Determinants of Economic Growth in a Least Developed Country: Time Series Analysis for Niger

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DETERMINANTS OF ECONOMIC GROWTH IN A LEAST DEVELOPED COUNTRY: TIME SERIES ANALYSIS FOR NIGER

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ABSTRACT

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This study investigates the determinants of economic growth in Niger by using data for the period of 1971-2018. According to the results of the Johansen co-integration test, there is long-term relationship between the variables and Capital formation, Trade openness, Labor force and Government expenditure have a positive impact on economic growth. However, the effect of inflation and Technology on economic growth is negative. According to the results of Vector Error Correction Model (VECM), there is long-run causal relationship from capital formation, technology, trade openness, labor force, inflation and government expenditure to the economic growth. The results of cointegration and VECM emphasize that Capital formation, Trade openness, Labor force and Government expenditure are the long-term determinants of economic growth in Niger. Niger should reform the education, agriculture and industrial production regardless of natural resources. Nigerien economy needs to move towards agriculture and manufacturing sector, despite its dependence on uranium. We also suggested that a new "Five-Year Development Program" should implement projects that will stimulate the economy.

Keywords: determinants of economic growth, Niger, time series analysis.

JEL Codes: C22, E01, O47, O55

1. INTRODUCTION

Economic growth has occupied a very important place in the debate of economists since the 18th century. There are many contradictory approaches concerning the factors that determine the economic growths. These contradictory approaches have raised questions such us: What is the secret of economic growth? What are the determinants of economic growth? There are various and different explanations about the conditions or factors under which economic growth occurs. Therefore, this issue ranks first among the subjects that attract the interest of economists. Different views of economists about the determinants of economic growth have emerged. We can divide these factors into two groups: basic resources and other resources. The main resources of economic growth are labor, physical capital, natural resources and technology, while other resources are factors such as human capital, entrepreneurship, government and institutional structure. According to the Solow-Swan growth model, there is three factors driving the output of an economy: technological change, labor, and capital (Abubakar, 2020, p. 1). In Endogenous Growth Models, capital accumulation and technology level are shown as determinants of growth.

The debates concerning the determinant of economic growth provided several hypotheses. Many empirical studies like those of Fischer (1993), Barro (1999), Roe (2003), Ndokoula (2004) and Petrakos, et al. (2007) investigated the factors determining the economic growth. Studies like Daouda (2013) have asked the question of whether growth is pro-poor or not. According to him, economic growth is not a sufficient condition for reducing poverty in Niger. In this study we are going to focus on one of the least developed countries in the world, Niger. In 1971, the United Nations identified the least developed countries (LDCs) as low-income countries facing serious structural barriers in sustainable development. These countries are highly vulnerable to economic and environmental shocks and have low human assets levels. There are currently 47 countries in the LDCs list, which are reviewed by the Development Committee (CDP) every three years. Niger is also on this list for many years. The Republic of Niger, is a West African country with a surface area of 1,267,000 km2 and has no coast to the sea. According to Figure 1, from the independence of Niger in 1960 until 2017, the average share of primary, secondary and tertiary sector in GDP of Niger is respectively 43%, 15% and 32%. This situation shows that Niger is a least developing economy, since the share of agriculture is greater than those of industry and services. With the Uranium boom in 1972, the share of primary sector decreased to 47%. 20 years after independence from France (In 1980), the share of primary sector in GDP decreased to 43%, the share of secondary sector increased to 24% and the share of tertiary sector became 24%. The share of the secondary sector increased from 9% in 1966 to 24% in 1979, and thus become the determinant of growth in the 1980s. Oil production at the end of 2012 led to an increase in the share of the industrial sector to 21.6% in 2013. This year (2013), represents the point on which the shares of the three sectors are closest to each other.

The main economic activity of the large part of the Nigerien people is agriculture and animal husbandry. Niger, which has been producing uranium since 1971, is one of the poorest countries in the world and its economy is facing structural problems. Niger has started producing oil in 2011 and have achieved a very rapid growth in 2012 (with a rate of 11.1%). It is among the fastest growing countries with an average growth rate of 6.23% from 2012 to 2019 (Institut National de la Statistique, 2020; Presidence du Niger, 2020). However, in term of GDP per capita Niger has a bad performance, 403.4 US$ in 208 (World Bank, 2020).

According to Figure 2, the closure of land border by Nigeria from 1984 to 1986 created a situation of economic instability in Niger by causing in 1984 a negative decrease of -16.8%, the lowest since 1974 (-17.04%). The implementation of the First Five-Year Development Program (1979-1983) and the Second Five-Year Development Program (1987-1991) led to a growth of 13.47 in 1978 and has diminished the effect of this uncertain economic instability.

The population, which is unevenly distributed in the national land, is estimated as 22 million in 2020 and its annual growth rate is 3.8%. Niger has all the characteristics of LDCs (Institut National de la Statistique, 2018). The lack of leadership and good economic orientations meant that the authorities do not really make an effort to get this country out of underdevelopment. In this context, this study will use time series analysis in order to investigate the macroeconomic determinants of economic growth in Niger, which is a LDC. One of the reasons that motivate us to perform this study is to contribute to the search for ways to remove Niger from the list of LDCs. Along with revealing the determinants of economic growth in Niger, this study will also provide some suggestions.

Thus, the rest of the document is organized as follows: The section 2 provides theories and determinants of economic growth. In the third section, the literature review of the studies on "determinants of economic growth" has been provided. The Section 4, presents the data set and methodology. We provided the empirical results of the time series analysis in Section 5. Finally, the Section 6 provides the conclusions and the recommendations of the study.

2. THEORETICAL FRAMEWORK

The classic growth model includes the views of leading economists such as Adam Smith (1723-1790), David Ricardo (1772-1823) and Thomas Malthus (1766-1834). According to Adam Smith, division of labor and capital accumulation are the main factors of economic growth. According to him, as the division of labor increases, the productivity of labor increases, and the production increases by the labor force. Thomas R. Malthus has argued that the increase in technology will inevitably lead to scarcity of natural resources, thereby increasing the number of people rather than increasing their standard of living or productivity (DeLong, 2002, pp. 121-122; Ünsal, 2007, pp. 58-59). David Ricardo has argued that productivity gains in the industry are unlikely to be continuous. Ricardo divides the production attendees into three separate groups: workers, entrepreneurs (Capitalists) and landowners. In addition, the shares of these groups in total output are respectively wages, profit and rent (Ünsal, 2007, pp. 60-64; Taban, 2014, p. 64).

Unlike the classical theories, John Maynard Keynes (1883-1946), who brought innovations to economic theories with his magnum opus "The General Theory of Employment, Interest and Money", argued that economies generally came to the equilibrium in underemployment. According to Keynes, the increase in autonomous investments will increase the revenue more than the product of the multiplier coefficient; increasing incomes will whip demand, which increases investments. The increase in investments causes the economy to get rid of the recession and start to grow; and the employment volume to expand. The Harrold-Domar growth model emerged mainly from the Keynesian short-term static equilibrium model. In the Harrold-Domar model, the capital/output ratio was used instead of capital's efficiency. In this model, it will be possible for the state to reach its targeted growth rate by intervening in the economy by means of fiscal policy instruments. Harrold-Domar model failed to account for the

sustained growth in output per person that has taken place in the world economy since the industrial revolution (Acar, 2008, pp. 78-81; Gnos, 2000, pp. 191-194; Aghion & Howitt, 2009, p. 49).

On the other hand, the Neo-Classical growth theories developed (under the leadership of R. Solow and S. Swan) considered the full competition conditions, payments of production factors according to their marginal productivity, the full employment and a changing capital-output ratio. In this model, physical capital depreciates at a constant rate δ and population grows over time at a constant rate n. Since there is full employment assumption and elimination of age structure in the population, the labor force and employment will be equal to each other at each point of time. The Solow-Swan model explains that the per capita income, which is the most obvious of the state of a given economy, will increase over time, even though the long run equilibrium growth rate will be zero unless some conditions are met (Ay, 2007, pp. 10-12; Novales, et al., 2009, pp. 53-60).

The main contributors of endogenous Growth Theories are Paul M. Romer and Robert Lucas. Endogenous Growth theories (models) emphasize the technological development and human capital. The simplest of these models is the AK model (Y = AK, A: technology level, K: capital, Y: output) which is the result of "learning by doing". According to AK model, when people accumulate capital, learning by doing generates technological progress that tends to raise the marginal product of capital, thus offsetting the tendency for the marginal product to diminish when technology is unchanged. The model provides a production function ($Y = AK$) in which marginal products of capital is equal to the constant A (Ünsal, 2007, pp. 239-250; Aghion & Howitt, 2009, pp. 47-48).

3. LITERATURE REVIEW

In this section, we will examine the empirilcal studies on the macroeconomic determinants of economic growth, and reveal which results have been obtained for which country or group of countries using which methodology and data. Our hypothesis here is that the variables we choosed are determinants of economic growth. In this literature review, we will use 3 tables (Table 1, 2, 3) that show the studies and their authors, countries (country group) /periods of study, methods applied, variables used and results.

The Table 1 shows the literature review of selected Least Developed Countries (LDCs) such as Niger, Central African Republic, Democratic Republic of Congo, Ethiopia, Tanzania, Burkina Faso, Zambia and Somalia.

Table 1: Review for studies on selected Least Developed Countries

Author / Year	Countries/Periods	Method / Variables	Comments (Results)
Tankari Ango, 2010	Niger, 1975-2007	*Engle-Granger cointegration, Vector error correction model (VECM),* Real per capita GDP Human capital Physical capital Monetary aggregate (M2) % of GDP Trade openness Public consumption % of GDP Inflation Political instability	Human and physical capital influence both long-term and short-term economic growth in Niger. In addition, public consumption has impacts to the growth in the long term, while the impacts of inflation and financial development is in the short term. The other variables, namely trade openness and political instability, remain insignificant. The physical capital is the most important determinant of economic growth in Niger. Financial development has a positive effect on the economic growth while public consumption has a negative impact.
Ndokoula, 2004	Central African Republic (CAR), 1970-2000	*Ordinary Least Squares (OLS) method* Real GDP per capita, The Literacy Rate, The Gross Investment Growth Rate, The Growth Rate of the Net Trade Balance, The Inflation Rate, Trade Openness, Political Instability,	Human capital negatively influences economic growth. The net trade balance positively influences growth. The contribution of trade to total GDP is below the country's economic potential. The degree of openness has a negative impact on the endogenous variable. The trade balance deficits are partly explained by the meager export earnings. On the other hand, physical capital, inflation and political instability are not significant.
Tcheta-Bampa, 2012	Democratic Republic of Congo (DRC), 1920-2000.	*Ordinary Least Squares (OLS) method* Real GDP, Physical capital stock Investment, Human Capital, Labor force,	The stock of public and human capital have insignificantly positive impacts on long-term growth. Capital stock contributes significantly and positively to GDP growth. However, human capital still does not play a crucial role in explaining the growth rate. The lack of physical and human capital linked to education as well as the underdevelopment of technical progress seem to be the determinants of the non-growth traps in which the DRC has been trapped for a long time.
Hassen, 2017	Ethiopia, 1980-2014	Johansen cointegration and causality approach, Vector error correction model (VECM), GDP, Industrial production index, Exchange rate, CPI, Interest rate, Broad money supply, FDI, Credit to manufacturing sector,	There is long run relation between economic growth and its determinants. Education and health expenditure, and inflation have positively affected the economic growth in the short run, while domestic investment and FDI have negative to the growth. However, there is insignificant relationship between openness, freedom and democracy in the short run.
Kabore, 2013	Burkina Faso, 1970-2011	*The Johansen cointegration test and Error correction Model (VECM)* Investment rate; Active population; Public consumption expenditures (% of GDP); Inflation; Public aid per person; Carbon dioxide emissions; Agricultural land area; Credit to the private sector (% of GDP) Real effective exchange rate	The public sector has managed to adjust the imbalances between the desired and actual levels of real GDP per capita growth. In the long run, investments and inflation affect growth positively. In addition, loans extended to the private sector slow down growth in the short term and contribute to growth in the long term.

Chirwa & Odhiambo, 2016	Zambia, 1970-2013	*ARDL, Cointegration* investment, human capital development, population growth, government consumption (% of GDP), real exchange rate depreciation, inflation, international trade, foreign aid	The key macroeconomic determinants of economic growth in Zambia are investment, human capital development, international trade, government consumption and foreign aid. Investment and human capital development are positively associated with economic growth while government consumption, international trade and foreign aid have negative effect to the economic growth in short-run.
Sheikh Ali, Dalmar, & Ali, 2017	Somalia, 1970-2012	*Ordinary least squares (OLS) regression* GDP, Exports (X), Foreign aid, Government expenditure, Gross capital formation, Foreign Direct Investment (FDI).	In Somalia, only Gross capital formation and FDI are affecting economic growth positively. There is long run relationship among the variables. Causal link also exist between the variables.

Source: Author's compilation

According to Table 1, the most commonly used methods for investigating the determinants of growth in LDCs are Johansen Co-integration, Regression (OLS) analysis and Vector Error Correction Model (VECM) analysis. Tankari Ango (2010) used Engle-Granger cointegration and VECM in order to find the determinants of economic growth. The same Table 1, shows that Foreign Direct Investments (FDI), Capital formation, trade openness and labor are the most used variables as determinants of economic growth in underdeveloped or least developed countries. Kabore (2013) and Tankari Ango (2010) emphasized that the public sector (public expenditures), investments and inflation are the determinants of economic growth in the long and short run respectively in the study on Burkina Faso and Niger, which are least developed countries of West Africa.

In Table 2, we reviewed studies carried on developing countries such as Turkey, Ghana, Nigeria, India, Ghana, Botswana and Pakistan. According to the Table 2, the most used methods are Conintegration and VECM analysis. The common used determinants of economic growth in developing countries are: FDI, capital formation (physical capital), human capital (labor force) and public sector (governement or public consumption or expenditure). In some studies, trade openness and inflation were unavoidable. Some studies used foreign trade and trade openness instead of FDI; maybe for lack of data.

Table 2: Review for studies on developing countries.

Author / Year	Countries/Periods	Method / Variables	Comments (Results)
Göçer, 2013	Turkey, 1992:Q1-2012:Q3	*ARDL Bound Test Approach; Granger causality analysis;* GDP, Foreign direct investments (FDI), Exports (X)	The impact of exports on economic growth is significant, while FDI have a positive but not significant effect on economic growth. For Turkey to achieve a high economic growth rate such as China and India and also to maintain this rate, more efforts is needed to attract FDI.
Havi, Enu, Osei-Gyimah, Attah-Obeng, & Opoku, 2013	Ghana, 1970-2011	*Johansen Cointegration Test,* GDP, Foreign Direct Investments (FDI), Capital formation, Labor force,	Physical capital formation and foreign aid have a positive effect on growth in Ghana; In the long run, physical capital, labor, FDI, foreign aid, CPI, government spending and military management are significant determinants of economic growth. In the

		Foreign aid, CPI, Public Expenditures	short term, FDI and public expenditures determine the growth.
Ajide, 2014	Nigeria, 1980-2010	*Multivariate Regression Approach* GDP, Foreign Direct Investments (FDI), Capital formation, Economic freedom, Life expectancy at birth, Labor force.	Labor force, life expectancy, openness and economic freedom are factors that affect economic growth both significantly and at different levels of importance. However, the size of the government (negative impact) and openness (positive effects) make sense out of five variables and form a composite index.
Baramay, 2015	Tanzania, 1995-2013	*Ordinary least squares (OLS) and cointegration test* Budget deficit, Inflation, Exchange rate, FDI	There is a negative relationship between budget deficit, inflation and economic growth. However, FDI and exchange rate positively affect economic growth.
Biswas & Saha, 2014	India, 1980-81 to 2010-11	*The Johansen and Juselius cointegration test and Error correction Model (VEC),* GDP, Capital formation, labor, export, FDI, Money supply, inflation, budget deficit	There is a stable long-term relationship between economic growth and its determinants. While capital formation, labor, export, FDI and Money supply positively affect the growth of India, inflation and budget deficit affect the growth negatively. In the short term, GDP was significantly affected by capital formation.
Mosikari, Xaba, & Tsoku, 2016	Botswana, 1966-2014	*Engle-granger test for cointegration, VECM* GDP, Keynesian macroeconomic factors (household final consumption, gross capital formation, exports of goods and services, Imports of goods and services)	All the variables worked as expected from Keynesian theory and according to this theory it is empirically proven that imports have negative impact on the economic growth. Household consumption, capital formation, exports of goods and services have a positive impact on economic growth
Ajmair, Hussain, Abbassi, & Bhutta, 2017	Pakistan, 1976-2014	*Structural Vector Auto Regression (SVAR)* Gross Fixed Capital formation (% of GDP), gross national expenditures (% of GDP) government consumption (% of GDP), personal remittances received (% of GDP)	The best relevant positive and significant determinants of economic growth are remittances received, gross national expenditures and inflation. The study suggests that government should focus on overall economic growth augmenting factors while formulating any policy relevant to the concerned sector.

Source: Author's compilation

Table 3: Review for Panel Data Studies on some Selected Countries.

Author / Year	Countries/Periods	Method / Variables	Comments (Results)
Dedewanou, 2015	WAEMU countries: Benin, Burkina Faso, Ivory Coast, Mali, Niger, Senegal, Togo; Top 5 Fast Growing Countries: Brazil, Russia, India, China, South Africa 1980-2013	*DOLS (Dynamic Ordinary Least Squares),* GDP, Gross fixed capital formation, FDI, Trade Openness, workforce	Investment, foreign direct investment (FDI) net inflows and human capital positively affect the economic growth of fast-growing countries. UEMOA countries' investment and human capital explain long-term economic growth. Economic policy measures must focus on good governance in order to attract both domestic and foreign investors to the WAEMU countries.
Ndambiri, et al, 2012	19 Sub-Saharan African countries, 1982-2000	*Generalized Moment Method (GMM),* GDP, Physical capital formation, Exports of goods and services, Human capital, Government expenditure, Nominal discount rate, Foreign aid	In sub-Saharan African countries, physical capital formation, export and human capital formation significantly contribute to economic growth. However, government expenditure, nominal discount rate and foreign aid lead to meaningful and negative economic growth.
Sissoko, Sloboda, & Kone, 2018	ECOWAS, 1981-2015	*Ordinary least squares (OLS) and panel regression* Real per capita GDP Gross capital formation total population population ages (15 - 64)	Productivity Index modestly increased and both factor accumulation and total factor productivity drive the economic growth in ECOWAS countries.
Adepoju & Ogundunmade, 2019	Panel of 126 countries, 2010-2014	*panel regression analysis* Policy Interest Rate, Industrial Production, Trade Openness, Unemployment Rate, Exchange Rate, Public Debt, Fiscal Balance Inflation rate	High increased trade openness, government expenditure control and low inflation are the factors that boost the economic growth of a country. There is no significant relationship between exchange rate and economic growth, whereas unemployment influences output for African countries. Fiscal balance and unemployment rate played their role in the growth of African countries.
Barro R. J., 1999	Chile, 100 countries, 1960-1995	*Panel Regression,* GDP per capita, Government Consumption (% of GDP), Rule of Law, Fertility rate, Years of schooling, Investment (% of GDP), Inflation, Democracy, Terms of Trade,	High Economic Growth estimations in Chile, mean low government consumptions, high rule of law, high investments, and low fertility. Education, inflation level, openness are roughly average in Chile, so they do not explain the economic growth-rate differential. The fertility rate is relatively low in Chile; however, the decline to OECD levels would increase the growth rate on impact by 0.5% per year.
Fischer, 1993	101 Countries, 1960-1989	*Panel Regression, Cross Section,* Inflation, Budget Deficit, Distorted foreign exchange markets, Investments, Capital accumulation, Productivity Growth	Cross-section and panel regression show that growth is negatively related to inflation, major budget deficits and distorted foreign exchange markets. There is also a causality relationship from macroeconomic policies to economic growth. Inflation reduces growth by reducing investments and productivity growth. Budget deficit also reduces both capital accumulation and productivity growth.

Source: Author's compilation

Finally, we eximined the studies for panel dana analysis of selected countries in Table 3. According to this table, the most used method for panel analysis is OLS panel regression model. The panel data studies used FDI, capital formation, human capital, public sector and trade openness. Dedewanou (2015), in his study on UEMOA countries including Niger, he suggested that FDI, human capital and capital formation are the source of economic growth. Hosseinpour, Ndambiri, et al (2012) also emphasize that physical capital formation, export and human capital formation significantly contribute to economic growth in Sub-Saharan African countries.

Let's summarize the review and draw a conclusion that we will use for the next step. Based on the information we have received above, we can consider Capital formation, Foreign Direct Investments, public sector, the openness of trade and workforce as the main determinants of economic growth. We also consider money supply, inflation and consumption as additional factors. However, we will choose the variables according to the availability of our data.

4. ECONOMETRIC METHODOLOGY

4.1. Data Set

This study will investigate the macroeconomic determinants of economic growth using time series analysis with data for Niger within the period of 1971-2018. Based on economic growth theories and literature review, a hypothesis was established with variables such as GDP per capita, Capital formation, technological subsidies, trade openness, labor, inflation and government expenditures. We obtained the data of these variables from the WDI database of the World Bank and EDENPUB database of BCEAO. According to these data, the following model could be established in Equation (1):

$$(1) \qquad Y = f(GFCF, T, TO, INF, L, GE)$$

Where,

Y = Real GDP per capita (US dollar value, WDI)

GFCF = Gross Fixed Capital Formation (% of GDP, from EDENPUB database)

T: Technical cooperation grants representing technology (US dollar value, WDI)

TO = Trade Openness: [sum (Exports + Imports) x 100/GDP] (% of GDP WDI)

L = Population ages 15-64, Representing Workforce (% of total population, WDI)

INF= Consumer price index Representing inflation, (2014 = 100, WDI)

GE = General government final consumption expenditure (% of GDP, WDI)

Then we can write the econometric model specification as indicated in Equation (2):

$$(2) \qquad Y = a_0 + a_1 GFCF + a_2 T + a_3 TO + a_4 INF + a_5 L + a_6 GE + \varepsilon_{it}$$

Where, α_0 denotes the intercept (constant term), α_1 - α_4 are the coefficients of the explanatory variables; ε is the error term. In the model, real GDP per capita was used as a dependent variable as proxy of real economic growth.

4.2. Econometric Methodology

Time series are used in economics because must of data used here are recorded over time. The term time series refers to a sequence of data, each of which is associated with a moment in time. Time series concern data taken at regular intervals. (Aljandali & Tatahi, 2018)

Before doing this study, the variables must be stationary. Since time series analysis is difficult to do in a classical way, we will use software package developed on the computer namely (EViews). Stationarity can be expressed as time series data fluctuating around a fixed mean and the variance of the fluctuation remains particularly constant over time. In the time series analysis, some unit root tests are used to test the stationarity. In this study, we will use the Augmented Dickey-Fuller (ADF) unit root test developed by Dickey and Fuller (1981) (Dikmen, 2012).

We will use VAR-based cointegration tests with the methodology developed in Johansen (1991, 1995) to estimate multiple cointegrated vectors. The cointegration approach states that if the series of economic variables are not stationary, there may be a long-term equilibrium relationship between the variables; despite the external shocks that affect the variables. As a result of the tests, if it is shown that the co-integrated vector or vectors are statistically significant, it is accepted that there is a long-term relationship between the series. We need to remember that before the Johansen co-integration test, we need to make sure that the series are first-order stationary. (Dikmen, 2012, p. 321; Göktaş, 2005).

After the cointegration test, if there is a long-term cointegration relationship between the series, dynamic models that reflect this relationship can be developed and thus Vector Error Correction Model (VECM) is applied. The VECM is used to conduct short and long-term causality tests between co-integrated variables and to eliminate the imbalance between the short / long-term relationships. VECM is also used to distinguish between long-term balance and short-term dynamics between variables and to determine short-term dynamics. In this model, the short-term dynamics of the variables in the system are affected by the deviation in equilibrium (Gujarati, 1995, pp. 824-830).

5. EMPIRICAL RESULTS

5.1. *Unit Root Test.*

We will use the Augmented Dickey-Fuller (ADF) test to test whether our series are stationary or not. We constructed the null hypothesis as "H0: There is a unit root in the variables) and the lag length is measured with the "Akaike Info Criterion".

Table 4: ADF test results

Variables	Level (p-value)			1st Difference (p-value)		
	Individual Intercept	Individual Trend	Intercept & None	Individual Intercept*	Individual Trend*	Intercept & None*
Y	0.0179	0.9997	0.0769	0.0000	0.0003	0.0000
GFCF	0.8467	0.3346	0.8478	0.0002	0.0013	0.0000
T	0.2112	0.6847	0.6987	0.0000	0.0000	0.0000
TO	0.1171	0.4172	0.6880	0.0000	0.0000	0.0000
L	0.8322	0.7085	0.1201	*0.0818*	*0.4316*	0.0277
INF	0.7190	0.0213	0.9981	0.0000	0.0001	0.0000
GE	0.0675	0.1792	0.8756	0.0000	0.0000	0.0000

 * H_0 : Variables are not stationary, **Accepted**.

Source: Created by Author from Eviews program

According to ADF test results in Table 4, all variables are stationary at the first difference. The summary of Table 4 shows that all the *p*-values are more than 5% (0.05) in level and below 5% in the 1st difference. Let's us note that in the first difference, and with individual intercept and trend p-values for labor force D(L) are above 5%. However, the prob value without intercept and trend is below 5%. Since there is no huge trend in this variable, we can accept the result at 10% level. During the ADF test compilation, the summary of result shows that the average *p*-value is equal to zero (0.000).

5.2. Johansen Cointegration Test.

Now we will perform the cointegration test in order to investigate the long run relationship between the variables. To do so, we need to select the lag order. According to the Akaike information criterion (AIC) in Tabe 5, the lag order selected is lag (4). Since the lag order is lag (4), we will perform the Johansen Cointegration test with lag 4. According to the unrestricted cointegration trace test results provided in Table 3II, there is six (6) cointegrating equations at 5% level, which is very desirable.

Table 5: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.999227	581.5076	125.6154	0.0001
At most 1 *	0.886091	273.3979	95.75366	0.0000
At most 2 *	0.787581	179.9866	69.81889	0.0000
At most 3 *	0.661320	113.3713	47.85613	0.0000
At most 4 *	0.615559	66.81521	29.79707	0.0000
At most 5 *	0.435236	25.70869	15.49471	0.0010
At most 6	0.026181	1.140788	3.841466	0.2855

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level
 * denotes rejection of the hypothesis at the 0.05 level
 **MacKinnon-Haug-Michelis (1999) p-values
Source: Created by Author from Eviews program

Table 6: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.999227	308.1097	46.23142	0.0000
At most 1 *	0.886091	93.41128	40.07757	0.0000
At most 2 *	0.787581	66.61530	33.87687	0.0000
At most 3 *	0.661320	46.55612	27.58434	0.0001
At most 4 *	0.615559	41.10653	21.13162	0.0000
At most 5 *	0.435236	24.56790	14.26460	0.0009
At most 6	0.026181	1.140788	3.841466	0.2855

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Created by Author from Eviews program

In Table 6, the Max-eigenvalue test indicates six (6) cointegrating eqn(s) at the 5% level, which is also very desirable situation. Therefore, our variables are co-integrated and come into equilibrium together. In other words, there is a long-run relationship between variables. To examine this relationship in more detail, it is necessary to look at the normalized vector coefficients provided in Equation (3):

$$(3) \qquad Y = 7.415\boldsymbol{GFCF} - 0.0000000793\boldsymbol{T} + 7.71\boldsymbol{TO} - 9.11\boldsymbol{INF} + 45.49\boldsymbol{GE}$$

According to the coefficients provided in the above equation, with the exception of inflation and Technical cooperation grants all variables have a positive affect GDP in long-term, ceteris paribus.

5.3. *Error Correction Model (VECM).*

Since there is a cointegration vector in the model, we can apply the Vector Error Correction Model (VECM) in order to investigate the long-term causality relationship. Thus, we can write the VECM model in Equation (4) with GDP per capita (Y) as the target variable:

$$
\begin{aligned}
\Delta Y_t = & -0.34\boldsymbol{ECT}_{t-1} + 0.19\boldsymbol{Y}_{t-1} - 0.21\boldsymbol{Y}_{t-2} - 0.074\boldsymbol{Y}_{t-3} - 2.97\boldsymbol{GFCF}_{t-1} \\
& + 0.2\boldsymbol{GFCF}_{t-2} - 1.7\boldsymbol{GFCF}_{t-3} + 0.0000003\boldsymbol{T}_{t-1} \\
& + 0.0000004\boldsymbol{T}_{t-2} + 0.0000001\boldsymbol{T}_{t-3} - 0.93\boldsymbol{TO}_{t-1} - 1.67\boldsymbol{TO}_{t-2} \\
& + 0.59\boldsymbol{TO}_{t-3} + 16\boldsymbol{L}_{t-1} + 25\boldsymbol{L}_{t-2} + 69\boldsymbol{L}_{t-3} + 0.51\boldsymbol{INF}_{t-1} \\
& + 0.03\boldsymbol{INF}_{t-2} + 0.18\boldsymbol{INF}_{t-3} + 0.22\boldsymbol{GE}_{t-1} + 0.11\boldsymbol{GE}_{t-2} \\
& - 1.35\boldsymbol{GE}_{t-3} + 5.97
\end{aligned}
$$

(4)

According to the model in Equation (4), the previous year's deviation from long run equilibrium is corrected at a speed of 34%. The cointegrating equation (ECT) for the long run model is in Equation (5):

$$
\begin{aligned}
\boldsymbol{ECT}_{t-1} = & 1.00\boldsymbol{Y}_{t-1} - 2.97\boldsymbol{GFCF}_{t-1} + 0.000001\boldsymbol{T}_{t-1} - 8.33\boldsymbol{TO}_{t-1} \\
& - 67.67\boldsymbol{L}_{t-1} + 0.46\boldsymbol{INF}_{t-1} - 11.59\boldsymbol{GE}_{t-1} + 3458.67
\end{aligned}
$$

(5)

Let us perform some diagnostics in order to see how seriously our results can be taken from this model. Therefore, we will perform the LM test and normality tests.

Table 7: VEC Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	31.83357	0.9727
2	50.95038	0.3968
3	43.11688	0.7095
4	33.11370	0.9601
Probs from chi-square with 49 df.		

Source: Created by Author from Eviews program

According to the LM test results in Table 7, the p-values are more than 5% meaning that there is no serial correlation in our model.

Table 8: Normality Test

Component	Skewness	Chi-sq	df	Prob.
1	-0.049594	0.018037	1	0.8932
2	1.482051	16.10748	1	0.0001
3	-0.025435	0.004744	1	0.9451
4	0.093409	0.063986	1	0.8003
5	-0.638266	2.987480	1	0.0839
6	0.352687	0.912180	1	0.3395
7	0.092729	0.063057	1	0.8017

Source: Created by Author from Eviews program

The result of normality test in Table 8 shows that the p-values of Jarque-Bera components are more that 5% except for the second line. Which means that, the residuals are normally distributed for all the variable except the GFCF. We can conclude that our model is reassuring.

Table 9: The VECM Model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.340343	0.089127	-3.818629	0.0010
C(2)	0.189350	0.150022	1.262156	0.2207
C(3)	-0.211928	0.126017	-1.681739	0.1074
C(4)	-0.073720	0.134952	-0.546264	0.5906
C(5)	-2.966292	1.362573	-2.176978	0.0410
C(6)	0.234405	1.051494	0.222926	0.8257
C(7)	-1.695927	1.038202	-1.633524	0.1173
C(8)	2.67E-07	2.74E-07	0.973787	0.3412
C(9)	4.42E-07	2.98E-07	1.484471	0.1525
C(10)	8.35E-08	2.96E-07	0.281882	0.7808
C(11)	-0.930871	0.775774	-1.199926	0.2435
C(12)	-1.669866	0.836862	-1.995390	0.0591
C(13)	0.585109	0.757047	0.772883	0.4482
C(14)	16.00606	42.86947	0.373367	0.7126
C(15)	25.06690	49.46561	0.506754	0.6176
C(16)	69.31087	38.28987	1.810162	0.0846
C(17)	0.510852	1.035853	0.493170	0.6270
C(18)	0.032764	1.010952	0.032410	0.9745
C(19)	0.181911	1.061560	0.171362	0.8656
C(20)	0.216430	2.163958	0.100016	0.9213
C(21)	0.106982	2.154657	0.049652	0.9609
C(22)	-1.350587	2.158924	-0.625584	0.5383
C(23)	5.973782	5.100289	1.171264	0.2546
R-squared	0.613385	Mean dependent var		-1.973243
Adjusted R-squared	0.208360	S.D. dependent var		21.42379
S.E. of regression	19.06163	Akaike info criterion		9.039019
Sum squared resid	7630.261	Schwarz criterion		9.971664
Log likelihood	-175.8584	Hannan-Quinn criter.		9.384889
Durbin-Watson stat	1.747781			

Source: Created by Author from Eviews program

In order to analyze the long run causality between the variables, we will determine the p-value of the C(1) which is the error correction term of VECM coefficient. According to the model in Table 9, C(1) is negative in sign and significant meaning that there is a long run causality running from all the other variables (Capital formation - GFCF, Technology – T, Trade openness – TO, Labor force – L, Inflation – INF and Government expenditure – GE) to the economic growth (Y). The economic interpretation of this is that physical capital, technology, openness, labor force, inflation and government expenditure are causing the economic growth in long term.

CONCLUSIONS

In this study, determinants of economic growth in Niger were investigated by using data from 1971-2018. During the study, we performed the time series analysis based on the information about the Niger economy. The time series analysis will concern the Cointegration, Vector Error correction and Causality test. To do so, our variables need to be stationary in the first difference. Thus, firstly the ADF unit root test was performed for stationarity test. We determined that our variables are stationary in the first difference.

The long-term relationship between variables was investigated by using the Johansen Co-integration test. According to the results of the Johansen co-integration test, there is a long-term relationship between the variables. According to the normalized vector coefficients, with the exception of inflation (INF) and Technology (T), all the variables (Capital formation - GFCF, Trade openness – TO, Labor force – L and Government expenditure – GE) have a positive impact on GDP in long-term, ceteris paribus. Thus, inflation (INF) and Technology (T) negatively affect economic growth. This negative effect means that Niger need to keep the inflation near 3% and the technology must be enhanced with technologic transfer and qualified labor force. Additionally, we applied the Vector Error Correction Model (VECM) to investigate the long-term causality relationship between variables. According to the results of the error correction model, there is a long-term causality relationship from Capital formation, Technology, Trade openness, Labor force, Inflation and Government expenditure variables to economic growth. The results of cointegration and VECM results mean that Capital formation, Trade openness, Labor force and Government expenditure are the determinants of economic growth in long-term. The results of cointegration and VECM results mean that Capital formation, Trade openness, Labor force and Government expenditure are the determinants of economic growth in long-term.

If Niger is relieved of its dependence on uranium and directed towards agriculture and industrial production, the trade openness could also determine the economic growth. This study suggests that reforms in education, agriculture and industrial production, should be made independently of natural resources. It is also suggested that a new "Five-Year Development Program" should implement projects that will stimulate the economy. The new development program must include the improvement of technology transfer, entrepreneurship and agro-industrial production.

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