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Impact of Disaggregated Government Expenditure on Human Capital Development in Nigeria: 1970-2022

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Abstract
Public expenditure is concerned with the utilisation by the government of the nation's resources with regard to the rules, regulations, and policies that shape planning, budgeting, forecasting etc., and the coordination of the inflow and outflow of funds aimed at maximizing the set objectives of the institution. Human capital has gained significant importance in the growth trajectory. However, the component of public expenditure that properly induces its development remains debatable in Nigeria. The study investigates the Disaggregated Impact of Government Expenditure on Human Capital Development in Nigeria: 1970-2022. The study made use of secondary data adopting the Error Correction Mechanism (ECM) as a method of analysis. The finding revealed that there is a long-run relationship between government expenditure and human capital development which is proxy by education and health. The study, therefore, recommended that Nigeria should drive growth processes with deliberate policies aimed at encouraging an appropriate mix of the two expenditure heads to drive needed human capital development for overall economic growth. This no doubt, if not well managed, will further impede any form of investment in capital formations in the country.
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1. Introduction

Conventionally, the issue of disaggregated government expenditure and human capital development has become a topical discourse due to the perceived strong link between the two. The near consensus among scholars is that government expenditure is undoubtedly an essential tool used to push for economic stabilization, particularly, amongst developing countries like Nigeria. Public expenditures can and have played an important role in physical and human capital formation over time (Bayoumi, Hewitt, and Schiff; 2015). Appropriate public expenditures even become more effective tool in boosting economic growth, even in the short run, when limits to infrastructure or skilled manpower become an effective constraint to increase productivity (Bayoumi, Hewitt, and Symansky; 2018).

Public expenditure is therefore concerned with the utilization by government of the nation's resources with regards to the rules, regulations and policies that shape planning, budgeting, forecasting etc. and the coordination of the inflow and outflow of funds aimed at maximizing the set objectives of the institution (Lawanson; 2019). Put differently, public expenditure deals with government spending and the level of liquidity in the economy directed towards achieving avowed objectives (Bose et. al.; 2014). Despite various efforts of the successive Nigerian governments, virtually all indices of human development especially those of health and education are embarrassingly low (UNDP; 2019). Many studies in the past which set to establish the effects of public expenditure on human capital development and economic growth however ended up with conflicting results: while some are of the view that a rise in the share of public spending is associated with a decline in human capital development and growth (Landau; 2006 and Scully; 2008); others have found that public spending is positively associated with human capital development (Taban, 2010) and still others have found no significant relationship (Temple, 2011).

In view of this, a number of studies have found a positive correlation between public expenditure and human capital (education capital): primary and secondary levels of educational attainment (Alesina, and La Ferrara, 2015); share of expenditures on education in total expenditure (Otani and Villanueva; 2020); and capital expenditures on education (Afonso, et.al. 2010). Other studies on the contrary, found indirect links between education and public expenditure, for instance, a link was found between education expenditures and private health out-of-pocket expenditure (Arjona et.al.; 2003). Thus, it can be safe to say that human capital denotes one of the production elements which can generate added values through inputting it; hence, the first recognition human capital as ‘labor force’ related to economic added value that is generated by the input of labor force as other production factors such as financial capital, land, machinery, and labor hours. Apparently, the other form of human capital can be viewed as the target of investment through education and training which expansively includes the meaning of “human as creator” who frames knowledge, skills, competency, and experience originated by continuously connecting between self and environment.

Human capital refers to education, health, on-job training, and the skills acquired through the interaction of people or societies. In more technical term human capital is defined as the aggregation of the innate abilities and the knowledge and skills that individuals acquire and develop throughout their lifetime (Ferid and Zefer, 2013). In contrast to the perceived positive correlations between education and public expenditure, a number of studies have reported only a weak correlation between labor productivity and health/education expenditure Gwatkin (2009), although there are exceptions also (World Bank; 2016a). It is in the midst of these controversies that the study attempts to explore not only the impact of public expenditure on human capital development but equally the relative impact of disaggregated expenditure. More so, studies in the past asserted that as government expenditures exponentially increase the law of diminishing returns sets in beyond a point that further rise in expenditure strangulates expected gains thereof amongst human capital indicators (Benito and Oswald, 2010). Contrarily, Abu and Abdullahi (2010), Abdullah and Cooray (2009) and Al-Yousif (2012) found that government expenditure stimulates human capital development cum economic growth. Their submissions were that government expenditure on capital (and not recurrent) expenditure increases private sector investment and firms' performance and by extension, social wellbeing of the people. It is in view of these controversies; that this study seeks to examine the impact of disaggregated public expenditure on human capital development in Nigeria from 1970 to 2022.

2. Literature Review

This chapter places the study in the context of prior research. It conceptualizes; reviews and presents the previous research undertaken on public expenditure and growth plus the few on disaggregated public expenditure and human capital development cum economic growth in Nigeria. A survey of the theoretical and empirical literature concerning disaggregated government expenditure and economic development including past studies are extensively reviewed.

According to Isedu (2002), the breakdown between these two types of spending is very important. "Capital expenditure has a lasting impact on the economy and helps provide a more efficient, productive economy." ("Impact of Recurrent and Capital Expenditure on Nigeria's ... - IISTE") A new hospital, for example, will be much more efficient and allow more patients to be treated for many years into the future. Current expenditure, however, does not have such a lasting impact. Once the money is spent, it is gone and the effect on the economy is simply a short-term one. This situation is shown on the production possibility frontier below. Point A has a high level of current expenditure and low capital expenditure. The level of growth in the economy is relatively lower. Point B in contrast has a much higher level of government investment and will help create more growth in the long term. The government must be very careful to strike the right balance between current and capital expenditure.

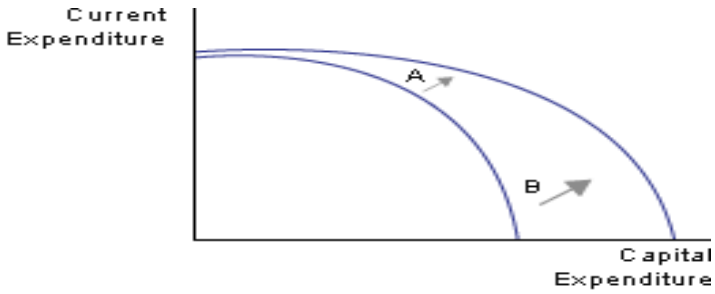


Fig. 1: Current & Capital Expenditure Curve 1999-2010

The theoretical framework of this study is premised on the growth theory with the 'mystery variable' otherwise known as the effectiveness of labour (A), whose exact meaning is not specified, and behavior taken as exogenous, Romer (2006). The effectiveness of labour is seen to be represented by knowledge or technology and its progress is plausibly the reason for more output in today's production processes with a given level of capital and labour. As a result, the study would adopt the simplified version of Research and Development (R&D) and Growth framework first developed by Romer (1990), Grossman and Helpman (1991a), Aghion and Howitt (1992), Uzawa (1965) and Phelps (1966). In adopting this framework therefore, the study would take a fairly mechanical view of the production in new technology of labour (human capital) in the traditional Cobb-Douglas production function in which labour, capital and technology are combined to enhance productivity. The model would normally comprise of four variables viz: labour (L), capital (K), and technology (A), and output (Y). The framework assumes two sectors: the goods-producing, where output is produced and the R&D sector, where additions to the stock of knowledge are made.

In an attempt to investigate the effect of government expenditure on economic growth, Nwadiubu and Onwuka (2015) employed a disaggregated analysis and found that government total capital expenditure (TCAP), total recurrent expenditures (TREC), and government expenditure on education (EDU) are negatively related

with economic growth.

Udoka and Anyingang (2015) investigated the effect of public expenditure on the growth and development of Nigerian economy (1980-2012). Three research hypotheses were formulated to guide the study. Ex-post facto research design was adopted for this study. Data were obtained from annual publications of Central Bank of Nigeria. Data gathered were analysed using Ordinary least square multiple regression statistical technique. Result of the findings revealed that aggregate expenditure had a positive impact on economic growth and development of the Nigerian economy, recurrent expenditure had a significant relationship on the growth and development of the Nigerian economy. The result also indicated that capital expenditure also had a significant effect on the growth and development of the Nigerian economy. They recommended that the government should increase its spending on components of public expenditure which will in turn promote investment in the country.

Abubakar (2016) took a step further by examining a disaggregate impact of the components of public spending on economic growth, taking Nigeria as a case study. The Augmented Dickey Fuller (ADF) test for unit root, Johansen Cointegration test, Vector Error Correction Model (VECM) and Impulse Response Function (IRF) were employed for analysis. ADF test result showed variables to be integrated of order one I(1), Johansen Cointegration Trace test and Max-Eigen Value test show variables to be cointegrated i.e. have long run association. Long run relationship result shows a negative and significant impact of Recurrent Transfer Payment (RTR), Capital Socio-Economic Expenditure (CSE) and Openness (OPP) on economic growth, while the negative impact of Recurrent Administration Spending (RAD) was statistically insignificant. Long run result also showed a positive and significant impact of Capital Administration Expenditure (CAD), Investment (INV), and Labour (LAB) on Economic Growth. Short run dynamics of the model showed a positive and significant impact of RAD and OPP on economic growth of Nigeria.

Egbo, Nwankwo, Okoye and Onuora (2016) explored the relationship between government disaggregated expenditures and growth of the Nigerian economy over the period of 1970 to 2014 with a critical focus on growth analysis. Using percentage changes in government expenditures on administration, economic services, social and community services and transfers and GDP, the study employed ex-post facto research design and the required data were sourced from CBN statistical bulletin and subjected to OLS, ECM, Granger causality and Johansen co-integration methods of estimations. Utilizing the ADF statistics, the employed variables were found to be stationary at level, while the OLS revealed a short run positive association between expenditures on administration, social and community services and transfers and gross domestic product while economic services expenditure relates negatively to GDP. The study also revealed the existence of equilibrium or longrun relationship among employed variables, while the ECM was rightly signed at 92% speed of adjustment. The granger causality revealed a demand-following unidirectional relationship between GDP and expenditures on economic services. Based on this, the authors recommended that Expenditures on economic services should be channelled towards diversification of the economy especially in this period of dwindling oil prices.

Iheanacho (2016) examined the long and short-run relationship between public expenditure and economic growth in Nigeria over the period of 1986-2014, using Johansen cointegration and error correction approach. Two components of public sector expenditure and gross capital formation ratio are derived from Cobb Douglas production function. The result shows recurrent expenditure is the major driver of economic growth in Nigeria. Controlling for the influence of non-oil revenue, this study shows a negative and significant long-run relationship between economic growth (rgdpc) and recurrent expenditure coexists with a positive short-run relationship, highlighting the dual effects of recurrent expenditure on economic growth in Nigeria.

3. Methodology and Model Specification

The section discusses the procedures employed in the study to arrive at its findings. In other words, it gives clear details on the nature and sources of data, model framework and assumptions, analytical technique(s) adopted and diagnostics (tests) and justification of the framework etc. As a result, the study has been structured to examine the disaggregated impact of Government expenditure on human capital development in Nigeria: 1970-2022, thus leading to the adoption of a quantitative research technique based on an ex-post facto research design. It is a type of research design that utilizes existing data on past events.

The study would be certainly interested in the long-run properties of the variables thrown in the model for analysis, i.e. the long-run equilibrium relationship (Gujarati, 2008). As a result, the study intends to adopt an unrestricted error correction mechanism or vector error correction technique, where applicable in the system (Toda-Yamamoto, 1995; Pesaran et al. 2001) Gujarati, 2008). This is, however, after ordinary least squares would have been performed on the series. Having said this, studies have shown that benefits accruable from expenditure on human capital in any type of economy are periodically gestational, as such lag effects become pertinent (see Giles 1975, WHO, 2006; Crisp and Gawanas 2008; MDGs, 2008). More so, dynamic models would usually portray the time path of

Following Haiss and Sümegi (2006), Eller (2005), Fink (2004, 2005) and Web, Grace and Skipper (2002), and in line with the study framework (Romer, 1990; Barro, 1991; Mankiw et al, 1992; Gemmell, 1996; Grammy

and Assane, 1996); the study adopts an endogenous growth model with a modified Cobb-Douglas production function (CDF) assuming constant returns to scale and perfect competition thus:

$Y = AK^{\propto} H^{\beta} L^{1-\propto-\beta}$ ----------(1)

Where: Y denotes the output change; A denotes technological progress; K denotes physical capital; H denotes human capital development; and L denotes the labour force.

In other that we standardized the model 1 by transforming it as below in its intensive form yields:

$$\ln \dot{y}(t) = \alpha \ln \dot{k}(t) + \beta \ln \dot{h}(t)$$ A(L)$^{1-\alpha-\beta}$----------(2)

$$\dot{h}(t) = s_H k(t)^{\alpha} h(t)^{\beta}$$ .....(3)

To incorporate therefore, the change in human capital (otherwise called the efficiency of labour) given that subsequent values of A can be estimated alongside the coefficients of labour, Haiss and Sümegi (2006) specified in two separately observable parts thus:

$\ln(A)=\delta_0 +\delta_1 \ln(Edu)+\delta_2 \ln(R\&D)+\mu$----------(4)

Model 4 treats education and research and development (R&D) as input factors augmenting the performance of human capital (factor). If we therefore control for education, research and development (R&D) via public expenditure in the country, then capital formation, quality of labour force supply etc. are in the model to arrive at:

$EDUc=f\{A(LS)\ ^{\Omega}GCF^{\rho},REXP^{\delta},CEXP^{q},HCAP^{\theta}\}$.....5

$HTc=f\{A(LS)\ ^{\Omega}GCF^{\rho},REXP^{\delta},CEXP^{q},HCAP^{\theta}$.....6

For $\Omega=1-\rho-\delta-q-\theta$

To be re-specified in its traditional OLS model thus:

Therefore, the study adapts the works of Egbo, et. al., (2016) in order to formulate its structural equation below:

$EDUe_t = f(CAPEX_t, RECEX_t, GCF_t, HCAP_t)$----------7

$HTe_t = f(CAPEX_t, RECEX_t, GCF_t, HCAP_t)$----------8

The equation (7 and 8) above can be further transformed into a mathematical model as follows:

$EDUe_t = \Omega_0 + \Omega_1 CAPEX_t + \Omega_2 RECEX_t + \Omega_3 GCF_t + \Omega_{4H} CAP_t$----------..9

The mathematical model above is re-specify in its econometric form:

$HTe_t = \Omega_0 + \Omega_1 CAPEX_t + \Omega_2 RECEX_t + + \Omega_3 GCF_t + \Omega_{4H} CAP_t + \varepsilon_t$ ----------10

A visual inspection of the time series plots of the variables n the next chapter revealed that all the variables are trending over time, most especially EDUe, CAPEX, and RECEX which exhibits some great elements of random walks with some extreme outliers. This is because only these variables are recorded in absolute amount (naira) not as a rate or ratio as such the natural logs of these variables are taken in order to secure normality and homoskedasticity. Thus, equations (9) and (10) become log-linear models through a logarithmic transformation as follows:

$InEDUe_t = \Omega_0 + \Omega_1 InCAPEX_t + \Omega_2 RECEX_t + \Omega_3 GCF_t + \Omega_4 HCAP_{gt} + \Omega_5 HTe_{t-1} + \mu_t$---------11

$InHTe_t = \Omega_0 + \Omega_1 InCAPEX_t + \Omega_2 RECEX_t + \Omega_3 GCF_t + \Omega_4 HCAP_{gt} + \Omega_5 EDUe_{t-1} + \mu_t$---------12

Where; EDUe= Education enrollment, the proxy of human capital development, InCAPEX = Natural Logarithm of Capital Expenditure of the government on education, InRECEX = Natural Logarithm of Recurrent Expenditure of the government on education, GCF = Gross Capital Formation, HTe= Life expectancy proxy of health, HCAP = Direct health and education expenditure, f = functional relationship, t = time-series observations of the variables for the period 1970-2022, Ω_0 = Intercept of relationship in the models, Ω_1, Ω_2, Ω_3, Ω_4 and Ω_5= the coefficients of explanatory variables for model, μ = error or stochastic term (other factors that were not captured by the model) fulfilling the usual classical linear assumptions of the error being independently and identically distributed (*iid*).

It is expected that at the end of this study to either see disaggregated government expenditure proxies influence economic growth; have a positive relationship with human capital development (proxy of education capital), i.e. supporting the Keynesian thought, or otherwise. As a result, Ω1, Ω2, Ω3,Ω4 and Ω5 >0 respectively.

4. Data and Preliminary Analysis

This chapter is designed to deal with the empirical results of the study. Specifically, it, not only presents the trends of the series used for the analysis, but also the results from the ordinary least squares regression analysis. More importantly, the data used for the study including both the pre and post-test results were equally presented in this chapter. As a way of summary, the results thereof are confronted with the study's hypothetical statements for appropriate decisions. In other words, the results obtained from the analyses are used to validate the study hypotheses by either supporting or refuting existing theories or studies' positions. The data used for analysis is contained in Appendix 'B' for your kind perusal and examination.

4.2 Pre-Estimation Tests:

This specifically covers the descriptive statistics, including the time-series normality test result as well as stationarity test result (using both the Augmented Dickey Fuller and Phillip-Peron tests) and cointegration test results etc.

4.2.1 Descriptive Statistics

These statistics are used to describe the core features of the data set to include measures of central tendency (mean, median, and mode); measures of variability (standard deviation, variance); the minimum and maximum values of variables (kurtosis and skewness) providing summary of samples and observations which forms the basis for decision making at the end of the study.

Table 1: Summary of Time-Series Descriptive Statistics Results

	EDU	HEALTH	CAPEX	RECEX	GCF	HCAP
Mean	1.96E+10	116.7892	436.1289	1410.968	4.30E+10	2.52E+09
Median	1.18E+10	134.0941	212.9263	136.7271	4.03E+10	2.17E+09
Maximum	6.62E+10	228.0315	2288.996	8121.640	8.98E+10	8.56E+09
Minimum	2.02E+09	12.72984	4.100100	1.080900	9.57E+09	1.82E+08
Std. Dev.	1.72E+10	66.42061	559.3250	2090.967	2.38E+10	1.94E+09
Skewness	1.224045	-0.037930	1.355836	1.495547	0.068414	1.161013
Kurtosis	3.364989	1.649760	4.188882	4.304318	1.461179	4.304647
Jarque-Bera	13.52905	4.038827	19.35958	23.51408	5.270613	15.66572
Probability	0.001154	0.132733	0.000063	0.000008	0.071697	0.000396
Sum	1.04E+12	6189.829	23114.83	74781.33	2.28E+12	1.34E+11
Sum Sq. Dev.	1.55E+22	229408.2	16267913	2.27E+08	2.95E+22	1.97E+20
Observations	**53**	**53**	**53**	**53**	**53**	**53**

Source: Author's computation, 2023

Table 1 shows that education expenditure has an average of 19 billion and a std. dev. value of 1.7 billion. This means that education expenditure has a wide variation (deviation) as supported by the max. and min. values of 66 billion and 20 billion respectively. With a positive skewness value of 1.224045 and platykurtic in distribution with a value of 3.364989, it implies an increasing but moderate expenditure in education geared towards the development of human capital with obvious occurrences of major fluctuations arising from the inconsistent recurrent and capital budgeting expenditure in education.

Also, health capital as a proxy of human capital development has an average and std. dev. Values of 116.78 billion and 6.642 billion which implies that although there was a marginal increase but not sufficient to command the desired result; hence, with a max and min. value of 28 and 12.78 billion respectively. Furthermore, capital expenditure shows a mean value of 436.129 million and as well as a std. dev. value of 5.593 million. Clearly, this indicates that the capital expenditure by the Nigerian government within the period in review has reduced considerably as maximum and minimum values range between 2288 million and 4.100 million respectively. Similarly, capital expenditure shows a positively moderate skewness value of 1.3558 and a leptokurtic value of 4.1888 that indicated an occurrence of a minor change in inducing human capital development within the period in review.

On the other hand, recurrent expenditure has a mean and std. dev. values of 1410.97 and 20.9096 respectively. This suggests that recurrent expenditure has increased spirally within the research period as further revealed by its max. and min. values of 8121 and 1.08 respectively. With a positively moderately skewed value of 1.4956 and a leptokurtic value of 4.3043, it suggests that there has been the occurrence of moderate addition due to the rise in recurrent expenditure directly directed towards human capital development. Lastly, the health human capital expenditure shows a mean and std. dev. values of 22.5 billion and 1.9 billion respectively; with max and min values being the same at 57.42646 billion and 1.085198 billion respectively.

4.2.2 Stationarity (Unit-Root) Test

The study commences its empirical analysis by first ascertaining the unit roots of the time series to be used for analysis. This is important because most time series exhibit non-stationarity traits in their level form, which often poses a serious problem to econometric analysis and may therefore lead to spurious result if appropriate measures are not taken.

Table 2 Unit-Root Test Result
Result of Unit Root Test

	ADF			PP			Remark
Variables	Level	1st Diff.	C-Value	Level	1st Diff.	C-Value	I(d)
Edu_t	0.2060	-3.9625***	-2.9389	0.5593	-3.8618***	-2.9369	I(1)
$Health_t$	-1.4807	-9.3984***	-2.9389	-2.2762	-9.3762***	-2.9369	I(1)
$Capex_t$	-1.2451	-3.8153	-2.9369	-1.2871	3.7475	-2.9369	I(1)
$Recex_t$	-0.2637	-3.1678	-2.9369	-0.1926	-3.1979	-2.9369	I(1)
GCF_t	-2.7142	-3.8153	-2.9369	-2.6525-	-3.7475	-2.9369	I(1)
$HCap_t$	-2.3628	-3.1678	-2.9389	-1.1635	-3.1979	-2.9369	I(1)

Source: Author's compilation (2023); **P-values at 5% statistical significance**

To guard against spurious results, this study takes the step of checking the properties of the variables with the use of the Augmented Dickey-Fuller (ADF) test developed by Dickey and Fuller (1981) and the Phillip-Perron (PP) test developed by Phillips and Perron (1988). The results are presented in Table 2. With respect to the ADF test on Table 2, all the variables were found to be non-stationary in their level form. The result of the ADF test is supported by the PP test result. However, the PP result showed a superior result when the values are compared. Therefore, this suggests that all the variables are integrated of order one, i.e. they are all I(1s).

4.2.3 Co-integration Test

The study followed this step as some of the variables used in the regression model are non-stationary and stationary, specifically of I(1) processes. The result for the model is summarized in Table 3.

Table 3: Nayaran/ Pesaran et al (2004; 2001) Test Results

Model		F-statistics
$F_{NOS}(edu, health, capex, recex, gcf, hcap)$		21.83359***
	K = 4	
Panel A: Narayan (2004) Critical Values	I(0)	I(1)
1%	3.892	5.173
5%	2.850	3.905
10%	2.402	3.345
Panel B: Pesaran, et al., (2001) Critical Values	I(0)	I(1)
1%	3.29	4.37
5%	2.56	3.49
10%	2.2	3.09

Note: Null hypothesis: No level relationship; *K* = number of regressors; *, ** and *** denote significance at 10%, 5% and 1% level, respectively.
Source: Author's compilation (2023)

The mode for which the cointegration test was conducted was the one with which education and health capital were used as the explained variables and government capital expenditure, government recurrent expenditure, gross capital formation, and direct health human capital as regressors. The result of the co-integration test reported in Table 4.3 is based on the bound approach by Pesaran, et al., (2001). The method uses the F-statistics in testing the existence of long-run relationships. The null hypothesis of the test is that there is no cointegration among the variables.

4a Estimation Output (Model One)/Short Run Dynamics:
Table 4: Estimated Results

Dependent Variable: EDU_t				
Part A: Short/Long Run Results				
Variable	Coefficient	Std. Error	t – Stats	Prob.
$CAPEX_t$	-12.55**	29.5E+09	-2.227	0.0031
$RECEX_t$	6.541**	5.6621	4.102	0.0002
GCF_t	0.32***	0.0505	6.286	0.0000
$HCAP_t$	3.79***	0.6706	5.588	0.0000
C	7.40E+08*	2.95E+09	-2.5052	0.0145

Source; Author's compilation, 2023

4b Estimation Output (Model Two)/Short Run Dynamics:
Table 4b: Estimated Results

Dependent Variable: Health				
Part B: Short/Long Run Results				
Variable	Coefficient	Std. Error	t – Stats	Prob.
$CAPEX_t$	-0.1268*	0.04660	-2.7726	0.0090
$RECEX_t$	0.0296*	0.01318	2.2454	0.0294
GCF_t	7.90E-09	4.18E-10	1.8889	0.0660
$HCAP_t$	9.68E-09	5.62E-09	1.72375	0.0912
C	72.011*	24.420	2.9482	0.0049

Source; Author's compilation, 2023; Key; *, **, *** significant at 10%, 5% and 1% respectively

As can been seen, tables 4a and 4b present results of the two models guiding the study on the disaggregated impact of government expenditures on human capital development proxy by education and health capitals. First, both models performed well, given that their respective coefficients of determinations were close to 100 percent; as such of good fit. They are capable enough to explain what happens to the dependent variables (education and health capital). For instance, in the first model, the coefficient of determination was 83 percent, in other words, the estimated equation or model accounts for variations in the dependent variable by that amount. The value of the f-statistic at 60.26 with its associated probability value of 0.0000 which is less than 1% implies that our overall regression model is statistically significant at 1% level of significance. Therefore, all the explanatory variables jointly explain change occurring on the dependent variable (education capital). More importantly, the estimated coefficients of the explanatory variables showed that they conformed to the expected theoretical expectations with the exception of capital expenditure of the government. For instance, recurrent expenditures, gross capital formation and health human capital direct expenditure were found positively related with the level education capital, proxy of human capital development. It was equally found that all were statistically significant at least at 5% error margin.

The result shows that human capital development appreciates as soon as the government increases her recurrent spending. This result agrees with the strand of economic theory that argues that government spending could boost output level and government spending on social overheads can stimulate human capital development through very many pass-through channels including capital formation etc. The effect of government recurrent spending on education is almost elastic, as human capital is expected to grow by approximately 6.54 percent as government spending on capital items increases by 1 percent.

Interestingly, when they were regressed on health capital, capital budget expenditure not only remained significant but emerged correctly in mathematical sign or theoretical expectation. In other words, the disaggregated expenditures continued to impact on health capital, proxy of human capital development. As government adjusts her expenditure budgeting, a percentage change in both would lead to approximately 13 and 2.03 percent rise in health capital, as other variables remain unchanged. However, the other factors remained non-significant. The finding justifies a stable macroeconomic environment as a critical component for capital formation, development and regeneration. The coefficient of health human capital was positive and significant indicating that it is a key driver of capital formation and development.

The second model result whose lag selection was based on the Alkaike Information Criterion (AIC) has a coefficient of determination of 0.23 and an adjusted R^2 of 0.22. The adjusted R^2 of 0.22 which is below 0.5

indicates the estimated model hasn't got a good fit; hence, can't be used for the benefit of forecast purposes. Lastly, the study noticed that the impact of recurrent and capital expenditures on education and health capitals, after one and two lags emerged obviously statistically significant. Similarly, it was observed that capital formation had contemporaneous impact on health capital growth. This result corroborates the long run effect of recurrent expenditure.

4.3.1 Error Correction Model

The error correction model represents an alternative way of presenting long run equilibrium relationship between variables. It shows the dynamic error analysis of the cointegrated variables. The results of the error correction model are reported in table 4.5a and 4.5b. Here, the model was regressed on the first differences of all variables plus the lagged value of the residuals from the cointegrating equation.

Table 5: OLS Error Correction Regression Result (Model One)

Dependent Variable: D(EDU)
Method: Least Squares
Date: 03/17/23 Time: 11:30
Sample (adjusted): 1971 2022
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.42E+09	2.79E+09	-2.300148	0.0260
D(CAPEX)	-8989055.	5221436.	-1.721568	0.0919
D(RECEX)	6017758.	1458258.	4.126675	0.0002
D(GCF)	0.312641	0.046311	6.750841	0.0000
D(HCAP)	3.154131	0.665910	4.736575	0.0000
RESID01(-1)	-0.482150	0.144817	-3.329373	0.0017

R-squared	0.867362	Mean dependent var	1.98E+10
Adjusted R-squared	0.852944	S.D. dependent var	1.74E+10
S.E. of regression	6.66E+09	Akaike info criterion	48.18419
Sum squared resid	2.04E+21	Schwarz criterion	48.40933
Log likelihood	-1246.789	Hannan-Quinn criter.	48.27050
F-statistic	60.16156	Durbin-Watson stat	1.826866
Prob(F-statistic)	0.000000		

Source: Author's Computation, 2023

The results in table 5 denote the OLS error correction regression. The differenced variables' coefficients represent short run effect of these variables on the dependent variable. The results show that our ECM model has a high coefficient of determination. This can be seen from the R-squared of about 0.87 (87%) percent and the adjusted R-squared of about 0.86 (86%) percent. The R-squared measures the percentage of variations in the dependent variable that was accounted for by variations in the explanatory variables. Thus, it can be argued that our data is well fitted in our model. The value of the F-statistic is 60.16 and its associated probability value is 0.000000 which is less than 1%.

This implies that our overall regression model is statistically significant at 1% level. Thus, all the explanatory variables jointly explain variations in the dependent variable (education capital) a proxy of human capital development. The estimated coefficients of the explanatory variables show that all the explanatory variables with the exception of capital expenditure conform to a priori specification and are all individually statistically significant at the conventional 1% or 5% levels. This implies that all except current capital expenditure impacts human capital development in Nigeria.

Having found cointegration among the variables, then it follows that the coefficient of the error correction term (ECT) should be negative and statistically significant for the disequilibrium to be corrected in subsequent periods and long run equilibrium restored. This condition is met by our model as the coefficient of the one period of the error correction term ECT_{t-1} is negative (-0.482) and it is highly statistically significant at 1 percent level. The negativity of the ECT_{t-1} signals that the system is stable enough and is capable of converging into the long run equilibrium after some shocks/disturbances in the system. The value -0.482 implies that about 48% of the disequilibrium is restored within one year. However, this means that the speed of adjustment is high enough as it will take only 2years and three months on average for long run equilibrium to be fully restored after any major shocks coming from the fiscal policy of the government in Nigeria.

Table 6: OLS Error Correction Regression Result (Model Two)
Dependent Variable: D(HEALTH)
Method: Least Squares
Date: 03/17/23 Time: 11:43
Sample (adjusted): 1971 2022
Included observations: 52 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	61.49461	19.83341	3.100556	0.0033
D(CAPEX)	-0.063941	0.038502	-1.660719	0.1036
D(RECEX)	0.011771	0.010912	1.078733	0.2863
D(GCF)	8.40E-10	3.31E-10	2.537243	0.0146
D(HCAP)	1.25E-08	4.52E-09	2.754994	0.0084
RESID02(-1)	-0.671653	0.120339	-5.581329	0.0000

R-squared	0.539199	Mean dependent var	117.7754
Adjusted R-squared	0.489112	S.D. dependent var	66.67571
S.E. of regression	47.65741	Akaike info criterion	10.67412
Sum squared resid	104476.5	Schwarz criterion	10.89926
Log likelihood	-271.5271	Hannan-Quinn criter.	10.76043
F-statistic	10.76524	Durbin-Watson stat	2.093314
Prob(F-statistic)	0.000001		

Source; author's compilation, 2023

The results in table 6 denote the OLS error correction regression. The differenced variables' coefficients represent short run effect of these variables on the dependent variable. The results show that our ECM model has a moderate value of coefficient of determination. This can be seen from the R-squared of about 0.54 (54%) percent and the adjusted R-squared of about 0.49 (49%) percent. The R-squared measures the percentage of variations in the dependent variable that was accounted for by variations in the explanatory variables. Thus, it can be argued that our data is well fitted in our model. The value of the F-statistic is 10.76 and its associated probability value is 0.000001 which is less than 1%.

This implies that our overall regression model is statistically significant at 1% level. Although, it was found that only gross capital formation and health human capital expenditure were significant when regressed on health capital at difference operator. Thus, all the explanatory variables jointly explain variations in the dependent variable (health capital) a proxy of human capital development. The estimated coefficients of the explanatory variables show that only two of the explanatory variables were significant, however, all conform to a priori expectation at the conventional 1% or 5% levels. This implies that GCF and HCAP impact health capital, proxy of human capital development in Nigeria.

Having found cointegration among the variables, then it follows that the coefficient of the error correction term (ECT) should be negative and statistically significant for the disequilibrium to be corrected in subsequent period and long run equilibrium restored. This condition is met by our model as the coefficient of the one period of the error correction term ECT_{t-1} is negative (-0.67) and it is highly statistically significant at 1 percent level. The negativity of the ECT_{t-1} signals that the system is stable enough and is capable of converging into the long run equilibrium after some shocks/disturbances in the system. The value -0.67 implies that about 67% of the disequilibrium is restored within one year. However, this means that the speed of adjustment is high enough as it will take only a years and some months on average for long run equilibrium to be fully restored after any major shocks coming from the fiscal policy of the government in Nigeria.

Post Estimation Test

Table 7: Diagnostic Results

Tests	CLRM Problem	χ^2 Value	χ^2 Prob.	Decision
Breusch-Godfrey LM	Serial Correlation	1.4159	0.7018	Serial independence
Breusch-Pagan-Godfrey	Heteroscedasticity	7.6308	0.8668	Constant Variance
Jarque-Bera	Normality	3.4309	0.1798	Normal residuals
Ramsey RESET	Model Specification	0.1647	0.6885	No misspecification
CUSUM	Stability	-	-	Stable Model
CUSUM of Squares	Stability	-	-	Stable Model

Source: Author's compilation (2023)

The survey of table 7 indicates that both models' error corrections do not suffer from the problem of serial dependency. The Breusch-Godfrey LM serial correlation reported a chi-square value of 1.4159 with insignificant probability value of 0.5648. The study therefore failed to reject the null hypothesis which implies that the model is free from serial correlation. The estimated model passes the normality test which was based on Jarque-Bera test. By implication, the errors of the education and health capital models are normally distributed.

The linearity test was based on the RESET test, and this was used to detect there is misspecification bias in how the model was set up. The Ramsey RESET reported F-statistics of 0.1647 with insignificant p-value of 0.6885, implying that at 5% level, the study failed to reject the null hypothesis, indicating that the functional form of disaggregated government expenditure on human capital development is correct. The Ramsey RESET test shows the disaggregated government expenditure on human capital development model is linear devoid of specification bias. The conclusion was reached following the probability value of the test statistics which is higher than the theoretical value of 0.05. Where this is obtainable, the null hypothesis cannot be rejected.

In similar fashion, the variance of the errors does not change over time and is homoscedastic. The heteroscedasticity test reported a chi-squared statistics of 7.6308 and insignificant probability value of 0.8668. The study, therefore, failed to reject the null hypothesis which implies that the variances of the model are homoscedastic. The study is within empirical jurisdiction to conclude that the estimates of the disaggregated government expenditure on human capital development are unbiased, consistent, and efficient as the Gauss-Markov theorem is satisfied. The test of structural stability of the regression coefficient was evaluated using the cumulative sum (CUSUM) and CUSUM of Squares. Figures 4 and 5 show the equation is stable as the test statistics of the CUSUM and CUSUM of Squares are within the 5 percent bound level.

Figure 4: CUSUM Plot

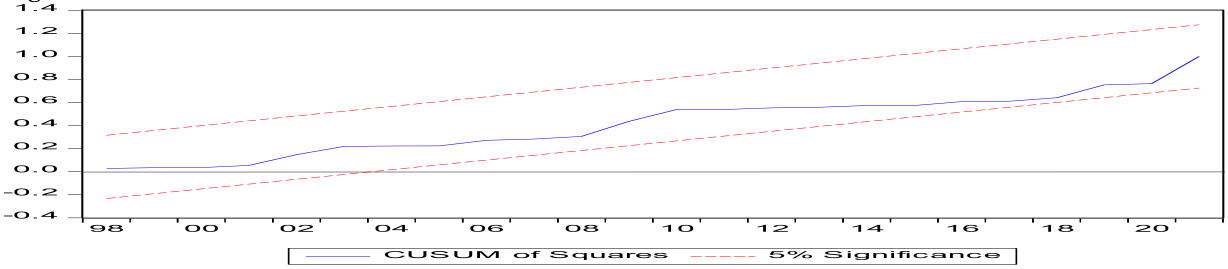


Figure 5: CUSUM of Squares Plot

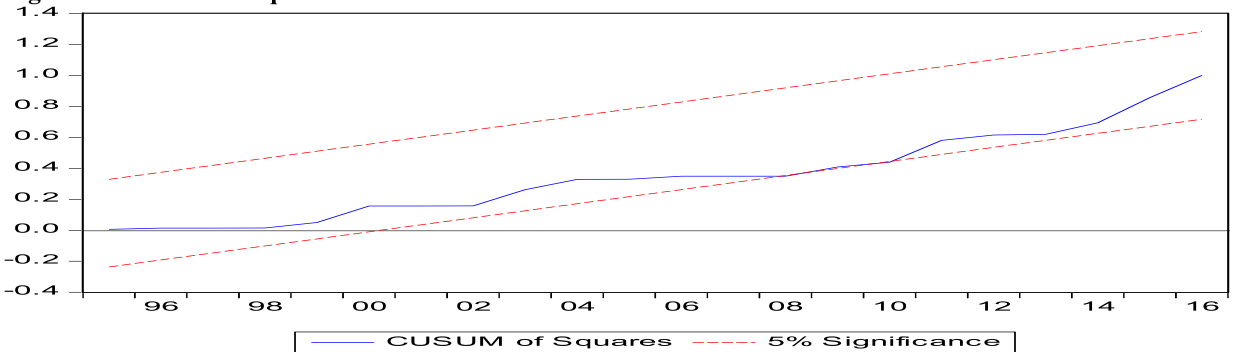


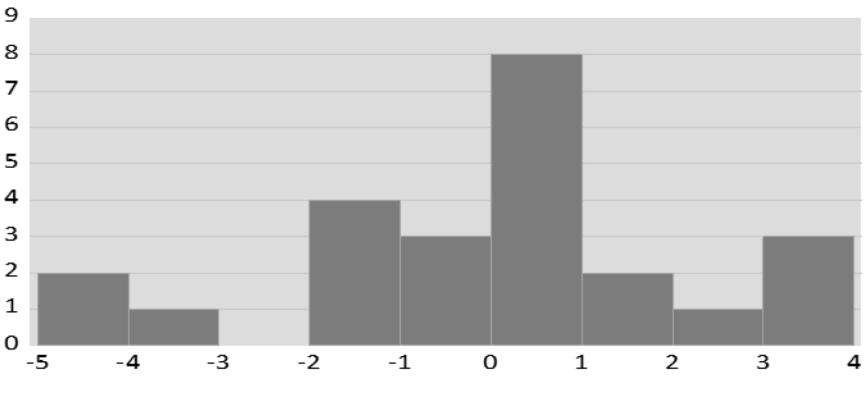
Figure 10: Cumulative Sum of Squares (CUSUMSQ)

Source: Author's computation (2023)

A graphical illustration of CUSUM and CUSUMSQ are within the boundaries, and hence these statistics prove the stability of the long-run coefficients of the repressors that have an effect on disaggregated government expenditure and human capital development in Nigeria. The models therefore appear to be stable and properly specified given that none of the two tests statistics go outside the bounds of the 5 percent level of significance.

4.3.2 Histogram Normality Test

From the out-put of the Jarque-Bera normality test, the mean values of the variable are lesser than the median value; as expected but its standard deviation is generally high which captures the volatility of the data used in the process of research while the coefficient of the symmetry (skewness) of the entire variable is negatively skewed to the left towards normality. Meanwhile, the kurtosis of the entire variable is less than 3 which shows that all the variables are all platykurtic in nature. Judging by 5% level of significant, all the variables used for the research, are normally distributed courtesy the fact that the Jarque-Bera probability value is greater than 5% level of significance.



Source: Author's computation, 2023.

4.4 Test of Hypotheses

H_{01}: There is no there is causal relationship between disaggregated public expenditure and human capital development in Nigeria.

Wagner's hypothesis was deeply rooted in his argument of government expenditure increasing directly with the level of industrial output, which resulted in his prescription for "social consideration" while carrying out industrial activities. What could be scrape together from the expressed argument is the existence, mathematically, of a functional association between growth rates (measuring industrial output or activities) and the spate of increase in the functions or activities performed by government (best captured by the amount expended by it at various layers of government). The hypothesis noted that changes in the expenditure categories will encompass expenditure on law and order, education, health, transport among others to which he argued in consonance with Musgrave are responsive to income growth and human capital development. Put differently, as real income increases, demand for these goods will increase faster, thus resulting in a rise in government spending as development evolves (Inimino, Tubotamuno & Shaibu, 2017). Empirically therefore, the study found, in the two models, that education and health capital are significantly related with the disaggregated government expenditure. The study concludes that there is a significant effect of government expenditure on human capital development, as such, we therefore reject H_{01}.

5. Discussions of Result

The impact of government expenditure on human capital development as drawn from the long run result of table 4.5a and b show that government recurrent expenditure stimulated growth and development of human capital proxied by education and health capitals. The effect of government recurrent expenditure is positive as an increase in it is expected to boost human capital development by approximately 0.3305 percent. Based on the probability approach and probability value of government recurrent expenditure, which is 0.0141, the study rejected the null hypothesis and accepts the alternative hypothesis, implying that, there is a significant relationship between government recurrent expenditure and human capital development. In terms of policy, the implication of this finding is that, an improved human capital growth and development can be achieved through increase in government recurrent and capital spending. The evidence of positive relationship between government recurrent/capital expenditure and human capital development is in line with the theoretical expectation of the study and an increase in government disaggregated expenditure can enhance development of human capital growth in Nigeria. The result of this study is in line with those of Amusa and Oyinlola (2019) who report that the impact of government recurrent expenditure on growth is positive and significant. The findings of this study also do conform to the results of Ubesie, Ananwude, Cyracus and Emmanuel (2020) who found the effect of government capital expenditure to be significant and that of Emmanuel and Oladiran (2015) who reported that increasing recurrent expenditure spur growth of the developing countries.

6. Conclusion and Recommendations

The study examined the disaggregated impact of Government expenditure on human capital development in Nigeria from 1970 to 2022. Human capital development is no doubt an important macroeconomic variable used in determining how much a country has developed including defining its international competitiveness. The study, as we conclude, found both capital and recurrent expenditures impact health human capital development in Nigeria in the short and long run respectively. Similarly, recurrent expenditure was found to have impacted education capital (human capital development) in both the short and long run; although, capital expenditure of the government is yet to impact education capital in the long run, meaning that there was no traceable

convergence while the study lasted. Therefore, human capital development appreciates as soon as the government increases her recurrent spending. This result agrees with the strand of economic theory that argues that government spending could boost output level and that government spending on social overheads can stimulate human capital development through very many pass-through channels including capital formation etc.

Consequently, with the suboptimal growth level and vulnerability of the Nigerian economy to swings in income generations, the administration in Nigeria, including the successive ones should consider disaggregating her expenditures to help check the susceptibility of the growth and development of human capital Nigerian. The path to improving human capital development, aside from direct education and health capital, has been through the deliberate provision of business-supportive infrastructures via government capital spending. The school of thought pushing for this view argued that government spending on social overhead capital would translate and boost direct productive activities clearly viewed in the famous balanced and unbalanced growth models. This is more specifically important since gross capital formation (GCF) and direct health capital expenditure (HCAP) were seen both significant in both the short and long run in Nigeria. Lastly, the study at this time is particularly considered vital to Nigeria in several ways since the country is widely seen as having a high number of poor people and one of the least developed countries of the world even as the world prepares to embrace the fourth industrial revolution strategy (4IRs). As a result, a good knowledge of the impact of disaggregated government expenditure on human capital development will not only help encourage national socio-economic policies but also inform (redirect) strategies for enhanced (inclusive) growth.

Based on the results obtained in this study, it is recommended that:

i. Given that current level of recurrent expenditure is seen as triggering obvious shock in the development of human capital (education capital), particularly in the short run, Nigeria should therefore drive growth processes with deliberate policies aimed at encouraging appropriate mix of the two expenditure heads to drive needed human capital development for overall economic growth. This no doubt, if not well managed, will further impede any form of investment in capital formations in the country.
ii. Interestingly, the result shows that recurrent expenditure impacts (education capital) human capital development in both the short and long run. In other words, human capital development appreciates as soon as the government increases its recurrent spending. In furtherance, the result showed an inelastic impact of government capital expenditure on education capital but for recurrent expenditure. It presupposes that the current capital expenditure by the Nigerian government isn't enough, as needed to complement recurrent expenditure for adequate growth in human capital development. It is therefore recommended that the government should enhance its expenditure in both areas.

Conflict of interest

The authors have declared no conflict of interest that could possibly have influenced the outcome of this research. The research is purely academic and is intended to spark policy reforms that would impact the economy.

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Appendix

Variable series table use for the study between the periods 1970-2023

Year	Edu (total_Enrol)	Health (total_year)	Capex(₦'m)	Recex (₦'m)	GCF (LCU'm)	Hcap (₦'m)
1970	9680455589	43.647	8.152684	1.5104	30830262525	182427000
1971	11607626444	44.104	8.218357	1.8184	36985102714	215739000
1972	11819392125	44.547	9.843124	2.4212	46128794699	281816000
1973	14728020161	44.963	8.070036	2.9786	65791757184	300324000
1974	9680455589	45.333	8.896912	5.2388	58555598719	332451000
1975	11607626444	45.637	8.451011	4.806	67059942800	361553000
1976	11819392125	45.867	4.598926	7.0649	64358230214	401834000
1977	14728020161	46.023	7.891292	1.0809	63813637484	447931000
1978	18984692892	46.106	8.329876	1.1986	67133043641	485394000
1979	14873906744	46.127	11.16018	2.185	68717263577	516049000
1980	11607626444	46.101	6.4765	1.4392	76750091021	554062000
1981	11819392125	46.048	6.567	2.6315	89838197381	599306000

Year	Edu (total_Enrol)	Health (total_year)	Capex(₦'m)	Recex (₦'m)	GCF (LCU'm)	Hcap (₦'m)
1982	14728020161	45.99	6.4172	2.4276	76611449511	710699000
1983	18984692892	45.939	4.8857	4.7508	62181425211	860391000
1984	14873906744	45.9	4.1001	5.8275	17314084579	935747000
1985	11435515388	45.875	5.4647	7.5764	11173046234	1391227000
1986	8855521101	45.857	8.5268	7.6969	9574774928	2170416000
1987	7447072056	45.845	6.3725	15.6462	12970297201	2971595000
1988	3137604914	45.843	8.3401	19.4094	18200437932	2758948000
1989	4081635352	45.854	15.0341	25.9942	18085082599	2936343000
1990	4354892035	45.88	24.0486	36.2196	17648102475	3320627046
1991	3693411915	45.923	28.3409	38.2435	20422791180	3356176435
1992	4932440120	45.994	39.7633	53.0341	18210344351	3253953000
1993	7813163333	46.103	54.5018	136.7271	13433797492	3304599000
1994	7180671769	46.267	70.9183	89.9749	15842822426	3467089000
1995	6661691668	46.51	121.1383	127.6298	17241934850	3488728000
1996	6511456628	46.835	212.9263	124.2913	16381595366	3109657000
1997	2558328251	47.242	269.6517	158.5635	15911992613	2783158000
1998	2017343885	47.72	309.0156	178.0978	18608675555	2841338000
1999	2898202022	48.252	498.0276	449.6624	14526281408	2613035000
2000	2624690795	48.812	239.4509	461.6	17476126876	2268463000
2001	8587971812	49.373	438.6965	579.3	26225949426	1958286000
2002	8717239390	49.913	321.3781	696.8	19936202795	1951004000
2003	11096414002	50.422	241.6883	984.3	17857669592	1987878000
2004	10875792251	50.896	351.3	1110.8	28447402089	1993917000
2005	16151796883	51.346	519.5	1321.3	40310900129	1858694000
2006	15008992496	51.786	552.4	1390.2	40020688227	2074407000
2007	26003095375	52.228	759.323	1589.27	53926131587	2309365000
2008	21987687010	52.672	960.8901	2117.362	63813637484	2454540000
2009	28296084705	53.112	1152.797	2127.972	58762782106	2852213000
2010	39838710029	53.541	883.8745	3109.379	60737133434	3704868000
2011	30778949362	53.95	918.5489	3314.513	65484666043	4207748000
2012	49520313777	53.042	874.7	3325.157	73988751466	4686028000
2013	66223188423	53.506	1108.386	3689.061	74210721042	5278061000
2014	56933435483	53.967	783.1224	3426.898	69452265183	5778820000
2015	54851231400	54.415	818.365	3831.947	68181599979	6225860000
2016	60971534198	54.843	653.609	4160.11	30830262525	6640044000
2017	53859924349	54.97	1242.296	4779.989	36985102714	7912964000
2018	35211532981	55.34	1682.099	5675.201	46128794699	8556968000
2019	32615573770	55.87	2288.996	6997.194	65791757184	1958286000
2020	37663684923	57.98	1614.889	8121.64	58555598719	1951004000
2021	38469503668	58.34	1242.296	4779.989	67059942800	1987878000
2022	45702418117	58.45	1682.099	5675.201	64358230214	1993917000