

Socio-Economic Impact of Covid-19 Pandemic and Strategies for Reviving Nigeria's Economy

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Abstract

This study provides multi-disciplinary assessment of coronavirus pandemic transmission in Nigeria, magnitude of confirmed cases, recoveries, deaths, and inventory of infected person with recovery lags. It applied the statistical outcomes in predicting spilling over to subsequent periods. It identifies economic sectors worst hit by COVID-19 triggered recession, simulate the estimates of potential fiscal and other macroeconomic impact of the pandemic in the country in short run alongside synthesis of restoration and sustainability strategies. Secondary data relating to coronavirus infection cases, spreads, recoveries and fatalities were assessed, using the susceptible-infected-recovered” (SIR) model in absence of mass testing and probable cessation from health crisis management. It identified economic sectors/activities being devastated by COVID-19 induced recession, provides interim estimates adverse impact based on economic peak and down-turn cycle method. The study also measured the magnitude of macroeconomic shocks in Nigeria's economy using a standard global computable general equilibrium model and exploration of sustainability strategies based on synthesis of extant reports were employed. These data-sets were obtained from the Nigerian sources and partly from global sources. Furthermore, it utilized trend analysis derived from empirical data of extant daily confirmed cases, discharges and hospitalized person together with tentative projection of additional confirmed cases as from July–September, 2020. Results revealed that confirmed cases in Nigeria will increase steadily from 25694 (in June) to around 74825 by the end September and expected to reach 121000 by end of year 2020. This suggests that the pandemic is likely to persist up to the second quarter of 2021. Education, transport (aviation), hospitality, tourism and sports businesses; trade (informal sector) in the services sector; petroleum exploration in mining sub-sector are most severely contracting activities industries in the economy. Given the prevailing intensity of recession, the result indicates that a reduction of about 5-to-7% in GDP will be recorded in 2020. Result of variance analysis of fiscal budget estimates indicates adverse increase of -2% or more in overall fiscal deficit balances during the periods, which may aggravate debt burden with decline of about -5.7 percent and up to -7 percent in nominal GDP. Health, education, agriculture, petroleum exploration; petroleum refining and petrochemical industries, manufacturing (particularly pharmaceuticals), energy and power generation should be given priority in the sustainability programme.

Keywords: Covid-19; Coronavirus outbreak; Spread; Social distancing; Pandemic; Financial crisis; Global recession; Public health; Nigeria.

1. Introduction

The novel coronavirus virus that initially erupted in Wuhan city, China has already caused significant devastation to the entire global economy and Nigeria in particular. At the beginning of year 2020, the world watched on as the city of Wuhan and province of Hubei went into lock down. Coronavirus disease changed global, and national economic as well as social outlook and human behaviours unexpectedly.

Whilst the demand for specific sectors like healthcare and agricultural produce and food supply sectors have been experiencing huge increase in operational activities all through the outbreak of coronavirus, other sectors such as air transportation and tourism have seen demand for their services diminish. At the same time, many economic sectors have experienced problems on the supply-side; as governments curtail activities of non-essential industries which compelled workers to stay in their homes. Several economists, public analysts and commentators believe that the economic impact could be dramatic and widespread (Baldwin and di Mauro, 2020).

Public health practitioners, epidemiologists and medical researchers have differed over the exact definition of a pandemic (pandemic or epidemics). An epidemic is the rapid spread of disease to a large number of people in a given population with a short period of time (Centre for Disease Control CDC, 2011). It is usually an attack rate in excess of 15 cases per 100000 people for two consecutive weeks. Pandemic on the extreme, describes widespread occurrence of disease, in excess of what might normally be expected in a geographical region. Going by the past

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episodes, cholera, bubonic plague, smallpox, and influenza are some of the most brutal killers in human history, and outbreaks of these diseases across international borders, are properly defined as pandemic throughout history. These epidemics and pandemics have killed between 300-500 million people in its 12,000 year existence. Economic consequences of epidemics, pandemics and public health crisis mostly result to recession.

Economic recession, being referred to as COVID-19 recession or the great shut-down has constituted a major global recession with the associated economic consequences. A recession occurs when there are two or more consecutive quarters of negative economic performance (growth) as measured by gross domestic product (GDP) or other indicators of macroeconomic performance including unemployment (Investopedia, 2020). The initial sign of the coronavirus recession was the 2020 stock market crash on 20th February and followed by the International Monetary Fund (IMF) report in April that all of G-7 nations were entering into deep recession alongside significant slowdown of growth in emerging economies (IMF, 2020). This pandemic has already caused more than a third of the world's population being placed on lock-down to prevent the transmission of COVID-19, thus causing severe repercussions for economies, stagnation of international stock markets and decline in consumer activity world-wide. COVID-19 pandemic has also induced far-reaching consequences beyond spread of the disease and efforts to quarantine it. As the pandemic has spread around the globe, concerns have shifted from supply-side manufacturing issues to decreased business in the services sector. This recession has seen unusually high and rapid increases in unemployment in many countries and in the same vein, causing several millions of people drifting into abject poverty presently. Coronavirus-induced recession influenced the collapse of the price of crude-oil triggered by the 2020 Russia-Saudi Arabia oil price war, the collapse of transportation and tourism, the hospitality and energy industries and a significant downturn in consumer activity in comparison to the previous decade.

Following from the public health and economic crises triggered by the pandemic, several countries have announced stimulus packages to counter the effects of the recession. For instance, it has been reported that direct spending ranges from USD\$1.06 billion for Cyprus and USA's vote of USD\$2900 as the highest sovereign stimulus programme. Nigerian government on its part has proposed N2.3 trillion stimulus programmes (FGN, 2020a) to cushion impact of COVID-19 health and economic shocks. The forecasts as on 30th June, 2020 indicate that coronavirus pandemic induced-recession ranges from -2% of GDP for Taiwan (lowest) and -7% in Italy. Unemployment rate has increased by 1.1% in Thailand and 29.1% (highest) in South Africa and then, decline of -4.8% on Nigeria's GDP and 10% increase in unemployment in Nigeria. It is uncertain whether the extant health response efforts, government interventions both domestically and internationally alongside plethora policy measures and stimuli would resuscitate national and global economy in the absence of effective drugs and cures for coronavirus at the moment. Thus, the study provides mid-year empirical assessment of the dimension of the pandemic with interim estimate of fiscal impact of the health crisis induced recession and decline in macroeconomic performance in Nigeria.

The main objective of this study is to examine or evaluate the nature of coronavirus (COVID-19) pandemic, its economic consequences and strategies for ameliorating the concurrent COVID-19 macroeconomic shocks in Nigeria. Specific objectives are to: ascertain magnitude coronavirus spread, discharge and probable timeframe of containment. Identify the most severely recessed sectors; and characterize or determine the most severely recessed sectors. Simulate estimates of fiscal costs and macroeconomic shocks as the adverse consequences of the pandemic in the Nigerian economy. Lastly, review the cherry-picked policy prescriptions put forward for ameliorating the identifiable macroeconomic effects in assessing the suitability of such policy options in reviving and sustaining of the economy.

The remainder of the paper is structured into four sections. Section two presents conceptual framework, chronology with demography and causalities of significant local epidemics and global pandemic during the past three centuries and discusses spillovers in Nigeria. Section three provides materials, methodology, models development and analytical tools. Analyses, results and discussion are rendered in section four. Summary, conclusion and recommendation are provided in section five.

2. Review of Literature and Related Studies

2.1. Conceptual Literature

2.1.1 Epidemics, Pandemics and Health Crisis

Coronavirus outbreak was initially noticed around in December 2019, in the region of Wuhan, China and was promptly code-named Covid-19, a shortened form of "coronavirus disease of 2019". This new virus spreads incredibly quickly between people, due to its newness and no one on earth has immunity to Covid-19, because no one had Covid-19 until 2019. While it was initially seen to be an epidemic in China, the virus spread worldwide within months and World Health Organisation (WHO) declared Covid-19 a pandemic in March, and by the end of that month, the world witnessed more than a half-million people infected and nearly 30,000 deaths. The infection rate in the US and other nations was still spiking. Total number of infected persons globally stands at 10 million as at 30th June, 2020; 5.5 million people have fully recovered with at least 500000 reported deaths. With the coronavirus pandemic, people all over the world have become more aware of the best practices during a pandemic; from careful hand-washing to social distancing. Countries across the world declared mandatory state-at-home measures, closing schools, businesses, and public places. Dozens of companies and many more independent researchers began working on tests, treatments, and vaccines. The push for the human race to survive the pandemic became the primary concern in the world. The outcome of the Covid-19 pandemic is impossible to predict, at the time of this writing.

2.1.2. Economic Implication of Epidemics, Pandemics and Health Crisis

Health and economic crises have been found to have direct effect on individual and household's health, well-being, consumption, savings, investments and wealth accumulation. Recession and market downturn is characterized by three important outcomes that affect retirement preparedness; a decline in home equity, a decline in other wealth, and increase in unemployment. Recession on the extreme provides a natural experiment for understanding more about economic influences on health and health disparities. There is extensive discourse the impact of pandemics, health crisis and recession in literature. For example, Brenner (2005) cited in [Baldwin and Weder di Mauro \(2020\)](#) found that, although gross domestic product per capita is occasionally associated with increased mortality rates over the short term; it is inversely related to mortality rates over the medium to long term. Strully (2009) also cited in [Baldwin and Weder di Mauro \(2020\)](#) found that respondents who lost jobs but were reemployed, are likely to develop health complications. In determining effects of recession on health, such factors as time lags, specific causes of death, lifestyle, environmental risks, and health care utilization are normally considered.

2.2. Public Health Emergency and Response Management

Control of epidemic means 'flattening the epidemiologic curve' is done by slowing rate of infection. For instance, reducing person-to-person contact overall via work and school closures and travel bans ('social distancing'), and removing infected people from the population either by quarantining and curing them. The desires to flatten epidemiological curve are exactly why governments around the world are taking extreme steps. The harsh reality is that there are no ready-made tools and medical remedies to fight COVID-19 presently. Health workers only rely the existing methods to control epidemics in the early 20th century. Macroeconomic consequences of wide-spreading epidemics, pandemic and public health crisis management is contextually considered from about four or more different perspectives. These include human medical services, facilities and supplies challenges as currently experienced in the present dispensation. It extends to reduction in national productivity since workers in their sickbeds cannot be contribution in producing GDP; economic impact of public and private containment measures that ranges from measures like school and factory closures, travel restrictions, and quarantines. The third dimension is the socio-psychological-related economic shocks, which is concerned with individual behaviour depends upon beliefs and these are subject to the usual cognitive biases. It is natural, for example, to make guesses on the number of future COVID-19 cases based on the number of new cases that appeared in the contemporary period.

2.3. Theoretical Literature

Thus, eclectics' theories of epidemics-pandemics induced health crisis; population's health crisis management, consequences and economics of cost of pandemic represent the theoretical framework guiding policy actions for curtailing the prevailing global health challenges ([Centre for Disease Control CDC, 2011](#); [World Health Organization WHO, 2012](#)). Health emergency response and disaster risk management prescribes the necessary activities undertaken when epidemics, pandemics and other anti-terrorist incident occur ([Centre for Disease Control CDC, 2011](#); [World Health Organization WHO, 2012](#)). Public health emergency response provides valuable resource reservoir and the framework for public health professionals with roles and responsibilities for initiating the public health response within the first 24 hours (acute phase) of an emergency or disaster ([Centre for Disease Control CDC, 2011](#)). These theories spell strategies for coordinating with the existing emergency response structures in specific types of incidents, such as floods, earthquakes, and acts of terrorism. The Management of epidemics or pandemic necessitates a whole-of-society approach; meaning that all the diverse drivers of public health issues are taken into consideration: genetics, ecology and biological factors ([WHO, 2018](#)). In other words, the physical environment, human behaviour and demographics; socio-political and economic factors are also taken into consideration.

The increasing convergences of many factors drive and amplify epidemic/pandemic outbreaks requires multidisciplinary, multi-sectoral and multi-faceted approaches. Moreover, since epidemics are social problems as well as medical ones, health authorities need to move beyond the traditional biomedical approaches in assessing the situations they emerge. This links community and biomedical perspectives for enhancing effective partnerships, ensuring that preexisting relationships are built to respond to epidemics.

Public health crisis refers to a difficult situation or complex health system that affects humans in one or more geographic area, from a particular locality, spreads to encompass the entire earth. Public health crisis management is defined in the U.S. Centre for Disease Control (2012) as a way to prepare and control an emergency. [Hook and Rogers \(2005\)](#) defined crisis management as a way to prepare and control an emergency. It involves identifying health emergency or crisis, planning response(s) and confronting and resolving them in order for normal activities or operations to be resumed ([WHO, 2018](#)). Thus, a problem-to-solve becomes a crisis when a time factor impacts the lives of citizens and influences the responders who are called upon. Emergency events such as the Ebola outbreak, flooding of several communities and the menace of erosion in some regions in Nigeria are remarkable examples and place emphasis on the importance of preparation, timing, communication, and coordination. [Hook and Rogers \(2005\)](#) discuss health risks associated with disasters and remind us how important the role of public health is within a community and for homeland security. Hooke et al opined that timely and accurate health risk information must be communicated to the public to ensure human well-being. More specifically, health emergency response and crisis management focus on handling of wide-spreading and pandemics in order to minimize mortality of the population as well as economic consequences. The landscape of the public health community has multiple boundaries and the definition of a community and its subsequent community capacity may be dramatically affected by the boundaries through which the community is defined ([Norton et al, 2002, cited in Hook and Rogers \(2005\)](#)). Geographic boundaries are found at the local, state, federal and global levels, whereas mission oriented, religious, cultural, and

illness related boundaries also exist within each of these boundaries. Furthermore, prompt laboratory investigation and confirmation is necessarily undertaken from the moment a new disease is recognized by the health system, early laboratory confirmation is necessarily.

It is critically important for global health security that there is a system for safely taking samples and shipping specimens to relevant laboratories in full compliance with biosafety and biosecurity regulations. Effective and rapid containment of emerging diseases is just as vital as early detection in order to avoid a large scale epidemic, therefore rapid containment should start as soon as the first case is detected regardless of the etiology, which is most likely to be unknown. It requires skilled professionals to safely implement the necessary countermeasures. Pre-training of these professionals is essential to guarantee the safety and efficiency of the operations. Then, control, eradication and mitigation commences from the inception of an outbreak of infectious disease and the threat reaches an epidemic or pandemic level, the goal of the response is to mitigate its impact and reduce its incidence, morbidity and mortality as well as disruptions to economic, political, and social systems (Centre for Disease Control CDC, 2011; WHO, 2015). The control of a disease may lead to its elimination, which means that is sufficiently controlled to prevent an epidemic from occurring in a defined geographical area. Eradication of a disease is much more difficult and rarely achieved which involve permanent elimination of its incidence worldwide. There is no longer a need for interventions measures. Three criteria are necessarily required in order to eradicate a disease: there must be an available intervention to interrupt its transmission; there must be available efficient diagnostic tools to detect cases that could lead to transmission; and humans must be the only reservoir.

Economic consequence of the pandemic is the current global economic crisis which triggered recession in many countries. Consequently, the theory of periodic crisis, by extension, economic cycle describes downward and upward movement of gross domestic product (GDP) around its long and short term growth trend is the core theory supporting pandemic triggered economic crisis. Recession or downturn and upward movement in economic activities of the economic cycle, specifically during the period of global crisis leaned periodic crisis of economic growth cycle theory as propounded by Sismondi in 1819 Grossman (2017). Sismondi's theory of economic (peak and trough) or fluctuation cycle was the first systematic exposition of economic crises that overthrown the prior theory of economic equilibrium around 1819 which convincingly demonstrated international economic crisis, occurring in peacetime. Prior to that point classical economics denied the existence of business cycles, or blamed such incidents on external factors, notably war or only studied the long term.

The length of economic (fluctuation) cycle is the period of time covering a single boom and contraction (downturn) in sequence. These fluctuating trends typically involve shifts between periods of relatively rapid economic growth or expansions and periods of relative decline in economic activities, stagnation otherwise referred as recession. These upward and downward fluctuations in economic activities do not normally exhibit uniform or predictable periodicity in the ecosystems where it emerges. Keynesian economics posit that fluctuations in aggregate demand causes the economy to come to short term equilibrium levels that are different from full employment rate of output or disequilibrium. In related arguments, classical economics or neo-classical economics as well as mainstream economics state that both external and endogenous (external factors-war as example) supply-side and demand side) cause economic shocks. These shocks may be stochastic and in some scenarios are deterministically chaotic and embedded in an economic system. There is a consensus among economists and non-economists alike that war, natural disasters, public health crises arising from epidemics-pandemics trigger economic crises. The Peak and downturn (trough) is the established method frequently used in literature macroeconomic in measuring bounds/rebounds in business and economic cycles but with emphasis on economic recession in this study Canova *et al.* (2012). This theoretical model helps in characterizing or identifying the recession devastated economic sectors / sub-sectors and analyses during the concurrent period of the pandemic in Nigeria.

Economic fluctuation cycle theory is directly connected with the adverse economic consequences of the current coronavirus pandemic and the associated global / sovereign economic crises and impacts on persons, households and organizations. In addition, this theoretical framework links several species of economic policy prescriptions and measures postulated in literature and frequently put forward as remedies for moderation of adverse impact of economic crisis and for revival and stabilizing and sustaining the affected economies.

Lastly, this study lean on economic intervention policy measures and fiscal stimulus programmes as propounded by Keynes (1936) in the exploration and consideration of suitable prescription of economic revival and sustainability strategies for Nigeria's ecosystem. Economic stimulus models are frequently utilized in resolution of economic crises, resuscitation and macroeconomic management. Some of these economic management strategies are duly prescribed and adopted in modernization of agriculture, produce preservation and processing, conversion and food security in different sovereigns. A stimulus package is a set of economic plans put together by the government to stimulate a floundering economy. The theory is behind the utilization of stimulus package is rooted in Keynesian economics which argues that an economy in recession can be revived with increased government spending (Canova *et al.*, 2012; Keynes, 1936). A recession, according to Keynesian economics, is a persistent deficiency in aggregate demand, in which the economy cannot self-regulate itself and activities return to normal but instead can reach new equilibrium at a higher rate of unemployment, lower output and slower growth rates. This pandemic and global crisis with its associated recession is a reference point.

Three different types of stimulus packages duly identified in literature and commonly applied in curbing recession are: economic, fiscal and monetary stimulus packages. Under economic stimuli, in order to combat recession, governments often implement in expansionary fiscal policies to make up for short falls in private sector consumption and business investment spending in order to restore aggregate demand and full employment of factor of production. Fiscal stimulus package is different from the use of expansionary monetary. Fiscal stimuli are more specifically targeted and conservatively approach to economic revival policies. Thus, the policy makers utilize fiscal

policies to replace private sector spending like; tax-cuts, and monetary policy measures such as lowered interest rates and new credit creation toward specific sectors of an economy to take advantage powerful multiplier effects that will indirectly increase private sector spending which in turn boost the economy out of recession.

2.4. Review of Empirical Studies on Epidemics, Pandemics and Economic Consequences

Colhart *et al.* (2107), assessed the magnitude of Ebola (EVD) epidemic outbreak in some African countries including Liberia, Sierra Leone and Democratic Republic of Congo (DRC). The result indicated that the mortality rate associated with Ebola ranges between 50–60 percent. Similarly, WHO (2019) situation report on the outbreak of Ebola in Guinea, Senegal and DRC indicates a mortality rate of 48 – 60 percent of the infected persons. Thus, from a comparison of the fatality rates reported in Colhart *et al.* (2107) and WHO (2019) and the current fatality rates of about 4% in Egypt and 2.2 percent in Nigeria proves evidence that Ebola is more deadly than coronavirus pandemic.

National Institute of Statistics and Economic Studies in France (INSEE) (March, 2020) survey report and Reuters News Agency (Reuter (Reuters News Agency), 2020) provided information on the trend pattern of COVID-19 in France. INSEE survey study and Reuters reported that the economic activities of the French economy is estimated to have declined by 35 percent or recorded a drop to 65% of its normal level on March (March 25), 2020 due coronavirus outbreak. In related development, the two sources reported that the French government has prepared a 45 billion euros (\$49.1 billion) stimulus package, the equivalent of two percent of that country's GDP and made up of deferred taxes and payroll off-sets or charges for companies that retained their workforce during the lockdown induced reduced productivity. Furthermore, government of France is also guaranteeing up to 300 million euros, the equivalent of 15 percent of the nation's GDP for corporate borrowing from the commercial banks to credit line circulating in the economy during the contemporary global crisis.

Muellbauer (2020) estimates that around one-half of the US economy would be considered either essential, or able to operate without creating risks of diffusing the virus. Most of these estimates in Muellbauer (2020), are estimates of instantaneous declines, and would translate to losses of annual GDP if the lockdown lasted for a year. Inoue and Todo (2020) measured the magnitude of the impact of shutting down firms in Tokyo and loss of output (productivity) in other parts of the economy through supply chain linkages, and estimate that after a month, daily output would be 86% lower than pre-shock (i.e. the economy would be operating at only 14% of its capacity). The authors adopted a calibrated extended consumption function, and assumed a labour income shock of 16% together with various consumption shocks by expenditure categories, estimates that there would be a fall of quarterly consumption of 20% world-wide as resultant effect of the coronavirus induced public health crisis. (OECD, 2020) which utilized aggregated industry-level shocks, estimates that there would be a drop in immediate GDP of around 25% of some of the African countries as well as the global economy. Barrot *et al.* (2020) estimates that the level of decrease in the output of industries by considering the list of essential industries, the closure of schools, and an estimate of the ability to work from home (based on ICT use surveys); Using these shocks in a multi-sector input-output model; found that six weeks of social distancing would bring GDP down by 5.6 percent.

Ozili and Arun (2020), empirically examine the impact of social distancing policies on economic activities and stock market indices. The findings reveal that the increasing number of lockdown days, monetary policy decisions and international travel restrictions severely affected the level of economic activities and the closing, opening, lowest and highest stock price of major stock market indices. In contrast, the imposed restriction on internal movement and higher fiscal policy spending had a positive impact on the level of economic activities, although the increasing number of confirmed coronavirus cases did not have a significant effect on the level of economic activities.

3. Methodology

This study adopts four dimensional methods; namely: public health-epidemiologists' empirical data analysis for establishing the pandemic spread, simulate demographic rate of penetration and containment. It also employed the synthesis of archival data on economic sectors severely recessed by COVID-19; and the multi-sector computable general equilibrium (CGE) in measuring economic impact. This is similar to the CGE approach employed by in Australia for analysis and evaluation of economic impact of the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002 to 2003 (Commonwealth Treasury of Australia, 2003; Corong *et al.*, 2107). Furthermore, the synthetic analysis of policy papers on contemporary survival and sustainability strategies adopted in other economies during periods of economic crisis and global pandemics services as learning experience on the prescription of appropriate remedies needed in managing adverse impact of COVID-19 in Nigeria.

3.1. Materials, Sources and Collection Methods

Empirical data-sets were extracted from National Centre for Disease Control (NCDC) sources and used in analysis for establishing the pandemic's spread, simulate demographic rate of penetration, recovery lead time and probable containment timeframe. Archival information drawn from cherry-picked empirical literature was adopted in gathering data for the severely operationally distressed economic sectors by COVID-19 pandemic induced recession in Nigeria and the global scene. We also extracted data sets on fiscal and macroeconomic aggregates from Nigeria's 2019 approved budget estimates and actual implementation performance, year 2020 original annual approved annual budget estimates and the revised annual budget appropriate bill and the initial 2021-2022 medium term expenditure framework-fiscal strategy paper (METF/FSP) 2020 and the corresponding revised versions respectively were collected from Budget Office of the Federation. Relevant macroeconomic statistics on the original forecast and revised projection of Nigeria's 2020 gross national product output from the National Bureau of Statistics (NBS). Central Bank of Nigeria, World Health Organization (WHO), World Bank. We surveyed literature and extracted

pertinent policy research papers, editorial commentaries and policy briefs and cherry-picked about 15 economic sustainability documents containing suitable policy prescription for managing health crisis and recession.

3.2. Theoretical Foundation of Models and Model Specifications

The epidemiologist’s ‘susceptible-infected-recovered’ (SIR) model, originally developed by Kermack and McKendrick (1927) cited in Canova *et al.* (2012) is the theoretical framework supporting assessment of coronavirus pandemic, spreads and emergency response in Nigeria. This demographic approach has been adopted to assess the dimension of COVID-19 pandemic in absence of mass testing with possibility of projecting or predicting tentative timeframe of containment, normalizing public health situation and economic recovery. This approach guides the epidemiological-economic model to account for human behaviour, and provides basis for measuring the speed of transmission, treatments, duration and containment. SIR model takes into consideration, demography, human dwelling clusters, and community infection of epidemics-pandemics in this model building. This model reveals that the adaptive human behaviour induce significant effect on disease dynamics, therefore have critical implication for the development of public health policies such as social distancing which alter the incentive structure of humans contacting each other and interaction of the work force. The assessment of human behaviour and disease dynamics, shed light on how to develop incentives for individuals to change their behaviour for optimal, cost effective disease response strategy and continuance or discountenance of economic activities.

Furthermore, adoption of economic cycle’s ‘peak and downturn’ estimation method model, borrowed from prior study by Canova *et al.* (2012), and combined with synthetic analysis of archival information from empirical studies guides the identification of economic activities devastated by the pandemic induced recession and determining magnitude of economic consequences. The peak and downturn (trough) is the established method frequently used in literature macroeconomic in measuring bounds/rebound and magnitude of impact of recession on the identified sectors in this study’s context. Furthermore, the study leans on the multi-sector computable general equilibrium model in measuring fiscal/economic impact of COVID-19 pandemic. And finally, we relied on economic intervention policy measures and fiscal stimulus programmes as propounded by Keynes (1936) in the exploration and consideration of suitable prescription of economic revival and sustainability strategies for Nigeria’s ecosystem.

3.2.1. Public Health Epidemiological Empirical (SIR) Model

The ‘susceptible-infected-recovered’ (SIR) model is a mathematical model conventionally used to evaluate disease outbreaks and predict epidemiologic outcomes (Kermack & McKendrick, 1927) cited in Canova *et al.* (2012). It has been frequently used as an epidemic risk models for measuring epidemic risk-spreading and incorporates human behavioral responses. The simple ‘susceptible-infected-recovered’ (SIR) model has been used to make accurate short-term predictions when provided with the appropriate information inputs and has been successful in modeling rapid spread of several recent epidemics including COVID-19 pandemic (Choi & Pak, 2003) cited in Dimdore-Miles and Miles (2020). However, does not explicitly include behavioral responses to disease risk. The model has only three compartments: Susceptible (S), representing healthy individuals susceptible of getting infected, Infected (R), and Recovered (R). This last compartment can also take into account deceased persons, however, for low mortality rate diseases, including only recovered persons represents good approximation.

This study modifies conventional compartment (SIR) model by incorporating coronavirus infected persons’ recovery lag (lead time), purposely to estimate scaling-down time and or containment of the pandemic. The present study modifies the conventional compartment (SIR) model by incorporating coronavirus infected persons’ recovery lag (lead time), purposely to estimate scaling-down time and possible containment of the pandemic **in absence of mass testing** (Dimdore-Miles and Miles, 2020). This study blends the daily or monthly moving average time series of the NCDC published data of COVID-19 disease spreads for two most recent months (April-May, May and June, 2020) to estimate and or plot trends of COVID-19 spread. We assume a constant population and that the death rate is low enough to mean that this is reasonable. We also assume that some constant proportion (a) of those infected do not develop symptoms or that they are quite mild as to count as asymptomatic. There is some evidence that the degree to which the asymptomatic are infectious may be different from those who have symptoms (Ferguson et al. 2020 cited in Dimdore-Miles and Miles (2020); and initially assume that the transmission rates are the same for all those infected. We denote the population of the symptomatic infected at time *t* by *I_{st}* and the asymptomatic as *I_{at}* such that *I_t* = *I_{st}* + *I_{at}*. The evolution of *S_t*; *I_t* and *R_t* in discrete time is given by the dynamic system; thus, system equation functions of the dynamics of an epidemic using a SIR model are as follows:

$$dS(t)/dt = -\beta S(t)I(t)/N, \dots\dots\dots(3.1.1)$$

$$dI(t)/dt = +\beta S(t)I(t)/N - \mu I(t), \dots\dots\dots(3.1.2)$$

$$dR(t)/dt = \mu I(t), \dots\dots\dots(3.1.3)$$

$$dP(t)/dt = -\beta P(t)I(t)/N - \mu I(t), \dots\dots\dots(3.1.4)$$

Where: *S* is the change in the population of the susceptible; *N* is the total population, *β* is the transmission rate of the virus at a time *t* (the mean number of people an infectious person will infect per unit time) and *μ* is the rate of recovery. The initial infection rate over the infectious period, the reproduction number, is defined as *R* = *β*/*μ*. We assume that the infectious group. *N* represents the total population size, *β* is the rate of infection, and *μ* is the recovery rate. At the beginning of an epidemic *S* equals approximately the entire population, and thus from (2) it holds that *I(t)* = *I₀* *e^[(β - μ) t]* = *I₀* *e^{-μ(R₀-1)t}*, where *I₀* represents the initial number of infected *I₀* = *I(0)* and *R₀* = *β*/*μ* is the basic reproduction number mentioned in the previous section. Then, infected persons’ recovery lag period (*P*) is inserted in the model to project the time-frame the infected proportion of the population can be extinguished on revolving basis. This number can be understood as the average number of secondary cases produced by an

infectious individual. Clearly, when R_0 is greater than 1, there is an exponential increase in the number of infected individuals on the early days of the epidemic. The conventional SIR model can also be used to estimate the point at which the rate of newly infected individuals begins to fall $S(t) < N=R_0$. At this point, the given population has reached what is known as herd immunity.

3.2.2. Recession-Inflicted Industry/Sectors Identification and Characterization

This model lean on archival information in identifying various economic sectors severely affected from a global viewpoint and more specifically in Nigeria as earlier indicated in sub-section 3.1. It also utilized significant number of reliable empirical studies that tracked the trends, penetration and severity of coronavirus pandemic induced recession in Nigeria and other economies in a synthetic analysis (Canova *et al.*, 2012; del Rio-Chanona *et al.*, 2020; Muellbauer, 2020). Furthermore, we also applied the “peak and trough” activity performances evaluation method in assessing all economic sectors in Nigeria to simulate estimate of the sectoral and aggregate economic impact in Nigeria. The synthetic analysis facilitates determination of different sectors currently devastated by COVID-19 in Nigeria.

The industry or economic sector’s devastation equation function characterized and identified whose operation are severely reduced as adopted in Canova *et al.* (2012) with as much as 10-15 percent are configured in this model functions .and expressed as:

$$(Y_{nij}) = f[(X_1 + X_2 + X_3 + \dots + X_n)] \dots \dots \dots (3.1.2a)$$

Research Question (RQ. 2): To what extent has the coronavirus pandemic induced recession, reduced economic growth (GDP) in the year 2020 in the Nigerian economy?

Hypothesis H_{02b} . The reduction in Nigeria’s GDP as direct consequences of COVID-19 pandemic in the current year is not significantly lower than -2 percent of the previous year output.

3.2.3. Measure of Magnitude of the Pandemic Induced Recession to Industries or Sectors

The ‘peak and trough(downturn) ’ activity performance evaluation estimation model is also employed in this model to statistically simulate changes (decreases / increases) in the expected nominal GDP at current market price to establish the magnitude of reduction in domestic productivity during the current year (2020) (del Rio-Chanona *et al.*, 2020; Muellbauer, 2020). About a quarter or roughly half-year of lost activities in certain sector in the year so-far are taking into consideration in this model building to derive the relevant changes. Then, the variation derived from the sectoral macroeconomic aggregates were captured in this supplementary model two to simulate estimates of decrease/increase to determine the reduction in Nigeria’s nominal GDP for the year. The equation function to measure the degree of changes in domestic production or loss of activities are configured in this model functions follow the approach adopted in Conova et al are expressed as:

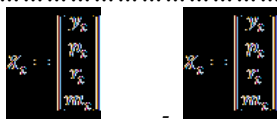
$$\Delta E_{CONSECTOR} = (Y_{nij}) = f[\text{Current Period Activity} \times \text{Yr-est/} \text{d share of Prior } N_{GDP}] \dots \dots (3.1.3)$$

3.2.4. Multi-Sector, Computable General Equilibrium (CGE) Model 3

This model utilize ex-post fiscal budget and ex-post macroeconomic aggregates for 2019; the originally approved and revised 2020 fiscal budget estimates/macroeconomic projections and Nigeria’s fiscal performance in the current year and in projecting future outcomes up-to 2022 in measuring the nature, size, and shape of economic consequences of Covid-19 pandemic in the Nigerian economy. The variances derived between the 2019 and 2020 approved annual fiscal budget; medium term fiscal strategy plan (MET-FSP) estimates for 2021-2023 and actual performance in 2019; revised annual budget estimates for 2020 (released in July) alongside the revised MET-FSP for 2021-2023 in this CGE model. These datasets were configured into multivariate in subtraction matrices’ simulation is similar to multi-sector, computable general equilibrium (CGE) form similar to Nwaorgu and Alozie (2017); Corong *et al.* (2107); Dabla-Norris *et al.* and World Bank (2020) and used in deriving estimates of the observable fiscal decline in the economy.

The multi-sector computable general equilibrium (CMSCGE) model functions formulated to facilitate the estimation of coronavirus pandemic’s fiscal and macroeconomic disruptions in the Nigerian economy. The multi-sector function numerical variables formulations take the form of matrices and are expressed as follows:

$$XA_{ijt} - XB_{ijt} = e_t \dots \dots \dots (3.1.3)$$



Where: XA_{ijt} - XB_{ijt} $= e_t \dots \dots \dots (3.1.3b)$

Where: Fiscal aggregates include: government aggregate annual revenues (oil and non-oil revenues), expenditures; non-debt expenditures, capital expenditures, statutory transfers and debt service spending. Others are overall annual fiscal balance, overall fiscal balance as percentage of GDP; Actual / Opening GDP values, annual GDP estimate, revised GDP estimates and future GDP projections.

Values fiscal and macroeconomic variable (e_t) residuals are computed by simple subtraction of structural items in XA_{ijt} matrices and XB_{ijt} which gives (e_t) representing adverse events in the economy – recession, trends in GDP. The outcomes derives in this model extend vertically and horizontally to the different government sectors, fiscal balance and link the troughs and peaks to the different industrial and services sectors, employment, labour force and work hours. It also serves a guide in the interpretation and discussion, having GDP in the last column implies the foreseeable changes (mainly decline) in GDP due to recession as consequence of COVID-19, that is, losses in productivity, reduction in employment etcetera.

$$X_{aijT} - X_{bijt} = e_t \dots\dots\dots(3.1.3)$$

$$\text{and} \quad X_{Aijt} = \begin{matrix} xa1 & xb1 \\ xa2 & xb2 \\ xa3 & xb3 \\ xa4 & xbn \end{matrix} - XBijt = e_t \dots\dots\dots(3.1.4)$$

Where: The X_{aijT} are the identities of the matrices of representative aggregates of the approved annual budget estimates, supplementary budget estimates and estimates of the 3 year medium term expenditure/fiscal revenue. Then, X_{aijt} are identities of the matrices of representative aggregates of actual annual fiscal budget performance, revised supplementary fiscal budget estimates and the revised estimates of the 3 year medium term expenditure/fiscal revenue. e_t are the derived (computed) annual fiscal policy assumptions, fiscal budget performance deviations; or derived variances from revised supplementary budget estimates and the revision of the 3 year medium term expenditure/fiscal revenue estimates.

3.2.5. Macroeconomic Resuscitation and Sustainability Strategy Model

This model utilizes summary of available information relating to policy prescription of economic resuscitation and sustainability strategies for the coronavirus induced recession and other economic shocks were cherry-picked from Nigeria and global economic sources. The narratives were extracted from editorial reports, government policy papers and independent experts' preposition as requisite species of government intervention, stimulus packages for Nigeria's economic survival and sustainability in short-run and medium term as model's deliverables. These were used in identifying, analyzing and determining potential contributions of the strategically selected activities or sectors with suitable narratives drawn from reliable prior reports. Economic resuscitation and sustainability functions model configurations were purposively selected as the six highly ranked economic sectors or activities extracted from Nigeria's economic sustainability policy documents and other economies is given as:

$$\text{Economic stimuli concentration sectors' function is } (Y_{nij}) = f[(X_1 + X_2 + X_3 + \dots + X_n)] \dots\dots\dots(3.1.4)$$

Where: Y_{nij} are the representative of economic activities or sectors randomly and frequently identified in policy documents for immediate-intensive government intervention and resource allocation of stimulus package. Then, $X_1 + X_2 + X_3 + \dots + X_n$, are identities of the different economic activities in the order of their respective priority.

3.3. Operationalization of Measures and Evaluation Procedures

Research Question (RQ¹): What is the magnitude of coronavirus spread, handling capacity and prospect of its containment in Nigeria?

Hypothesis Ho₁: Coronavirus spread, rate of recovery and prospect of it containment within the remaining part of the current year (2020) is not significantly possible, considering the trend pattern of transmission.

Research Question (RQ²): Which economic sectors or activities are severely hurt or distressed the coronavirus-induced recession in the Nigerian economy?

Ho₂: Consequences of COVID-19 pandemic have not inflicted more than 20 percent contraction of the productivity at least six distinct economic sectors.

RQ³: To what extent has the coronavirus pandemic induced recession, reduced the level of productivity (GDP growth rate) during the year (2020) in the economy?

Ho₃: The expected reduction in Nigeria's GDP as direct consequences of COVID-19 pandemic in the current year is not significantly lower than -2 percent of the previous year output.

RQ⁴: To what extent do the macroeconomic disturbances caused by coronavirus pandemic alter the current year's projected fiscal and economic aggregates?

Ho₄: Consequences of COVID-19 pandemic will not cause significant decrease of more than 2% in some of the core components of current year's budget estimates; short-term expenditure strategy and growth rate in the economy.

Research Question (RQ⁵): Which economic sectors (or activities) require the allocation of larger proportions of the economic stimulus packages and other government interventions in preventing the economy from collapse in the short run?

A simply hypothesis formulated to guide numerical analysis of frequency of sector-wise nomination, and prioritization for implementation is Ho₅: Priority sectors that were frequently identified/selected in the policy documents in other economies and Nigeria in particular, does not exceed four thematic areas or core sectors.

Majority of the empirical data used for analyses covered short time-frame therefore, simple numerical analyses, were adopted without the standard econometric screening tests and evaluation procedures. Decision rule followed in operationalizing for test results based on actual outcomes are: if the projected trends in COVID-19 spread are not increasing without holding stock of hospitalized infected persons by end of 2020; we accept null hypothesis Ho but if otherwise, reject and adopt the alternative. If the number of the recessed sectors are not more than four sectors or sub-sectors have been severely hurt by COVID-19 recession; and also the estimated decline is not greater than -2% of the 2020 GDP forecast; we accept null hypothesis Ho but if otherwise, reject and adopt the alternative. Third, if the number of the reduction in the fiscal and macroeconomic projections for 2020 and may be in subsequent two years does not -2% (on average); we accept null hypothesis Ho but if otherwise, reject and adopt the alternative. Lastly, where the number of sectors is not greater than four, we accept null hypothesis Ho but if otherwise, reject and adopt the alternative.

4. Analysis and Results

Results of analyses are presented in five sub-sections, notably epidemiological data analysis on coronavirus spreads and containment; synthetic analysis for identification of severity of recession in economic sectors; determination of the degree of decline in acutely distressed subsectors. Then, followed by multi-sector computable general equilibrium (CGE) measures of the consequences of COVID-19 pandemic and synthesis of some prescriptions of sustainability strategy for the economy.

4.1. Results of Analysis

SIR epidemiological model commences with calculation and of the numerical trends of confirmed cases coronavirus infection, discharged persons, deaths and spread, and number of hospitalized infected persons based on Nigeria Centre for Disease Control (NCDC) from April and up to 30th June, 2020. Based on the trend of pandemic spreading towards end of June, In deriving future estimates, we assumed that the average infected cases revolve and fluctuate within the range of 600 persons to 750 persons and downward from 450 to 550 during the first half in the month of July. Thereafter, moves upwards to around 800 by end of the next month. Logical reasons for steady rise in confirmed infection cases hinge on the increase number of screening tests, lifting of restrictions land and air travels; reopening of schools etcetera and above-all the citizens' behaviours.

We utilized available numerical data in forecasting on a revolving basis, likely additional numbers of infected person from July to September 2020 and later extended the projection to the end of the year. The lead time or infection ad recovery time-lag amounting to between six weeks to two months of the average recovered person was taken into account in our estimation of additional infected cases, continuing trend pattern of the number of infected persons, fatalities and un-discharged hospitalized COVID-19 infected persons in projecting the total confirmed cases up to 2020 year-end as well as the probable – foreseeable cessation of the pandemic in Nigeria is presented in table 1.

Table-1. Summarized Monthly & Period Averages data from March - July 2020

with Simulated Projections from July - December 2020						
Periodic Data	Confirmed Cases	Discharge Cases	Fatalities (Deaths)	Total Cases	Hospitalized Cases	
68 days(mean)	363	143	8	10,480	15,426	
Month (mean)	3,234	108	5	6,424	3,840	
Last 45d (x)	446	363	9	NA	NA	
Jun (Mean)	517	224	10	NA	NA	
July (Act x)	627	627	NA	NA	NA	
July (est x)	498	498	NA	NA	NA	
July (Mean)	556	553	30	NA	NA	
Actuals						
February	1	1	0	1	1	
March	138	9	2	139	128	
April	951	166	58	1,932	1,708	
May	8,228	3,007	287	10,162	6,868	
June	15,449	9,746	544	25,694	15,358	
Demographic Forecasting						
July (est)	17,241	17,129	922	42,935	24,884	
Aug (est)	15,480	24,214	1261	58,415	32,940	
Sept (est)	16,410	30,719	1,619	74,825	42,427	
Oct (est)	15,531	37,323	1,935	90,356	51,098	
Nov (est)	14,820	43,443	2,267	105,176	59,466	
Dec (est)	16,306	48,565	2,723	121,482	70,194	
Sources:	NCDC (2020); Authors' Compilation of the Projection of Covid-19 Spreads, Discharges, Deaths, Hospitalized Cases					
	Moving averages of COVID-19 empirical data sets were used, and reflect trend percentage of last 45 days.					
	www.ncdc.gov/ng/ an update of covid-19 outbreak					

Demographic estimation of total number of average monthly confirmed cases indicate that of infected persons will increase from 15500 (39-41% of confirmed cases) during the month of June 2020 to 17240 in July decline slightly to 15480 in August and 16400 in September) and estimated to reach 16306 in December. Total confirmed cases in Nigeria will rise from 25694 to around 74825 by the end September and expected to reach 121000 by end of this year. The number of discharged infected persons would increase from 9746 in June to 16410 by end of September 30619 and likely to peak at 46800 in December (estimates are based on 39-41% of confirmed cases). Total deaths which currently amounts to 588 on 30th June, is likely to increase to 922 by the end of the month of July, 2020. It increases to 1619 and 2723 by September and December 2020 respectively. Hospitalized infected persons which currently at stands at 15358 will increase proportionately with the spike in the pandemic infection alongside the increase in screening test; and reaching 24880 in July; 42427 in September and the highest number of 70194 by end of December 2020. This signifies that COVID-19 is likely to persist till the next year.

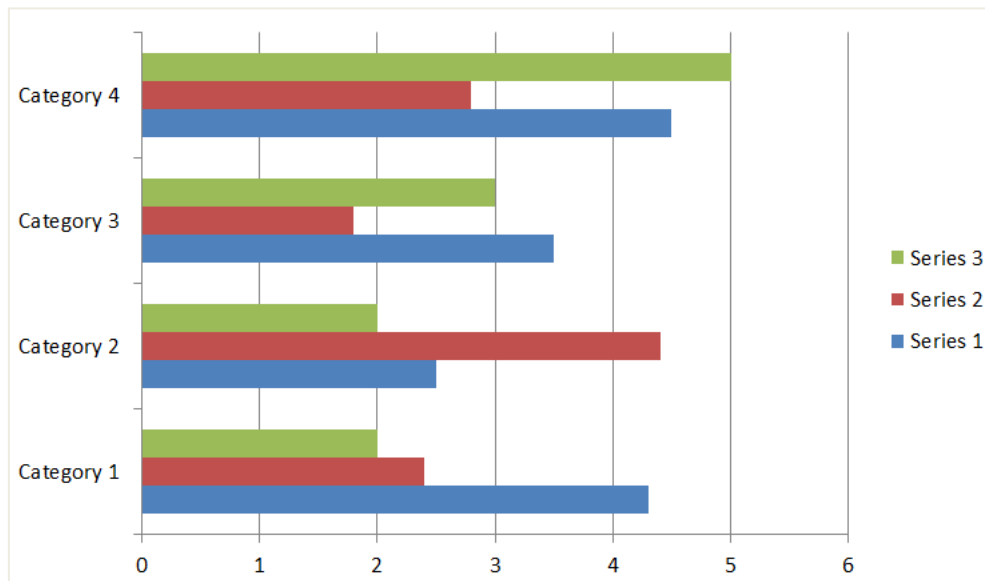
4.1.2. Synthetic Analysis of Archival Information on Severely Distressed Sectors

Synthesis of information (data) on severely recessed economic sectors is presented in table 2.

Table-2. Schedule of the Severely Recessed Sectors Identified in Prior Studies

As on 30th June 2020																	
SECTORS	RANKING SCORES FROM 14 EMPIRICAL PAPERS:																
TYPE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Agric	2	1	2	2	1	2	2	2	3	2	2	1	2	2	1	2	28
Msoil	2	2	3	2	2	2	3	2	2	1	2	2	2	1	2	2	32
Mfgnd	2	3	2	2	3	2	3	2	2	3	2	2	2	2	3	3	38
CnsBlg	3	2	3	2	3	3	2	3	3	2	3	2	3	2	3	2	43
T(w&R)	2	2	1	3	2	2	2	2	2	2	3	3	2	3	2	2	35
Srvcs	4	5	4	4	4	4	3	4	3	5	3	5	4	5	4	4	64
Total	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	240

Source: Data extracts from 14 empirical papers & Authors compilation



Source: Authors Compilation (2020)

Analysis result of the severely distressed sectors indicates that the services sector is the most severely recessed activities in Nigeria. Education came in first position, followed by transport sub-sector (particularly aviation services) second; hospitality/tourism and sports businesses in the third– all in the services sector. These sub-sectors experienced near or total closure in Nigeria as result of mandatory lock-down measures that was introduced to moderate coronavirus spread. The manufacturing sub-sector is ranked fourth, and was followed by the petroleum (crude-oil) production sub-sector in mining and quarrying sector in the fifth position (sixth); then trade (informal sector segment of whole, retail etcetera) in sixth position. Health sub-sector experienced an overall increase in demand for its output but it is placed in the seventh position due the problem of shortages in supply essential consumables and materials utilised in providing services. In essence, result distilled from the synthetic analysis of empirical information confirmed a total of six-to-seven core sub-sectors severely devastated by COVID-19 induced recession in the economy is significantly greater than four or five sectors as hypothesized in sub-section 3.3.

4.1.3. Measurement of the Magnitude of Devastation Effect COVID-19 in the Sectors

The empirical data with analysis adopted in deriving the degree of data in the relevant severely recessed economic sectors is presented in table 3.

Table-3. Sector-wise distribution of severity of Covid-19 induced recession with Magnitude of Decline in Productivity in Nigeria

Computation of Sector-wise Distribution of Magnitude of Decline in Economic Productivity in Nigeria as on 30th June 2020					
Economic Sectors (Nominal GDP (N))	Prior Year Share of GDP Output in Naira Billions	Ratio of GDP (%)	Activity Level 2020 (%)	Decline Ratio (%) Δ (%)	Calc Impact Δ (%)
Agriculture	12.800	9.0000	95%	5%	-0.0045
Mining & Quarry	12.800	9.0000	90%	10%	-0.0090
Manufacturing	13.400	9.0000	88%	12%	-0.0108
Construction / Blg	0.900	0.0100	72%	28%	-0.0017
Trade (Wholesale & R)	2.200	0.0150	84%	16%	-0.0024
Services:					

(1) Transportation	3.050	0.0200	33%	67%	-0.0140
(2) Information	15.400	0.0110	100%	0%	0.0000
(3) Finance & Ins	4.200	0.0300	95%	5%	-0.0014
(4) Real Estate	9.020	0.0600	88%	12%	-0.0074
(5) Prof & Sci -Tech	9.000	0.0600	85%	15%	-0.0090
(6) Admin & Suport	0.002	0.0000	85%	15%	0.0000
(7) Public Admin	2.900	0.0200	90%	10%	-0.0020
(8) Education	3.000	0.0200	10%	90%	-0.0018
(9) Health	1.000	0.0010	20%	80%	-0.0002
(10) Tourisms, Arts	0.020	0.0001	85%	15%	-0.0001
(11) Other Services	4.017	0.0320	95%	5%	-0.0016
TOTALS	145.64	100%	64%	-36%	-0.0660

Sources: NBS (2019) & CBN Sector Accounting Classification (2020) ; Authors (2020)

[http://www.bof.gov.ng/fgn/annual budget estimate/2019](http://www.bof.gov.ng/fgn/annual%20budget%20estimate/2019)

[http://www.bof.gov.ng/fgn/annual budget estimate/2020](http://www.bof.gov.ng/fgn/annual%20budget%20estimate/2020)

[www.cbn.gov.ng/economic sector account classification/2020](http://www.cbn.gov.ng/economic%20sector%20account%20classification/2020)

[www.nbs.gov.ng/economic statistics forecasts/2019-2022](http://www.nbs.gov.ng/economic%20statistics%20forecasts/2019-2022)

www.nbs.gov.ng/q.1-gdp-2020

The paper's assessment of macroeconomic disturbances/COVID-19 induced-recession in the Nigerian economy indicates that there shall be a drop of at least -5.7 percent from N-GDP for 2019 established that the decline in the nominal GDP projection for 2020 is greater than -2% as given in FGN's 2020 GDP projection. This result further confirmed that more than four sectors or sub-sectors are severely hurt by COVID-19 recession; and estimated decline is much greater than the -2% of the 2020 GDP forecast.

4.1.4. Estimation of Fiscal Cost Impact and Macroeconomic Losses of COVID-19 Pandemic

The computed variances derived from the respective original and revised budget projections and representing fiscal cost impact and distortions in macroeconomic aggregates-envisage (excluding value of life) of COVID pandemic during the contemporary times as on 30th June, 2020 is given in table 4.

Table-4. Analysis of changes in fiscal & macroeconomic aggregates depicting impact and magnitude of recession vis-à-vis decline in productivity in Nigeria 2020-2022

Variables	PERIODS:-	2019	2020	2021	2022
Crude-Oil Output (Diff)	Mkbd	0.34	0.20	0.21	0.12
Crude-Oil Export (AVG)	Mkbd	0.30	0.20	0.00	0.00
Crude-Oil Price Used	USD(\$)	7.20	32	0.00	0.00
Naira Exchange Rates		0.00	80.00	0.00	0.00
F G N Revenue (in N Billion)		2,878	2,512	1,986	1,483
FGN Total Spending (do)		624	276	(307)	(511)
Annual Overall Fiscal Balance		2,260	2,236	1,679	972
Overall Fiscal Balance (N-GDP%)		(2.10)	(2.31)	(1.48)	(3.00)
Size of Economy)N-GDP @ CMP		0	3,443	21,532	20,548
Annual Growth Rate - NGDP (%)		(1.23)	(7.36)*	0.47	0.68
Data FGN, 2018, 2019-2023; IMF, 2018, 2019 -2023;					

Sources: World Bank, 2019 -2022; NBS 2019 -2022; Authors,2020

[http://www.bof.gov.ng/fgn/annual budget estimate/2019](http://www.bof.gov.ng/fgn/annual%20budget%20estimate/2019)

[http://www.bof.gov.ng/fgn/annual budget estimate/2020](http://www.bof.gov.ng/fgn/annual%20budget%20estimate/2020)

<http://www.bof.gov.ng/metf/fsp/2020-2022>

[www.worldbank.org/economic data/ Nigeria](http://www.worldbank.org/economic%20data/Nigeria)

[www.cbn.gov.ng/economic statistics/economic sector account classification/2020](http://www.cbn.gov.ng/economic%20statistics/economic%20sector%20account%20classification/2020)

[www.nbs.gov.ng/economic statistics forecasts/2019-2022](http://www.nbs.gov.ng/economic%20statistics%20forecasts/2019-2022)

www.nbs.gov.ng/q.1-gdp-2020

From our review of the key assumptions used in the budget estimates and fiscal strategy paper, it is observed that the annual oil production and export volumes will reduce with about 200000-300000 and 300000 barrels respectively. Crude-oil price benchmark adopted in export revenue projections for the periods under review will be decreasing; from \$60 and \$57 in 2020; \$35 in 2021 and \$40 in 2022 down to \$25-30 (on average) in 2020 and possibly in 2021 as well.

Result of multi-sector computed general equilibrium in the 4-year fiscal and economic aggregate projection from 2019 to 2022 (variance analysis from the approved fiscal budget estimates and actual outturns for 2019; approved and revised budget estimates (2020) and initial and revised METF/FSP (2021-2022) projections) as presented in table 5 indicate that: federally collectible revenues, and FGN retainable revenue estimates in 2020 through 2022 will decline with about 25-to-35percent yearly. Similarly, federal government projected expenditures will be increasing with about N500 billion-to-about N1 trillion annually in 2020, 2021 and 2022 respectively, partly to meet contingency spending for public health and the related economic interventions / fiscal stimuli.

In essence, there will a significant adverse increase of more than the -2% in overall fiscal deficit balances as reflected in the revised budget during the periods. The result also reveals that there will be significant decline in

Nigeria's nominal GDP of about -5.7 percent to -7.2 percent for the current year as indicators of direct consequences of COVID-19 pandemic and its related recession in the economy. This is also greater than the range given in (FGN, 2020b) budget. With this particular result, the paper has established the magnitude and dimension of COVID-19 consequences in Nigeria to date (as on 30th June, 2020).

4.1.5. Synthetic Analysis of Policy Prescriptions on Revival and Sustainability Strategies

Synthetic review of empirical studies, policy research papers and policy documents (FGN, 2020c) on economic revival and sustainability strategies revealed that; health sector; (ii) education sector; (iii) agriculture, food production and food supply sector, (iv) petroleum and gas sector—development of local refineries and petrochemical plants and expansion of local production base are some of critical sectors which must be given special strategic intervention in sustaining the economy. Others include manufacturing sector with special emphases on pharmaceutical industries and productivity, localization of raw materials and intermediate goods; (vi) energy and power generation / distribution sector. From the synthetic analysis, about seven (7) core activities (economic sectors) as enumerated above were already prioritized for immediate government intervention and earmarked for disbursement of stimulus package. In this case, total number of prioritized activities is greater than four as hypothesized; thus, Ha₄ is adopted in line with theory.

4.2. Discussions

Global impact trend and in Nigeria, health and socio-economic consequences of COVID-19 and policy measures introduced by different sovereigns has affected price of crude-oil in the international market. It also results cut in production quota allocation for Nigeria, sharp reduction in oil revenues, depreciation in naira exchange rates and public money utilization in 2020 fiscal budget (Ozili et al). Relevant discussion of results and findings and policy measures introduced by sovereign governments world-wide to cope with coronavirus-induced recession are presented sequentially in sub-sections 4.2.1–4.2.4.

4.2.1. Coronavirus Disease, Recoveries, Fatality, Carrying Sick-Persons and Prospect

Simulation of weekly moving averages of COVID-19 spreads as on 30th June 2020 together with its baseline two-month recovery lead time or lag (inclusive of incubation period) of confirmed cases, outstanding inventory of unrecovered persons to be carried-over to the first or second quarter of 2021 were computed. This provides evidence that coronavirus infection and discovery of new infections is likely to persist throughout this year. The combination of additional coronavirus infections that may occur in third and fourth quarters of 2020, probable infections in first quarter of 2021 and carry-over unrecovered infected persons suggests that prevalence of COVID-19 would linger in Nigeria in the coming year(s). If effective medical remedies are not in place, coronavirus disease may likely to constitute new normal infectious disease that might remain with humanity—at least in the short term.

The extended demographic analysis of relationship between confirmed COVID-19 cases of infected persons to population on one angle (31000/202000000) equals to 0.0002 on one angle. The officially confirmed fatalities (600/30000) an average of 2 percent, demonstrates that mortality rate of coronavirus pandemic is quite insignificant, implies people will continue to be infected with as low as 2–3% percent of infected persons dying. In effect, adverse impact of total fatalities cannot bring about significant reduction on Nigeria's current and future rate of population growth. COVID-19 pandemic has inflicted huge public spending and unforeseen additional fiscal burden to household and government. This necessitates that Nigeria needs to allocate more resources for the health sector and expand the treatment facilities and preventive medical remedies to minimize the spread. Thus, government should therefore make sufficient budgetary resource allocation to the health sector, more than the amount earmarked in the revised 2020 approved budget estimates. The paper encourages Nigerian governments to lift restrictions on all activities in the economy except large gatherings in order to enable human activities return gradually to near full employment of economic resources.

4.2.2. Economic Sectors and Activities Distressed by COVID-19 Pandemic's Recession

(i) The economic lock-down policy and socio-physical distancing measures introduced to curb the spread of coronavirus inflicted severe negative impact on agro-farming businesses and factories throughout the length and breadth of Nigeria as well as on trade, transport and tourism. The entertainment, hospitality/tourism and sports businesses (all in services sub-sector) were also identified to have experienced near total collapse due lock-down measures introduced to moderate coronavirus spread. Nigeria's economy is structurally unbalanced and fragile. It has been estimated that Nigeria's Aviation Industry alone lost about 3.5 million passengers due to restrictions necessary to curb the pandemic, resulting in over \$760 million in lost revenue (Ozili et al) and IATA projects that the number of jobs at risk in the country's aviation industry is 91380. Micro, small-medium-scale enterprises account for about 96% of businesses and provide 54% of employment and labour utilization and contributed around half of the GDP. Empirical studies show that larger proportion (millions) of small businesses in the country is ill-equipped to handle a crisis of this scale, thus government need to concentrate its intervention programmes and stimulus packages to MSMEs and agric-entrepreneurs for survival and continuity. Unemployment rate rose to 23.1% and underemployment rose to 16.6%, with over 20 million Nigerians currently unemployed in 2017 pre-COVID 19 periods (NBS, 2020). This figure shall increase significantly with the impending job losses arising from the pandemic. Nigerian government expressed concerns that 39.4 million Nigerians may lose their jobs before the end year 2020 as a result of COVID-19 outbreak in the economy if appropriate measure were not taken (FGN, 2020a). Nigeria predicts that no fewer than five million people will drift into extreme poverty by end of the year (FGN,

2020d) and envisage that number of from 27 million people in 2019 and up to 47 million by 2023 (Statistics.com, 2020).

(ii) The education sector that provides education and training across levels remained closed and stagnant for about six months and counting. Prior to implementation of Nigeria's economic lockdown measures, the public university system had been closed down since last quarter of 2019 as a result of ASUU ordered strike. Whilst Nigeria's basic and higher education systems closed, their counterparts in USA, Canada, United Kingdom and different parts of European countries have continued with their steady teaching and learning programmes; but Nigeria whither indulges in prolonging strikes remained under closure. This phenomenon speaks volumes of the sub-optimality in public activities and programmes. From the international scene, there were school closures of some kind in 44 countries on four continents, including Africa, with hundreds of millions of students around the world facing disruptions.

(iv) Health sector has experienced an overall increase in demand for human healthcare services whilst coping with shortages in the supply essential consumables and materials utilised in providing services. Coronavirus outbreak also affected the pharmaceutical supply chain and hitherto drug makers around the world relied heavily on ingredients made in Chinese factories. About 60% of the world's active pharmaceutical ingredients (API) were made in China before the coronavirus outbreak, and the coronavirus outbreak caused severe supply problems as China shutdown majority of its factories including factories that produce drugs. Many pharmaceutical companies did not store up substantial amounts of APIs prior to the coronavirus outbreak, and as a result, some essential drugs were in short supply. The overreliance on Chinese API manufacturers posed the biggest risk to the global pharmaceutical industry and the COVID-19 outbreak amplified the risk even further. Shortages of pharmaceutical supplies and AP teaches Nigeria to explore opportunities in producing drugs, medical consumable and APIs through from her petroleum sub-sector and to be self-reliant on these materials.

(v) Petroleum industry in mining and quarrying sub-sector suffered sharp decline due to reductions in crude-oil price in the export market. This trend is apparently having serious adverse impact both on the operations of exploration companies and government revenue mobilization because crude oil price per barrel now hardly cover cost of production and government currently generate up 50 percent of its oil revenue projection. The impact of pandemic on oil revenue-dependent countries has been severe (World Bank, 2020); many countries are facing increasing pressure on their foreign reserves, leading to devaluation of local currencies against the dollar; reductions oil revenues, exchange rates and adverse impact on national budgets (Ozili et al).

4.2.3. Simulated Estimation of COVID-19 Fiscal Costs and Macroeconomic Shocks

Following the envisage reduction in revenue and increase in aggregate expenditures, there is strong likelihood of astronomical increase in Nigeria's annual primary and overall fiscal deficit balance(s) in 2019 (actual performance = -N4938 as against -N1919), specifically much more higher than the projected fiscal deficit balances for 2020; 2021 and 2022. The size of Nigeria's economy (N-GDP) in nominal terms will decline with about -4.6 to -8.0 percent in 2020 alone as the direct result of economic lock-down, restriction in human and automobile movement and stoppage of productivity in non-essential activities. There will be further decrease of around -3 and -5% in N-GDP on year-on-year basis particularly in 2021 because COVID-19 is not disappearing soon (shown earlier result in 4.1.1) expect effective drugs curing coronavirus is found and readily available. The envisaged decline in nominal N-GDP for 2020-2022; sharp drop in government revenues particularly from oil sources, combining with increase in public spending together with lowering individual productivity and observable aggregate domestic output emerge from COVID-19 pandemic-induced recession depicts magnitude of losses of resources in the economy.

The implication of fiscal consequences of COVID-19 pandemic to the economy is that Nigeria will experience increase in annual overall fiscal deficit balance in 2019 (reported already), 2020 and in next two years beyond the level reflected in all FGN extant estimates. This envisaged excessive annual fiscal budget deficit will lead to additional borrowings and over-bloated sovereign debt. It is pertinent to stress that Nigeria is not keeping reserve fund worth N2.3 trillion which it proposed to dispense as fiscal stimuli anywhere as reserve fund asset; but she could only raise such funds through borrowings, devaluation of Naira (from N305 to N385 presently), increase in taxes or impose new levies on citizens. It means that implementation of the policy measures and fiscal stimulus package will be a tough order and challenging to the citizenry and the state (World Bank, 2020).

4.2.4. Syntheses of the Prescriptions of Economic Revival and Sustainability Strategies

(1) Nigeria proposes to strengthen and reposition the health sector. This will be on four key priorities, namely, boosting the response to the COVID-19 pandemic; ensuring access of every Nigerian to qualitative health services based on the prioritisation of primary health care, building preparedness for the threat posed by infectious diseases and boosting local research and development efforts aimed at the production of medical and pharmaceutical resources (FGN, 2020c). Government proposes to expand the National Health Insurance Scheme (NHIS) to cover all citizens, the protection of health workers on the front lines of addressing COVID-19 and other infectious diseases shall be a priority.

(2) Government focus in the education sub-sector is designed to remedying the disruptions caused by the pandemic and ensuing social distancing measures at all levels of education. Specifically, virtual learning is currently contemplated to be implemented, to continue educational progression but it is left to seen!

(3) Nigerian government has marshalled out appropriated strategies toward enhancement of agricultural productivity in the economy and it is structure to spread project over a period of 12 months (likely from July 2020). The programme is designed to expand existing production in the agricultural sector and stimulate the establishment

of new farms in partnership with State Governments, the private sector and individual citizens. It is planned to create five million jobs by focusing on increasing land under cultivation with State governments contributing between 20,000 to 100,000 hectares from a combination of aggregated smallholder farms and utilisation of abandoned states farm settlements and agricultural projects. The project will span the entire agricultural value chain, from ‘farm to table’.

(4) With regards to electricity and power supply; the planned solar energy plan will swiftly increase the stock of affordable energy by providing solar power to rural communities that have little or no access to the national grid. Private sector installers of solar systems will be supported to access low-cost financing from development finance institutions and the CBN in order to install solar systems at an affordable price.

(5) Strategic development of petroleum and liquefied natural gas sub-sector hold the key for the country’s economic growth and sustainability but minimal effort is given to this fortune changing sector IMF, 2019; (IMF, 2020).

4.3. Critique of Nigeria’s Economic Resuscitation and Sustainability Strategies

This study identified clear omission and gaps in policy prescription in the following core sector which for immediate consideration. First, we observe that the inadequate attention of government to the development of crude-oil refineries, petrochemical industries and negligence of production of ‘Active Pharmaceutical Inputs’ (APIs). Development of this particular sub-sector would necessarily reposition the economy from over-dependence on crude-oil export revenue earning and wastages of export earnings on importation of finished petroleum products to self-sustenance. Nigeria ought to utilise its oil and gas resources through expanded domestic production and also export large volume of these domestic production to the neighbouring countries and also creation huge employment opportunities to its army of unemployed / underemployed persons. Nigeria should adopt strategic development policy of its petroleum sub-sector which involves the establishment of cottage crude-oil refineries, petrochemical industries and gas plants—optimization of the intermediate processing of petroleum and gas products. By the time the new installed and refurbished refineries are fully operational, additional job opportunities would materialize through indirect employment through retail outlets, filling stations, and in transport. The potential positive spillover effects to West and Central Africa include increased supply and reduced costs for refined products. There is urgent need for development of local raw materials, banning of certain importation, expansion of pharmaceutical industry, and local production base. Nigeria should adopt strategic development policy of its petroleum sub-sector. This necessitates the establishment of modular crude-oil refineries, petrochemical industries and gas plants – optimization of intermediate processing of products.

(b) There have been contrasting arguments on adequacy and inadequacy of medical doctors and other health professionals in Nigeria in the past, with government functionaries claiming there is sufficient number of physicians to handle human health requirement of Nigeria’s population. The truth of the real situation has been exposed and it is now confirmed that there is serious physicians’ density deficit, as well as shortages of other categories of health workers. Besides comprehensive overhaul, rebuilding and repositioning of the entire health systems including education and training of the physicians and other health professional workers in Nigeria. However, this latest blueprint on repositioning of the nation’s health service omitted to consider the problems of sub-optimal resource cost accounting, lack of reliable financial stewardship in the public health sector, weak public financial management and governance systems. Without mincing words, implementation of this sustainability programme may not yield the expected results if lack of accountability and governance persists in the system.

Nigeria’s health services should immediately be restructured in the pattern of the United Kingdom’s National Health Service (NHIS) and properly funded. Restructuring of Nigeria’s health system should be anchored on comprehensive resource costing, allocation and cost absorption with sound fiscal accountability, transparency, timely financial reporting and governance practices in the health sector.

(c.) The study observes that the provision of adequate storage facility, preservation agricultural produce, conversion into intermediate goods, and commodities marketing were not incorporated into Nigeria’s FGN economic sustainability planned strategy for the sector. In addition, there is need for government to purchase agricultural outputs directly from the farmers and manage marketing and distribution of agricultural commodities in domestic and export market to as strategic measures to boost productivity and growth of the sector similar to the USA’s model.

(d) COVID-19 pandemic outbreak has exposed the inadequacies of Nigeria’s educational systems and other countries that hitherto have not implemented online learning programme platforms into the conventional physical contact modes of education. There urgent need for implementing of a blending teaching and learning system involves adoption of mixture of virtual learning and physical learning methods in Nigeria henceforth. It is pleasing to note the National Open University of Nigeria (NOUN) is running its programmes virtually during throughout the lockdown but ironically, certain professional bodies in Nigeria will refuse to recognize NOUN awarded degrees for admission to the special training. Government and stakeholders should realise that salary payments to employees in the education sector for six month or more translates to colossal fiscal loss. Relevant authorities of the Federal Ministry of Education / NUC need to direct all Nigerian Universities to commence virtual learning to all categories of postgraduate students. They should utilize this period to clear the unnecessary backlog of research students who are yet to complete their course since the numbers are too large to constitute large gathering – especially this period the highly populated undergraduates are not in session.

(d) Electricity generation, distribution and supply play critical roles in Nigeria’s domestic productivity and well-being of the population. The planned solar energy plan designed to will increase affordable energy by providing solar power to rural communities that have little or no access to the national grid is a bold step. However, the

challenges of electricity supply has been compounded by the DISCOs that are inefficient, ineffective and having preference of denying consumers access to installing pre-paid meter to gauge private user consumptions in preference to estimated billing method. The Solar Power Strategy should be supported with establishment of smaller-size or cluster-rotary power generation plants and possibly decentralized electricity transmission system should be implemented to boost capacity of power supply. Government should consider to issuance of licenses to private and state investors for independent power generation and distribution; and such producers to pay taxes and thereby eliminate occurrence of nation-wide 'black-out and ensuring steady supply.

(e) The revised revenue estimates and projections for 2020-2022 are not likely to be realized; hence the revenues will not be sustained. In essence, the bottom line is that Nigeria shall experience larger overall fiscal deficits in 2020 and subsequent periods. This implies increase in budget deficits, government borrowings, sovereign debt and debt service.

5. Summary, Conclusion and Recommendation

The paper assessed magnitude of COVID 19 transmission, confirmed cases, recovery, deaths, carrying stock of infected person with recovery lags and applied statistical outcomes in predicting spilling over to subsequent year(s). It also identifies the economic sectors that have been worst hit by COVID-19 triggered recession; simulate the estimates of potential fiscal cost and reduction in macroeconomic aggregates in Nigeria during short run alongside synthesis of restoration and sustainability strategies.

The results revealed that total number of confirmed cases in Nigeria will rise exponentially till end of this year. Coronavirus pandemic in Nigeria is likely persist up to the second quarter of 2021 and may constitute new normal infectious disease that might remain with humanity except if effective cure found and readily available. Second, the study identified education, transports, hospitality/tourism and sports businesses (services); trade (informal sector), petroleum exploration in mining sub-sector and crude oil exports for government sector, as most severely contracting activities industries in the economy. Core results obtained from the multivariate approved budget estimates (2019 – 2020) and METF/FSP (2021-2022) projections in comparison with actual performance in 2019, revised annual appropriation for 2020 and 2021-2022 amended projections indicate adverse increase will exceed -2% in the overall fiscal deficit balances during the periods. It established that Nigeria's nominal GDP will decline by -5.7 percent and up to -7 percent in the current year. Lastly, health, education, agriculture, petroleum exploration; petroleum refining and petrochemicals, manufacturing (particularly pharmaceuticals), power generation and trade deserve urgent injection of stimulus packages.

The implications of these findings include the following: The number of confirmed cases in Nigeria will rise exponentially till end of 2020 and that coronavirus pandemic in Nigeria, and it is likely persist up to the second quarter of 2021. Nigeria's average daily screening test is around 2000 and with less than 200000 tested persons, suggests that vast majority of the population is uncovered; meaning that control and eradication of COVID-19 in Nigeria will take longer period. It is likely to constitute new normal infectious disease that might remain with humanity except if effective cures are not found and readily available. The activities in education, transports, hospitality/tourism and sports businesses (services) are severely contracted due to prolonged closure and restrictions. Other sectors include trade and petroleum exploration is most severely contracting activities industries. Emergence of COVID-19 exposed lopsidedness and ineffectiveness in Nigeria's education, health and other government services and fragility of the economy that are spiced with corrupt tendencies. The paper confirmed declining trends in Nigeria fiscal revenues particularly in oil sources and fast rising public expenditure which demonstrate that most of the estimates used in the budget and METF cannot be relied upon. Nigeria will experience increase in overall fiscal deficit balance as in 2019 (reported already) again in 2020 and next two years and will lead to additional borrowings and over-bloated sovereign debt.

The paper recommends that government should enhance the entire health systems based on the fact that coronavirus disease will linger for longer period and require huge expenditure in the health sector, education and social welfare services. Government should relax the lock-down policy and allow normal activities in the economy to thrive and provide succor to Education, transports, hospitality/tourism and sports businesses (services), petroleum and gas, manufacturing, mining and construction are the most depressed sectors due to the Covid-19 pandemic. Relevant authorities of the Federal Ministry of Education / NUC need to direct all Nigerian Universities to commence virtual learning to all categories of postgraduate students thereby utilize this period to clear the unnecessary backlog of research students who are yet to complete their course since the numbers are too large to constitute large gathering – especially this period the highly populated undergraduates are not in session. Health, agriculture, electricity services; local petroleum refineries and petrochemical industries, pharmaceutical raw materials and pharmaceutical production sectors deserve greater allocation of stimulus package. Government should also plough sufficient stimuli to education, transports, hospitality/tourism and sports, trade (informal sector), petroleum exploration as duly identified severely recessed sectors to revive the economy. Nigeria should not to lean heavily on excessive budget deficits, excessive borrowing and debt as core sources of financing its stimulus package to avoid debt burden to tax payers and future generations. Disbursement of stimuli needs to be concentrated on health, education, informal sectors, manufacturing including APIs-pharmaceuticals, power supply, social investment programmes. Government is advised endeavour to look inwards and turn around the economy through domestic utilization of crude-oil in domestic productivity in refining of crude oil and petrochemical products for domestic consumption and exportable goods- this sub-sector holds the key for reviving the economy.

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ABBREVIATION PAGE

APIs	- Active Pharmaceutical Ingredients
ASUU	- Academic Staff Union of Universities (in Nigeria)
CBN	- Central Bank of Nigeria
CDC	- Center for Disease Control (USA)
CGE	- Computable General Equilibrium
CMP	- Current Market Price (i. e, GDP at Current Market Price)
COVID-19	- Coronavirus 2019
DISCOS	- Electricity Distribution Companies in Nigeria
DRC	- Democratic Republic of Congo
EVD	- Ebola Virus Disease
FGN	- Federal Government of Nigeria
FSP	- Fiscal Strategy Paper
G-7	- Group of 7 Industrialized Nations
GDP	- Gross Domestic Product
IATA	- International Aviation Travel Agency
ICT	- Information, Communication and Technology
IMF	- International Monetary Fund
INSEE	- National Institute of Statistics and Economic Studies in France
MBPD	- Million Barrel (of Crude-oil) Per Day
METF	- Medium Term Expenditure Framework
METF/FSP	- Medium Term Expenditure Framework/Fiscal Strategy Paper
MSCGE	- Multi-Sector Computable General Equilibrium (CGE)
MSME	- Micro, Small Medium Enterprises
NBS	- National Bureau of Statistics
NCDC	- National Centre for Disease Control (NCDC), Nigeria
NGDP	- Nigeria's Gross Domestic Product
NHIS	- National Health Insurance Scheme (NHIS)
NOUN	- National Open University of Nigeria
NUC	- National Universities Commission
OECD	- Organisation of Economic Cooperation and Development
RQ	- Research Question
SARS	- Severe Acute Respiratory Syndrome
SIR	- Susceptible-Infected-Recovered (SIR) model
US	- United States Economy
USA	- United States of America
USD	- United States Dollar
WHO	- World Health Organization