3815
b. Breusch-Godfrey Serial Correlation LM test:		
F statistics Obs R-squared	0.4429 1.2609	0.6475 0.5324
c. Heteroskedasticity test Breusch-Pagan-Godfrey:		
F statistics Obs R-squared	1.053942 8.574903	0.4247 0.3794

Notes: 1. denote the respective model (4.1) of the study.

The diagnostic test results show that since the p-values of the dependent and independent variables are greater than 5% level which means not significant, indicate that the model does not suffer from serial correlation, no heteroscedasticity and the error term is normally distributed.

Similarly, the residual stability from the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUM of squares) test are displayed in the Figure 3.

Figure 3: Model Stability diagnostic test

The results of both CUSUM and CUSUMQ of OLS recursive residuals clearly demonstrate a steady state of the specified ARDL model in the study at both long and short run levels. Since the residuals denoted in the blue line lie between the lower and upper critical boundaries at 5 percent, therefore, the long run coefficient of the repressors is stable and thus the results suggest that the estimated parameters of the respective models specified are generally steady over the study period. Furthermore, the next section discusses the findings of the study in relation to literature.

Discussions

The results show that FDI inflow has a significant long run and short run effect on the economic growth in Chad. Hence, in the long run, the relationship is significant and positive, while in the short run, the relationship is negative and significant. Similarly, the control variables have a significant effect on economic growth in both long run and short run, except for openness. More specifically, the result revealed that in the long run, gross capital formation (in line with Ndambiri *et al.*, 2012), inflation (GCF, INF) have a significant positive effect on economic growth; and openness (OP) has a positive (in the long run) and negative (in the short run) effect on economic growth. Therefore, the findings are in line with the study conducted by Otto & Ukpere (2014); Jugurnath *et al* (2016); Saini *et al* (2016); Loots & Kabundi (2017); Carbonell & Werner (2018); Masipa (2018); Dkhili & Dhiab (2018); Baiashvili & Gattini (2020) which suggested that cumulative FDI had a significant positive effect on economic growth as a result of the beneficial role of FDI to stimulate growth.

Mbogela (2019) conducted a study for 49 African countries using cointegration and granger causality where the empirical results revealed that FDI flows, openness and gross capital formation shown to have a significant effect on economic growth in the selected African countries. Besides, Blonigen (2019) confirmed that when FDI contributes significantly to economic growth, faster economic growth attracts more FDI inflow thus FDI encourage domestic. As such, prominent finding from studies in the Sub Saharan Africa (SSA) regions including Chad have revealed that most of the finding have negative effect for FDI on economic growth due to the absence of proper application of the factors affecting economic growth which led to a lower FDI. Besides, other local conditions such as human capital and market structure are among the important factors for the effect of FDI on economic growth, although Koyuncu & Ünver (2016) have proven that population growth and inflation do not have statistically significant effect on FDI.

On the contrary to this study, finding by Jugurnath, Chuckun & Fauzel (2016) confirmed that there is no significant effect of foreign direct investment in the Euro zone although the contribution of FDI is relatively higher than domestic investment (Jugurnath, Chuckun & Fauzel, 2016). Moreover, in Spain, the study conducted by Carbonell & Werner (2018) has shown no evidence of FDI towards stimulating economic growth. Therefore, FDI can significantly influence economic growth in developing countries than in the developed countries and the findings thus support the hypothesis H_{1a}.

The results of the hypothesis H_{1b} of this study was achieved and partially support the hypothesis. The findings explain that there is evidence of causality from foreign direct investment inflow (FDI) to economic growth. And it shows the existence of a uni-directional causality (one-way) between FDI to economic growth but it does not go the other way. As such, the findings indicate that FDI is dominant and have huge impact on the economic growth in Chad. It means that when FDI inflow is significant and boost the economy, then GDP growth tend to considerably grow as a result of the importance and the high influence of FDI to Chad which then improve infrastructure, openness and stabilizing inflation rate. In line with this study, Mbogela (2019) confirmed the existence of the unidirectional causality between FDI and economic growth which highlight the importance of FDI to stimulate growth. The study thus suggested that the export and investment would be more advantageous for the growth of African countries if it would increase real incomes and economic structural transformation of these countries. However, a contradiction was found where Vo *et*

al (2019) employed the Granger causality test and the system generalized method of moments (GMM) found a bidirectional causality between economic growth and foreign investment in the middle income countries. In addition to the comparison on the contrary from previous studies conducted, the results of the causality test of this study is partially supported from the study conducted by Senkuku & Gharleghi (2015) who found evidence of a bilateral causality between FDI inflows and economic growth. This means that FDI stimulates growth and that growth stimulates FDI in Tanzania which led to economic growth and GDP growth in Tanzania has attracted inflows of FDI.

Therefore, the outcome of this paper thus suggests that an improvement in trade openness and a strong infrastructure will lead to more significant economic growth; while inflation rate needs to be monitored in order to achieve the inflation target of the country's treasury bank and reduce instability in the economic climate. Dike (2018) argued that agricultural FDI only account for 2% to 3% which can contribute less to the GDP or economic growth of these countries including Chad. In addition, since agriculture is the primary sector of income of poor countries such as Chad, foreign investors are encouraged to invest more in the agriculture sector and mild or less amount towards industrialization for the moment.

Limitation, Conclusion and Recommendations

This study has investigated the effects of FDI on economic growth in Chad. The study collected time series data from the World Bank database dated between 1980 and 2019. The data were analyzed using the autoregressive distributed lag (ARDL) techniques to estimate the long run and short run models and the error correction representation, as well as the pairwise Granger causality test. In the long run, the ARDL estimation for FDI and economic growth analysis revealed a strong evidence that the individual dimensions of foreign direct investment including the control variables (GCF, INF, OP) indicators have a significant effect on economic growth in Chad and are also revealed to be the important factors in explaining economic growth in Chad. While in the short run, the effect is significant but negative.

The results of this study evocate the need for the government as well as the policy makers to enhance openness, infrastructure, and inflation by improving the skill labors so that the country is able to attract more investment (FDI) and improve the overall economic growth of the country. In addition, strategies that can enhance economic growth should be developed. First, because FDI and GDP growth were retarded by technical inefficiencies, mismanagement and miss guidance which indicate that a robust policy should be developed. Second, government should also encourage local contribution than foreign involvement as a sole aim of step in the direction to improve efficiency and boost foreign investor's confidence.

This paper hence highlights some limitations firstly in terms of the limited availability of FDI inflow data per sector of investment. The data per sector of investment were only available prior to three-year period instead of 1980 to 2019. Therefore, the data would not be as useful and meaningful for each sector in the analysis which combine all sectors as inflow of FDI. In addition, from the literature, there have been very little studies conducted in the same area equally to the current research which make it difficult to have more information about the existing researches conducted in Chad. Moreover, using a time series dataset would allow the researcher to identify and estimate the effects that are simply not detectable in either pure cross-sectional or pure time-series data across countries.

Direction of future research should then focus on a wide range of every state of Chad or at least from every region (in rural and urban) in order to clearly identify and specify the effects and determinants of economic growth accordingly. In addition, more variables like market integration, natural resources intensity and specific human capital factors may also be point of focus. Therefore, future studies should have to investigate specific impact of FDI (a particular sector) on economic growth performance (by investigating featured variables) to see the effects and significance of these variables.

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