International Digital Organization for Scientific Research ISSN: 2579-082X
IDOSR JOURNAL OF BANKING, ECONOMICS AND SOCIAL SCIENCES 4(1): 70-89, 2019.

Agriculture Productivity and Agricultural Value Chain Upgrade: The Role of Governance

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ABSTRACT

Agriculture productivity and efficient agriculture value chains are basic to economic growth.Agriculture productivity boosts agriculture value chain upgrade and both can be enhanced by government investments, policies, and governance institutions.This study empirically examinedthe relationships between government investment in agriculture, governance institutions and agriculture productivity on one hand and agriculture value chain upgrade on the other. The study adopted time series datafrom Nigeria for the period 1980 to 2017. Data sources includedCBN, World Bank, The GlobalEconomy.com, etc. Quantitative technique was employed in a multivariate study. Restricted Error Correction Model was adopted. The ADF and PP unit root tests proofed stationarity of the study's variables and Johansen Test forco-integrationproofed long-run relationship within the study's variables. VECM was employed for further analysis as well as impulse response and variance decomposition. The results denoted that in the short-run period, government investment, human capital and government effectiveness positively and significantly influenced agricultural productivity, agricultural value chain upgrade impact was also positive but insignificant. It was also shown that technology, corruption and exchange rate negatively influenced agricultural productivity. The impulse response and variance decomposition tests indicated that agricultural value chain upgrade, exchange rate, governance, technology, government investment and human capital can serve as major driving tools for agricultural productivity in the long run. The study recommends that to enhance agricultural productivity, policies should be directed at improving agricultural value chain upgrade, good governance, government investment in agriculture, technology and human capacity building, while corruption should be eliminated and exchange rate policy reviewed and made more friendly to agribusiness.

Keywords: Agriculture, productivity, value, governance, Akwa Ibom, Nigeria.

INTRODUCTION

Agricultural development is an aspect of economic development; it suggests improvements in the principles and practice of agriculture and subsequent improvements in materials, resources and wellbeing of farmers. Agricultural development results in maximum output increase per capital income and enhanced standard of living [1]; [2]; [3]. Investments in agriculture will enhance agriculture productivity and empower a more effective means of reducing hunger and poverty. Such investments therefore increase incomes and create social and economic ripple effects that engender economically strong and stable communities [4]; [5]. Agriculture productivity is a measure of quantum of agricultural output that can be produced from a given volume of inputs [6]. Increased productivity translates to more food and agriculture products from few resources canstabilize food prices, enhance livelihood of citizens and provide a direct pathway out of poverty. It can also broaden economic development as resources may easily flow from agric sector to other parts of an economy. Further, it enhances international competitiveness and positive trade balances [7]

As agriculture productivity increases, agribusiness will expand and this is a key aspect of agriculture value chain which creates a linkage between the farm subsectors and inputs on one hand and with the consumers on the other (Asian Development Bank, 2012). [8] asserts that value chain encompassesall the activities necessary to promote agriculture products and services right from inception to intermediary stages of production through to when the products or services are ready for delivery to consumers and then to final discard after use. As proposed by [9], raising agriculture productivity and boostingagriculture value chains efficiency are essentialfor the growth of sub Saharan African economies as well as the growth of individual citizensincomes. Thus, as noted by African Development Bank Group (2013), systems of African agribusinesses, from production to when agric products reaches the market, should be restructured, well funded and upgraded to make it more productive and attractive to consumersas well ascompete betteringlobal agricultural market place. This can be done through agriculture value chain upgrade. However, value chain is entrenched within the local economic, social and institutional dynamics of a society. So, value chain upgrade which is a move to higher value activities or improved value creation relies on better and different combinations of government investments, governance institutions, technologies, human capital, policies and corporate strategies [10]. Hence, while agriculture productivity can boost agriculture value chain upgrade, government investments, policies and governance institutions, among others,can also promote agriculture productivity,value chain upgradeand then agriculture development.

As noted in [11], since agricultural policies can drive sustainable agricultural development, Nigeria has evolved such policies over the years and the first national policy was adopted in 1988. From 2007, an innovative framework to transforming the agricultural sector was launched as Agricultural Transformation Agenda (ATA) with the vision of treating agriculture not just as a development project but more as a business, centered more on a dynamic, profit-driven enterprise connecting farmers to a value chain of processors, distributors and retailers [12]; [13]. Building on ATA, the present government in 2016 launched the Agriculture Promotion Policy (APP). This new policy, apart from increased productivity, isfocused on using agriculture to achieve long term economic prosperity and security; ensuring food and social security; enterprise development and successive linkages between value chain stages in agriculture; among others(FMARD, 2016).Across nations of the world, governments have played pivotal roles in agriculture development. Thus, the contributions and importance of the public sector in agricultural development cannot be wished away. Agricultural policies implementations are moderated by macroeconomic policies of a country and most support for agriculture is anchored on public expenditure, institution supports and policies(Eze, Lemchi, Ugochukwu, [14].

In developing countries, public expenditure is the main instrument used by government to promote agricultural development which is an important element of sustainable economic growth [15]. Public expenditure or government investment in agriculture is the budgetary provisions made for developing the agriculture sector in particular and the economy in general. Such investments especially in the form of food security, is also important for human existence [16]. However, [17] notes that despite the relative increase in government expenditure on Nigeria's agriculture sector for many years now, the sector is still embroiled inlow productivity. Food and Agriculture Organization (FAO) report thatNigeria's capital budget allocation between 1970 and 1980 to the agriculture sector averaged just 4.74%. Between 1981 to 2000 and 2001 to 2007 it rose to 7% and 10% respectively. This seems to have increased but is still far below the FAO recommended 25%.

Apart from government expenditure, the public sector also controls the governance system. United Nations (2012) refer to governance as those activities involved in exerting political and administrative authority necessary foreffective control ofa country.This includes the fundamental processes and institutions through which individuals and the public use to organize their interests, exert their legal rights, perform their duties and settle their differences. Quoting Koffi Annan of the United Nations, [18] recognizes good

governance as a veritable tool foreradicating poverty and promoting development. Governance through institutions, rules, political processes, policies formulations and implementations matter for economic, social and agricultural development. According to World Bank (2003), governance measures include: government effectiveness, rule of law and corruption. While good governance enhances growth through improved business environment, good business leads to investments and then to faster growth. However, weak governance in agriculture canresult from policy biases, underinvestment, lack of macroeconomic policies and absence of strong state and public sector organizations interventions [19].

Statement of the problem

[20] alerts that agriculture in less developed countries,including Nigeria is largely underdeveloped in production for local as well as international markets. Surprisingly, though literatures abound as to causes of agricultural problems in Nigeria, solutions are yet to be concretely established for such problems and so they keep piling up and recurring. Agriculture Ministry in Nigeria agrees that problems in the agriculture sector dates back to the early 1970. Probably, these problems may be caused by poor investments on the part of government or weak/ineffective governance institutions. Though studies have shown that positive relationship exists between growth and cost-effective government investments in agriculture, the rate of government investment on agriculture in most developing countries, Nigeria inclusive, is very poor, and this reflects in the low agricultural outputs of these countries [21] [22], [23]. [24] while arguing for public investments as a means to enhance increased agricultural productivity found that such public investments has led to a decrease in agricultural productivity in Ghana, a situation akin to Nigeria as shown in [25]. [26] also alerts that there are institutional constraints working against agricultural sector development, and these problems border on government effectiveness in policy formulation/implementation, corruption, etc. Agricultural productivity is the bedrock of agriculture value chain upgrade and factors impeding productivity may also have direct/indirect negative impacts on value chain. As opined in [27], to promote value chain, countries must improve and upgrade agric productivity. However, [28] observe that barriers facing developing nation's value chain upgrade include: environments that do notenhance good institutions, lack of infrastructural supports,dearth of resources and coordinating policies. [29] warn that low-value products/services and insignificant share in global trade can be avoided by African countries if they canincrease productivity and upgrade efficiency of their agriculture value chain. [30] posited that institutional qualities in Nigeria are very weak and ineffective to drive productive activities. [31] report that agric productivity short fall is created by bogus bureaucracy, corruption, overlapping,ill outlined responsibilities between the tiers of government, not well defined policies and lack of political will by the government to enforce laws beneficial to agriculture development. All these may also affect agriculture productivity and agriculture value chain upgrade in Nigeria. As noted in [32], the public sector with its established institutional supports, legislation and policies remains a major force to fast track development of agriculture, as such, where they fail agricultural development faces the consequences of such failure.

This study was therefore undertaken to examine the relationship between government investment in agriculture, governance institution and agriculture productivity, onone hand,and with agriculture value chain upgrade,on the otherhand,in Nigeria.

Research questions

(i) Is there significant impact of government investment in agricultureand governance institution on agriculture productivity in Nigeria?

(ii) Is there significant impact of government investment in agriculture and governance institution on agriculture value chain upgrade in Nigeria?

LITERATURE REVIEW

Theoretical literature

Agriculture productivity is a measure of the quantum of agricultural output produced from a given amount of input or sets of inputs. Factors that influence agricultural productivity include land, labour, chemical, physical and human capital, research, technology, public/private investments, policy formulation/implementation, etc. [33] [34]. As noted in [35], there are solid theoretical basis to agree that growth in agriculture productivity play key roles in economic growth of a country, studies such as [36], [37], [38], [39] are few of the many works cited to support this view. This gives reasons for linking agricultural productivity theories to economic growth theories. Some of such theories are discussed below.

The New Growth Theory: this theory relies on the works of many authors among who is Robert Lucas Jnr and it emphasizes the relevance of technological and institutional modifications alongside human capital formation in economic growth process of an economy. [40] adopted a dynamic optimization structure that incorporates individual preferences with interest on generating endogenous growth along a steady-state equilibrium path of aggregate or single sector models. As noted in [41], agriculture, by employing non-reproducible inputs that are subject to diminishing returns fits uneasily into such models. To help analyze the invention and diffusion of new agriculture technologies, institutions as well as the linkages between agriculture and non agriculture sector, the induced innovation hypothesis and threshold model are adopted. The induced innovation hypothesis is associated with [42], [43], [44], etc. This hypothesis is a leading model that can be used to explain the creation of new technologies and holds on to the dynamics of long run factor substitution. It treats technology and institutions as reactions generated within the forces of factor supply and product demand [45]. The threshold model is a standard tool that can be used to analyze timing and extent of technological diffusion. It concentrates on short run cost calculations and is associated with the works of [46], [47], etc.

Upgrading is an important concept in value chain and is defined in terms of organizations,nations or regions migrating to greater value activities in global value chain (GVC) to enhance the benefits from participating in global production. This study will borrow from [12] framework for value chain analysis who considers value chain in terms of production networks where business playersutilize competitive resources and work within institutional space.GVC analysis takes its roots from commodity chain approach of [17]. It examines how multinational firms, the "lead firms", and other players in international value chainsrelate. The key concepts in its analysis are "power relationships and information asymmetry", so, it focuses "on governance and upgrading opportunities in developing value chains" [2], [3], [4], [5]. GVCs are usually connected with long-term relationships and reinforced by foreign direct investments (FDI). Value chain is built on the premise thatarrayof horizontally and vertically allied firms collaboratively aim at or work towards supplying services/products to a market. It is characterized by its: network structure – drawing from industrial organizations and network theories; value added – drawing from organizational, transaction costs and value chain theories; and governance form – drawing from transaction costs, value chain and network theories [20].

Different schools of thought have different opinions as to the effects of government expenditure on economic activity, agricultural activity inclusive. Among the guiding theories on public expenditure is the Musgrave Theory,this theory has its roots from Musgrave (1969) who argued that what matters most in government spending is its effectiveness. Where productive category of government spending is ineffective, it will negatively impact growth. Musgrave posited that when per capita income of a country is low, public services' demand will also be low; this is because such incomes will be employed to cater for primary needs.However, where per capita income rises above low levels, public sector services'demand will start to rise thereby encouraging government to spend more on public services such as agriculture, etc. On the other hand, when income level is high, which is usual of advanced economies,the public sector growth rate will begin to fall as more basic services and goods are satisfied.

There are growing theoretical literatures that give tribute to institutions as fundamental cause of productivity. For instance, [32] argues that inability of societies to develop effective institutions lead to stagnation and underdevelopment. Agreeing to this, [29] asserts that institutions are veritable tools to achieve economic development. The Institutionalist lay much emphasize on the importance of institutions in leading to long-term growth [32], [33]; [34]. The basic theory behind this view is that good and stronginstitutions are favorable and at the same timepromote investments in technology, human capital, physical capital, innovations, and effective allocation of resource via the markets.So,institution enhances productivity growth and higher income levels [18].

Empirical literature

[7] study on agricultural labour productivity used current theories of economic growth and data sets to find some existential regularity between labour productivity growth in agriculture, investments, education and environmental factors for 44 economies from 1980 to 1993. The study found that in an economy where investment in agriculture and rate of educated people are high, agricultural labour productivity will grow faster. The study showed that geographical factors and free trade can influence growth. In a study of agricultural productivity and economic growth, [11] asserts that agriculture forms a major part of economic activity in developing world as 25% of value added in such economies emanate from this sector. Thus, changes affecting agriculture have large aggregate effects on such countries. As witnessed in developing countries, Nigeria inclusive, agriculture productivity is very low compared to other sectors of such countries and low productivity retards growth.

[27] takes value chain to be a production network where businesses and their playersutilize competitive resources and work within an institutional domain. He asserts that with global integration, ever growing international markets and burgeoning middle and high income strata in many developing economies, opportunities are opening for producers in developing nations to participatein the wide emerging national and international markets.This implies that,developing nations' producers should effectively and efficiently control their production, trade and allocation processes if they desire to compete favorably in the international market with value added products. [41] Observe that though many exporters in Africa are making waves in selling non value added products in emerging markets, without considerable advancement in their business environment, competitive and value added exports products, they risk being enmeshed in producing low quality, less value added products that will strife hard to win a significantly improved part of global exchange system. In a study bordering on value added and productivity gap in less developed economies, [19] noted that in such economies, value added per worker is four times greater in non- agriculture sector than agric sector. This tends to create agricultural productivity gap which suggests misallocation of labour across sectors in developing world.

[24] examined how agriculture sector and economic growth are impacted by government expenditure in Pakistan between 1983 and 2011. The study used data from Statistical Year Books and Economic Survey of Pakistan. ADF tests, Johansen co-integration tests and OLS were adopted. The results indicate that long-run relationship exists between government expenditure and agriculture output. Also, it was found that agriculture output and government expenditure have significant impact on Pakistani's economic growth. In a similar study, [12] investigated the public investment and agricultural productivity nexusin Ghana from 1961 to 2013. The study adopted annual time series data and employed the Johansen tests, vector error correlation model and ordinary least square regression tests. It was found that public investment negatively influences agricultural productivity instead of the expected positive influence.

For Nigeria, [11] examined the role agriculture plays in the development of the country between 1981 and 2012. The study took an analytical and quantitative dimension and adopted the Solow growth model. The restricted error correction model for a multivariate study was used. The study showed that agriculture plays significant role in Nigeria's economic development. However, because the sector has suffered

neglect by successive governments, its contribution to the country's GPD has dwindled since the 1990s. [18] examined the impact of agricultural issues concerned with formulation, implementation and achievement of agriculture policies and programmes. The study used both primary and secondary data sources. Their findings indicated that agricultural policies in Nigeria were made based on inadequate data and there are implementation problems that negatively affect intended results. They argue that agricultural policies have not been very effective for several years and this has resulted tofood security problems, hunger, low agriculture earnings, etc. In a related study, [14] blame inconsistency in government policies, degraded environment and unsustainable agricultural production for possible causes of shortfall in food supply.

[8] undertook a study on the effects of government spending on Nigeria's agricultural sector output by employing time series data generated from CBN and NBS. The study adopted the OLS technique of multiple regression, Johansen co-integration tests and ECM model. The study showed that government spending on agriculture positively and significantly impacts agric output in the country though private investments through bank loans did not significantly impact agriculture output.

[22] examined the impact of system of governance institutions and human capacity building on industrial growth of Nigeria. The study's period was between 1986 and 2016 and time series data was generated from World Bank, CBN, etc.The studyemployed Granger causality and ECM technique for data analysis.Findings showed that while some governance institutions indicators significantly and positively impacted industrial growth, others did not and that human capacity building insignificantly impacted industrial growth.In a related study, [studied how institutional support and macroeconomic policiesimpact agriculture industrial growth in Nigeria from 1970 to 2008. They used data from CBN and Fully Modified OLS method of analysis. The study showed that institutional reforms have significantly and positively promoted innovations in agricultural outputs for the time period under consideration. Hence, they agree that institutions matter for development even in agricultural sector.

From the literatures reviewed above, there is yet a common ground both theoretically and empirically as to the consequences of government investment and governance institutions on agricultural productivity and agricultural value change upgrade. This thus calls for more pragmatic research in this area. Also, for Nigeria few studies exist to proof empirically the influence of government investment and governance institutions on both agricultural productivity and value chain upgrade, hence this study was undertaken to fill this gap.

METHODOLOGY

Description of Study Area

This study was undertaken for Nigeria, a country with a vast agricultural space and an estimated population of 182 million people as at May 2017 (NPC, 2017). The country is endowed with 98,311 million hectares of land, 12 million hectares of freshwaters and about 960 kilometres of coastlines. 75.30% of the available land in the country is regarded as arable, 10% is under rain forest reserves and 14.70% is for permanent pastures, residential areasand areas that cannot be cultivated [9]; [10]. However, only 40% of the cultivable land is actually cultivated. Over 90% of agricultural production is rain fed with small holding subsistence producers accounting for about 80% of all farm holdings [12]; [13]. The country enjoys a highly diversified agro-ecological condition suitable for a wide array of agricultural production and businesses that can enhance value added upgrade.

Sources and Description of Data

This study uses time series data on agriculture productivity, agriculture value chain upgrade, government effectiveness, government expenditure on agriculture, human capital, foreign direct investment, exchange rate and corruption from the period 1980 to 2017. The mean annual time series data of the selected variables were adopted for the study. Agriculture total factor productivitywas used as proxy for agriculture productivity. As shown in [41], agriculture total factor productivity index measures technological advancement due from development of scientific agriculture research, enhanced expansion services, human capital development, etc. Data was sourced from The Conference Board Total

Economy Data Base (Adjusted version, 2017); Proxy for Agriculture value chain upgrade (AVC) was agricultural raw materials exports. As shown in [43], one prominent measure of AVC upgrade is increased exports. Data from World Bank Development Indicators (2018); Government effectiveness, a governance institution is measured in government effectiveness index. It measuresindependence and quality of public and civil services, classes of policy formulation, rate of policy implementation and level of government commitment to their policies. Data from The Global Economy.com (2017); Proxy for government investment in agriculture is government expenditure on agriculture. As shown in [30], government expenditure on agriculture takes care of research and development, infrastructure development and extension services and these are important components that enhance both agricultural productivity and AVC.Data sourced from CBN Statistical Bulletin of various years; Foreign Direct Investment net inflows was adopted as proxy for Technology, data was generated from World Bank Development Indicators (2018); Human capital was measured in terms of enrolments in secondary schools in Nigeria, data was generated from World Bank Development Indicators (2018). Exchange rate is a prominent factor of export which measures agriculture value added upgrade.Data generated from average official exchange rate of Naira to US$ from CBN statistical bulletin (2017); and Corruption which is a measure of governance institutions was measured in corruption perception index of Transparency International

Analytical Framework

Quantitative technique was employed in a multivariate study. Restricted error correction model was adopted. Unit root tests were conducted on the variables. Johansen test forco-integration was used to determine the existence of long term relationship among the variables and with existence of a long term relationship, restricted VAR i.e. vector error correction model wasadopted for further analysis. Wald test was adopted for long and short terminfluences of the variables while VEC Granger causality test was employed to ascertain causal relationship between the variables and direction of such causality. Analyses of impulse response function and variance decomposition werealso undertaken.VEC model diagnostic tests carried out included Normality testsand residual portmanteau tests for autocorrelations.

Model Specification

Based on the prescriptions of the reviewed literature,the functional relationship between agriculture productivity and its determining factors is expressed as:

ATFP = f(AVC, GOVEFF, GOVINV, FDI, HUM, EXCH, COR) - - - (1)

Also, the functional relationship between agriculture value chain upgrade and its determining factorsas:

AVC = f(ATFP, GOVEFF,GOVINV, FDI, HUM,EXC, COR) - - - (2)

Where: ATFP = Agriculture total factor productivity (proxy for agriculture productivity).

AVC = Agriculture value chain upgrade

GOVEFF = Governmenteffectiveness (institutions).

GOVINV = Government investment in agriculture.

FDI = Foreign direct investment net inflows in millions of US$(proxy forTechnology).

HUM = Human capital (proxy is number of enrolments in secondary schools in Nigeria).

EXP = Exports of agriculture products from Nigeria

COR = Rate of corruption in Nigeria

The study employed error correction model to evaluate the extent to which agriculture productivity relate with other variables in the model, the ATFP equation using the estimated form of equation (1) is shown in equation (3):

$$\ln ATFP_t = \lambda_0 + \lambda_1 \ln AVC_{t-I} + \lambda_2 \ln GOVEFF_{t-i} + \lambda_3 \ln GOVINV_{t-i} + \lambda_4 \ln FDI_{t-i} + \lambda_5 \ln HUM_{t-i} + \lambda_6 \ln EXCH_{t-i} + \lambda_7 \ln COR_{t-i} + ECM_{1t-1} + e_{1t} \quad - - (3)$$

Also, the estimated form of equation (2) is shown in equation (4):

$$\ln AVC_t = \beta_0 + \beta_1 \ln ATFP_{t-i} + \beta_2 GOVEFF_{t-i} + \beta_3 \ln GOVINV_{t-i} + \beta_4 \ln FDI_{t-i} + \beta_5 \ln HUM_{t-i} + \beta_6 \ln EXCH_{t-i} + \beta_7 \ln COR_{t-i} + ECM_{2t-1} + e_{2t} \quad - - (4)$$

Where:The variables are as defined earlier; ln represents log of the variables; β_{1-7} and λ_{1-7}represent parameters of coefficients of the variables; ECM is the error correction model and e represents white noise.

It should be noted that the VECM can be used to compute thelong and short term causality. If the ECM shows statistical significance and

is different from zero, it meanslong term causality exist.

Empirical Analysis

Unit Root Tests

Table 1: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root Tests Results

	ADF Unit Root Test			PP Unit Root Test		
Variables	1st Difference t-Stat	Prob. value	Remarks	1st Difference t-Stat	Prob. value	Remarks
D(ATFP)	-6.013408*	0.0001	I(1)	-9.465848*	0.0000	I(1)
D(AVC)	-5.738052*	0.0002	I(1)	-6.403863*	0.0000	I(1)
D(lnGOVINV)	-6.558435*	0.0000	I(1)	-12.18087*	0.0000	I(1)
D(lnFDI)	-11.07814*	0.0000	I(1)	-11.07814*	0.0000	I(1)
D(lnHUM)	-3.457637***	0.0596	I(1)	-3.435801***	0.0624	I(1)
D(GOVEFF)	-6.385344*	0.0000	I(1)	-15.07995*	0.0000	I(1)
D(COR)	-6.626746*	0.0000	I(1)	-13.31956*	0.0000	I(1)
D(EXCH)	-3.861444**	0.0244	I(1)	-3.856698**	0.0247	I(1)

Source: Computed by Authors using Eviews 9

Note: Test critical values (Constant): 10% = -3.204699; 5% level = -3.544284; 1% level = -4.243644
*** 1% significant level; ** 5%significant level; and * 10%significant level

Table 1 is the result of the unit root tests undertaken using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Both test results indicate that the variables were stationary at first difference and therefore integrated of order one. Hence, we infer that the variables in the model are stationary at first difference. This implies that all the variables' data can be adequately used for generalized results.

Tests for Co-integration

Table 2: Johansen Cointegration Rank Test Results

Hypothesis: No. of Co-integrating Equations	Eigen Value	Max-Eigen Value	0.05 Critical Value	Prob**	Trace Statistic	0.05 Critical Value	Prob**
None *	0.934412	98.07682	52.36261	0.0000	234.6599	159.5297	0.0000
At most 1*	0.697695	43.06747	46.23142	0.1052	136.5831	125.6154	0.0090
At most 2	0.627554	35.55584	40.07757	0.1481	93.51561	95.75366	0.0706
At most 3	0.534713	27.54360	33.87687	0.2354	57.95977	69.81889	0.3033
At most 4	0.380466	17.23633	27.58434	0.5597	30.41617	47.85613	0.6975
At most 5	0.181010	7.188587	21.13162	0.9461	13.17983	29.79707	0.8832
At most 6	0.150233	5.860555	14.26460	0.6312	5.991246	15.49471	0.6966
At most 7	0.003624	0.130692	3.841466	0.7177	0.130692	3.841466	0.7177

Source: Computed by Authors using Eviews 9

Note: Trace test denotes 2 cointegrating eqn(s) at the 0.05 level
Max-eigen value test denotes 1cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

Table 2 presents the results of the Johansen co-integration rank tests. The value of Max-Eigen value exceeds the critical value indicating one co-integration equation at 0.05 level. Also, the Trace statistic value exceeds the critical value indicating two co-integration equations at 0.05 level. We thus conclude that there is co-integration in the model implying existence of a unique long-term relationship between the variables.

Vector Error Correction Estimates and Relationships

Table 3: Estimated Long Term Relationships
Dependent Variable: ATFP

Variables	Coefficient	Standard error	t-statistics
Long Run Estimates			
AVC(-1)	28.83771	1.35116	21.3429
InGOVINV(-1))	49.27159	3.04557	16.1781
InFDI(-1))	-53.87177	3.90604	-13.7919
InHUM(-1)	22.83530	10.8345	2.10764
GOVEFF(-1)	700.7601	34.1571	20.5158
COR	10.65513	4.37618	2.43480
EXCH	-0.812841	0.09151	-8.88291
C	371.2846		
ECM(CointEq1)	-0.053390	0.06106	-0.87435

Source: Computed by Authors using Eviews 9

Table 3 showcases the test for long term relationship between the model variables and agriculture productivity (ATFP). From the results, there is a long-term relationship between FDI and EXCH respectively and ATFP. This is known from the negative signs of their coefficients. However, other variables exhibit no long-term relationship with ATFP. To confirm this relationship, ATFP error correction equation was adopted, this is reflected in the Wald test results shown in Table 7. The error correction term (ECM) though is negative and less than oneisinsignificant. Hence,we can say that the long-term causality of the explanatory variables to ATFP is insignificant.

Table 4: Vector Error Correction Results for ATFP
Dependent Variable: D(ATFP)

Variables	Coefficient	Standard error	t-statistics
Short Run Estimates			
D(ATFP(-2))	-0.137170	0.21612	-0.63470
D(AVC(-2))	1.534265	1.24748	1.22989
D(InGOVINV(-2))	2.345906	2.29190	1.02356
D(InFDI(-2))	-2.760527	2.66650	-1.03526
D(InHUM(-2))	7.529665	17.0309	0.44212
D(GOVEFF(-2)	28.62253	26.1120	1.09614
D(COR(-2)	-3.460665	4.03353	-0.85797
D(EXCH(-2)	-0.048256	0.12775	-0.37772
C	0.354578	1.78168	0.19901
ECM(CointEq1)	-0.053390	0.06106	-0.87435
R-squared	0.455958	F-statistic	2.046128
Adj. R-squared	0.285709	Log likelihood	-91.49186
Sum sq. resids	82.0599	Akaike AIC	6.256678
S.E. equation	4.740687	Schwarz SC	7.056571

Source: Computed by Authors using Eviews 9

Table 5: Vector Error Correction Results for AVC
Dependent Variable: AVC

Variables	Coefficient	Standard error	t-statistics
Short Run Estimates			
D(AVC(-2))	0.126816	0.20060	0.63220
D(ATFP(-2))	0.024724	0.03977	0.62170
D(InGOVINV(-2))	0.270871	0.36854	0.73499
D(InFDI(-2))	-0.062499	0.42877	-0.14576
D(InHUM(-2))	1.777170	2.73858	0.64894
D(GOVEFF(-2)	4.181576	4.19882	0.99589
D(COR(-2)	-0.875432	0.64859	-1.34974
D(EXCH(-2)	0.006280	0.02054	0.30572
C	0.203894	0.28650	0.71169
ECM(CointEq1)	-0.031616	0.00982	-3.21994
R-squared	0.803269	F-statistic	4.083078
Adj. R-squared	0.606538	Log likelihood	-27.52612
Sum sq. resids	9.878812	Akaike AIC	2.601493
S.E. equation	0.762303	Schwarz SC	3.401386

Source: Computed by Authors using Eviews 9

Table 4 presents the estimated values of the coefficients for the short term equations showing the relationship between Agriculture Productivity (ATFP) and other variables in the equation while table 5 presents those of Agriculture Value Change Upgrade (AVC)and its equation variables. Theseare further presented in equations (5) and (6):

$$ATFP_t = 0.355 - 0.137(ATFP)_{t-2} + 1.53(AVC))_{t-2} + 2.346(InGOVINV))_{t-2} - 2.76(InFDI))_{t-2} + 7.53(In(HUM))_{t-2} + 28.62(GOVEFF)_{t-2} - 3.41(COR)_{t-2} - 0.048(EXCH)_{t-2} - 0.053(ECM)_{1t-1} + e_{1t} \quad (5)$$

$$AVC_t = 0.204 + 0.127(AVC)_{t-2} + 0.025(ATFP)_{t-2} + 0.271(InGOVINV))_{t-2} - 0.063(InFDI))_{t-2} + 1.777(InHUM))_{t-2} + 4.182(GOVEFF)_{t-2} - 0.875(COR)_{t-2} + 0.006(EXCH)_{t-2} - 0.032(ECM)_{2t-1} + e_{2t} \quad (6)$$

Equation (5) gives ATFP as dependent variable with positive constant indicating a positive intercept and by how much ATFP responds to variations in the explanatory variables at their zero levels. Also, in equation (6) AVCas a dependent variable has a positive intercept. Table 4 and Equation (5) indicates a negative and insignificant relationship between lagged ATFP and current ATFP, meaning that a unit increase in previous period's ATFP will yield a reduction in current ATFP. However, whereas positive and significant relationship subsists between AFTP and previous periods GOVINV, HUM and GOVEFF, pervious period's AVC indicated a positive but insignificant relationship with AFTP. The equation further indicates negative and significant influence ofprevious periods' FDI and COR on ATFP while EXCH exhibited negative and insignificant relationship with ATFP.

From table 5 and equation (6) the results indicate that AVC has a positive relationship with lagged AVC meaning that a unit increase in the lagged AVC yields a unit increase in current AVC upgrade. The results further indicate that lagged ATFP, GOVINV and EXCH positively but insignificantly impact AVC while HUM and GOVEFF positively and significantly impact AVC. On the other hand, FDI and COR negatively and insignificantly impact AVC. The ECM values for both equations (5) and (6) are significant and with the correct negative signs indicating the length of time equilibriumcan be attained in the short-term given that long-term relationship exist.

Wald Test for Long and ShortTerm Relationships

Table 7: Wald Test results on ATFP equation

Test Statistic	Value	df	Probability
F-statistic	0.791617	(18, 17)	0.6866
Chi-square	14.24911	18	0.7127

Table8: Wald Test Results on AVC equation

Test Statistic	Value	df	Probability
F-statistic	4.083078	(17, 17)	0.0030
Chi-square	69.41232	17	0.0000

Source: Computed by Authors using Eviews 9

Further tests for both long and short-term influences between the variables were carried out using the Wald Test as shown in Tables7 and 8. In table 7, since the Chi square value is not significant at 5% level, we submit that insignificant long-term relationship subsist between ATFP and the exogenous variables.This indicates that there is no causal effect between ATFP and its exogenous variables. However, table 8 results show that long-term relationship subsist between AVC and its exogenous variables. This conclusion is based on the Probability value of 0.003 and Chi-Square value of 69.412. Thus, there is a long-term influence of the exogenous variables on AVC.

Tests for Causality

Table 9: VEC Granger Causality/Block Exogeneity Wald Tests

Dependent Variable: D(ATFP)				Dependent Variable: D(AVC)			
Excluded	**Chi-sq**	**Df**	**Prob**	**Excluded**	**Chi-sq**	**df**	**Prob**
D(AVC)	1.537569	2	0.4636	D(AFTP)	0.392007	2	0.8220
D(InGOVINV)	1.858000	2	0.3949	D(InGOVINV)	13.15325	2	0.0014
D(InHUM))	0.941261	2	0.6246	D(InHUM))	0.483274	2	0.7853
D(GOVEFF)	2.544490	2	0.2802	D(GOVEFF)	8.942041	2	0.0114
D(InFDI)	1.082108	2	0.5821	D(InFDI)	5.191663	2	0.0746
D(COR)	2.671183	2	0.2630	D(COR)	2.240741	2	0.3262
D(EXCH)	1.561007	2	0.4582	D(EXCH)	10.88556	2	0.0043
All	10.60261	14	0.7169	All	32.26865	14	0.0037

Source: Computed by Authors using Eviews 9

The Granger causality test in table 9presents the direction of causal effects between the variables and also indicates how current period's behavior of a variable can forecast the growth of another variable in the long-term. The direction of causal effect is determined by probability values and this study uses 0.05 levels of significance as a guide for choosing the direction of causality. Based on these, it is seen from the results that GOVINV, GOVEFF and EXCH Granger cause AVC upgrade. However, no causal relationship is shown to exist between ATFP and the variables.

Tests for Autocorrelation

Table 10: VEC Residual Portmanteau Tests for Autocorrelations

Lags	Q-Stat	Prob.	Adj Q-Stat	Prob.	Df
1	60.63433	NA*	62.41769	NA*	NA*
2	119.8786	NA*	125.2526	NA*	NA*
3	169.9848	0.0018	180.0562	0.0003	120
4	212.9383	0.0707	228.5521	0.0142	184
5	264.6972	0.2226	288.9374	0.0379	248
6	318.4532	0.3885	353.8154	0.0515	312

Source: Computed by Authors using Eviews 9

The results of the residual autocorrelation test shown in table 9expresses no autocorrelation in the series. This decision is guided by probability values which exceed 0.05 level of significance, so we accept the null hypothesis of no autocorrelation.

Tests for Serial Correlation and Heteroskedasticity

Table 11: Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.811604	Prob. F(2,15)	0.4627
Obs*R-squared	3.417649	Prob. Chi-Square(2)	0.1811

Source: Computed by Authors using Eviews 9

Table 12: Breusch-Pagan-Godfrey Heteroskedasticity Test Pagan-Godfrey

F-statistic	0.664023	Prob. F(24,10)	0.8024
Obs*R-squared	21.50553	Prob. Chi-Square(24)	0.6088
Scaled explained SS	3.819223	Prob. Chi-Square(24)	1.0000

Source: Computed by Authors using Eviews 9

Table 11 presents the results for serial correlation test. Based on the F-statistics and Obs*R-squared p-values, we accept the null hypothesis of no serial correlation and submit that the estimates of the standard errors are correct and valid for statistical inferences. Test for heteroskedasticity was carried out to determine predictive ability of this study's model and errors in the regression. Based on the results shown in table 12, we accept the null hypothesis of no heteroskedasticity. This implies that the standard errors of the estimates are not bias, hence the results of this study are efficient and can be used to draw inferences.

Tests for Normality

Table 13: VEC Residual Normality Tests

Component	Jarque-Bera	df	Prob.
1	2.099381	2	0.3500
2	1.076461	2	0.5838
3	9.583124	2	0.0083
4	0.162060	2	0.9222
5	0.154182	2	0.9258
6	0.214322	2	0.8984
7	4.601792	2	0.1002
8	2.493320	2	0.2875
Joint	20.38464	16	0.2034

Source: Computed by Authors using Eviews 9

Test for normality as shown in Table 13indicate that the residuals are multivariate normal. This decision is based on the joint p-value of 0.2034 for skewness and kurtosis which is captured by the Jarque-Bera results shown in table 13.

Impulse Response Test

Table 14: Response of ATFP

Period	ATFP	AVC	COR	EXCH	GOVEFF	InFDI	InGOVINV	InHUM
1	4.740687	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	3.336847	0.608955	-0.692282	-0.107000	-0.827785	-0.194003	0.719363	0.392444
3	3.154714	0.565473	-0.919478	0.080196	-0.028382	-0.573104	0.121067	1.402420
4	3.463888	1.956750	0.416144	0.613427	-0.940842	0.116696	0.067007	0.937041
5	4.144078	1.360519	-0.200887	0.243069	-1.007016	-0.036314	0.136107	1.402288
6	3.990295	1.104341	0.099409	0.362886	-1.117575	0.610386	-0.770707	1.128231
7	4.129692	0.984829	-0.126786	1.132912	-1.289175	0.431819	-0.528961	1.717851
8	4.320743	0.914533	-0.017793	0.398077	-0.878011	0.102598	-0.242960	1.571864
9	3.932964	1.208752	0.338141	0.400991	-0.984126	0.304360	-0.279642	0.593171
10	4.098893	0.961455	-0.215992	0.445929	-1.095828	0.350646	-0.330444	1.318257

Source: Computed by Authors using Eviews 9

Table14 presents the results of the impulse response analysis. The impulse response function indicates how the variables respond to different shocks in the model. Table 14illustrates the response of ATFPto its exogenous variables. The response of ATFP to itself was a volatile response which decreased from the first year to the third year and thereafter keeps fluctuating. Response of ATFP to AVC was also volatile as it decreased from the third year and then increased in the fourth year after which it kept decreasing up to the ninth year. Response of ATFP to COR was negative in the second and third years and increased positively on the fourth year after which it became negative again in the fifth year. EXCH showed negative response in year two but from the third year it was positive but fluctuating. GOVEFF showed a negative response from year two and thereafter. FDI indicated negative response in years two and three and a positive response in the fourth year. GOVINV showed a positive but fluctuating response to the fifth year and negative responses thereafter from the sixth year. HUM showed positive but fluctuating responses. Theseresults indicate that sudden distortions in AFTP will lead to distortions on AVC, EXCH, GOVINV and HUM highlighting the relative importance of these variables on ATFP although the level of response is poor. On the other hand, COR, EXCH, GOVEFF, GOVINV and FDI responded negatively and

very poorly to ATFP upgrade. These indicate that these variablesdo retard ATFPin the long-term.

Variance Decomposition Test

Table 15: Variance Decomposition of AFTP

Period	S.E.	ATFP	AVC	COR	EXCH	GOVEFF	InFDI	InGOVINV	InHUM
1	4.740687	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	5.988702	93.70998	1.033961	1.336290	0.031923	1.910598	0.104943	1.442881	0.429427
3	7.021331	88.36041	1.400807	2.687056	0.036269	1.391573	0.742580	1.079411	4.301892
4	8.213238	82.36234	6.699731	2.220472	0.584329	2.329202	0.562879	0.795510	4.445537
5	9.464748	81.19178	7.111370	1.717125	0.505970	2.885975	0.425335	0.619721	5.542720
6	10.50493	80.33750	6.877933	1.402863	0.530062	3.474537	0.682890	1.041330	5.652884
7	11.60847	78.44486	6.352142	1.160747	1.386523	4.078647	0.697599	1.060390	6.819088
8	12.55913	78.85440	5.957138	0.991873	1.285027	3.973295	0.602661	0.943358	7.392249
9	13.28260	79.26584	6.154023	0.951575	1.239995	4.101207	0.591304	0.887716	6.808341
10	14.05592	79.28753	5.963374	0.873361	1.207954	4.270150	0.590262	0.847991	6.959381

Source: Computed by Authors using Eviews 9

Table 15 provides the results from variance decomposition analysis which serves tocomplement information about the dynamic behavior of the variables under review. The analysis is used to decompose forecast variance into each of the different shock's contributions. The variance decomposition results reveal that ATFP is solely responsible to its own shock in the first period. The feedback shock from its own lag gradually decreased from 100% to 88%, 80% and 79% in the third, sixth and tenth years respectively. In the second, fifth and ninthperiods, AVC contributed 1.03%, 7.11% and 6.2% respectively to shocks in the ATFP. Generally, the results indicate that at the short-term there are no shocks from the explanatory variables, for COR, the shock increased from second to third period after which it declined all through to the tenth period. For EXCH the shock started fluctuating upward from second year, the same goes for GOVEFF, FDI and HUM. For GOVINV, the shock fluctuates up and down all through. These results imply that variations in the level of ATFP in Nigeria is endogenous and that AVC, EXCH, GOVEFF, FDI, GOVINV and HUM can serve as major instruments to enhance ATFP in the long-term as they possess the potentials to contribute to variations in ATFP in the long-term.

DISCUSSION

Unit roots tests undertaken using both the ADF and PP proofed that the variables used for analysis were stationary at first difference, hence fit for generalized results and forecast. The Johansen Co-integration test results proofed that there is cointegration in the model indicating the presence of a unique long-termrelationship between the variables. These results enhanced the adoption of VECM analysis. From the VECM analysis, it is proven that a long-termrelationship exist only between technology (FDI), exchange rate (EXCH) and agricultural productivity (AFTP) in Nigeria. As shown in [41], technology drives agricultural productivity which is confirmed in this study for Nigeria. [47] Highlights that trade (export)which is enhanced by exchange rate is afactor for agricultural productivity and that has been confirmed in this study's results. However, most of the variables in the equation had no long-term effect on agriculture productivity which may be due to the nature of agriculture production in Nigeria. Further analysis using Wald tests confirms the lack of such long term influences. This may account to the low productivity in agricultural productivity in Nigeria as highlighted by [2], [3] [4].

The short-term analysis indicates that respectively, lagged government investment (GOVINV), human capital (HUM) and government effectiveness (GOVEFF) positively and significantly impact agricultural productivity in Nigeria. This shows the importance of these variables in promoting agricultural productivity. Musgrave (1969) noted that effective government spending impacts growth while [7] argues that good governance institutions

enable productivity growth. Also, [9] attributes faster agricultural productivity to higher investment and better educated people. This study's results support [23] [24]. However, despite Nigeria's poor institutional profile [11], this study agrees with [12] [13] that some governance institutions do positively impact productivity in Nigeria. This study however is contrary to [27] as human capital is shown to drive productivity.

The short-term analysis further indicated that though there is a positive influence of agricultural value change upgrade on agricultural productivity, such impact is not significant. As noted in [33], usually value chains is built on long-termrelationships andenhanced by foreign direct investment but asshown in this study,no long-term relationship subsist between agricultural productivity and value chain upgrade in Nigeria. For [25], low productivity translates to insignificant value added and vice versa, a case shown in this study. The analysis also indicates that technology, corruption and exchange rate negatively impacts agricultural productivity in the short-term. Though institutions are important for productivity [38], negative and ineffective institutions such as corruption leads to stagnation and negates productivity [35]. [39] observed that corruption is among the factors creating shortfalls in Nigeria's productivityand this study corroborates that observation. CBN (2017) data show that the exchange value of Naira (Nigeria's currency) has fallen greatly over the period covered by this study implying that while agricultural inputs are becoming more expensive to buy, farm outputs are becoming cheap to sell. This can be discouraging and hence impact productivity negatively.

From the analysis of the relationship between agriculture value chain upgrade (AVC) and its determining variables, the results indicatethat agricultural productivity, government investment and exchange rates impacted agricultural value added upgrade positively although the rate of impact was insignificant. Human capital and government effectiveness however exhibited positive and significant impact on agricultural value added upgrade. As noted in [46], to achieve value added, countries must have an encouraging control over production, trade, distribution and operate in cost effective way and these factors are confirmed in this study as driving agricultural value added upgrade in Nigeria. This study therefore corroborates [5], [6], [7], [8] [9]. On the other hand, the study show that foreign direct investment which is a proxy for technology and corruption command negative impact on agricultural value added upgrade in Nigeria. This indicate that our level of technological advancement is not enough to enhance positive value added and hence the fears raised in Webber and Labaste stare us in the face as our technology and business environment cannot enhance the competitiveness of our exports. Also, as shown in [11] [12], corruption is among the important barriers to agricultural value change upgrade as shown in this study for Nigeria.

The impulse response and variance decomposition tests undertaken indicate that agricultural value chain upgrade, exchange rate, governance, technology, government investment and human capital can all serve as major tools for enhancing agricultural productivity in Nigeria in the long-term, this however is achievable where concerted efforts can be made to salvage the present poor conditions of those variables. As noted in [44], productivity and the success of value change upgrade relies on better and diverse mixes of relevant variables.

CONCLUSION

On the basis of the analyzed results, this study concludes as follows: (i)there is no long-term relationship between agricultural productivity and agriculture value chain upgrade, government investment in agriculture and governance in Nigeria. In the short-term, agricultural value chain upgrade does not significantly impact agricultural productivity in the country but government investment in agriculture, human capital and government effectiveness significantly impacts agricultural productivity in Nigeria. However, corruption, exchange rates and technology impedes agricultural productivity in the country. (ii) In the short-term, agricultural productivity, government investment in agriculture and exchange rates do not significantly enhance agricultural value chain upgrade in Nigeria. Also, while government effectiveness and human capital significantly impact agricultural value chain upgrade, technology and corruption

negatively impact agricultural value chain upgrade in the country.

RECOMMENDATIONS

On the grounds of this research studyfindings, we proffer the following recommendations:

- To enhance agricultural productivity in the country, policies should be directed at improving the factors highlighted as having the potentials of driving productivity; these are agricultural value chain upgrade, good governance, government investment, technology and human capacity building. The present drive of the present administration towards enhanced agricultural development is a welcome development but it should be backed up with adequate policy implementations, funding and monitoring.
- Corruption as shown in this study is an antidote to both agricultural productivity and agricultural value chain upgrade. It should therefore be reduced to the barest minimum if the country is to achieve higher productivity and enhance value added. The current drive to eliminate corruption should be taken more holistically. New policies or review of existing policies should focus on promoting institutional values and eliminating corruption. The government should alsosum up the political willpower to implement laws that will benefit agricultural development.
- As earlier shown, where more than 80% of all farm holdings are accounted for by small holding subsistence producers and over 90% of agricultural production are rain fed without adequate irrigation and application of modern technology and innovation, agriculture productivity is bound to be negatively affected. So this study recommends that mechanized farming should be made a priority while large scale farming should be encouraged through enabling policies, credit provision, enabling laws, adequate security provisionand incentives that can attract foreign and local investors into large scale farming in Nigeria.
- Exchange rate is one of the determining factors of value chain upgrade as well as agricultural productivity since some of the inputs are imported. This factor as indicated in this study negatively impinges on both agricultural productivity and agricultural value chain upgrade in Nigeria. Thus, exchange rate policy should be reviewed and made friendlier to enhance agribusiness. The rate should be lowered as this will enhance productivity and encourage exports of processed agric products in the country.

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APPENDIX 1: Data Used For Estimating the Model

Year	A AgricExpts(Naira)	B ATFP (Index)	C GovEffect (Index)	D Gov Expend on Agric(₦B)	E FDI (US$)	F Enrol in Sec Sch(% Gross)	G Corruption (Index)	H Exch Rate
1980	0.11669	-6.67	-0.6	0.01	-738870004	13601810.46	0.9	0.546781
1981	0.116690	-17.43	-0.6	0.01	542327289.1	17008560.18	0.9	0.617708
1982	0.076946	-6.10	-0.7	0.01	430611256.5	20909999.85	0.9	0.673461
1983	0.076945	-8.57	-0.7	0.01	364434580.2	25040470.12	0.9	0.72441
1984	0.045199	-4.10	-0.75	0.02	189164784.9	28684919.36	0.9	0.766527
1985	0.044902	7.87	-0.75	0.02	485581320.9	29173559.19	0.9	0.893774
1986	0.409406	0.78	-0.8	0.02	193214907.5	27083030.7	0.9	1.754523
1987	0.519733	-4.12	-0.8	0.05	610552091.5	27072589.87	0.9	4.016037
1988	0.51973	5.68	-0.8	0.08	378667097.7	25080000.00	0.9	4.536967
1989	0.519733	3.34	-0.85	0.15	1884249739	24132020.95	0.9	7.364735
1990	0.519733	0.18	-0.85	0.26	587882970.6	24595819.47	0.9	8.038285
1991	0.557717	-5.71	-0.85	0.21	712373362.5	24572000	0.9	9.909492
1992	0.557717	-3.95	-0.9	0.46	896641282.5	24345900	0.9	17.29843
1993	0.557717	-5.72	-0.9	1.80	1345368587	24276500	0.9	22.0654
1994	0.557717	-5.09	-0.95	1.18	1959219858	24145000	0.9	21.996
1995	0.557717	-1.69	-0.95	1.51	1079271551	24000500	0.9	21.89526
1996	1.622144	0.17	-0.98	1.59	1593459222	23985000	0.69	21.88443
1997	0.079305	-1.07	-0.98	2.06	1539445718	23765200	1.7	21.88605
1998	0.099477	-1.04	-1.12	2.89	1051326217	23564320	1.9	21.886
1999	0.133504	-2.40	-1.12	59.32	1004916719	23415559.77	1.6	92.3381
2000	0.005945	2.29	-0.96	6.34	1140137660	24459909.44	1.2	101.6973
2001	0.006176	2.84	-0.96	7.06	1190632024	26861200.33	1	111.2313
2002	0.281333	8.78	-1.06	9.99	1874042130	29421009.06	1.6	120.5782
2003	0.009263	2.14	-0.96	7.54	2005390033	31543200	1.4	129.2224
2004	0.009263	3.79	-0.91	11.26	1874033035	34752040.86	1.6	132.888
2005	0.009263	4.93	-0.88	16.33	4982533943	34699119.57	1.9	131.2743
2006	0.361642	3.12	-0.96	17.92	4854416867	34187400.82	2.2	128.6517
2007	0.760782	2.59	-1.04	32.48	6034971231	31613830.57	2.2	125.8081
2008	0.928382	2.78	-0.97	65.40	8196606673	35097961.43	2.7	118.546
2009	1.135933	2.19	-1.2	22.44	8554840769	38904518.13	2.5	148.9017
2010	1.631811	5.52	-1.15	28.22	6026232041	43836711.88	2.4	150.298
2011	6.129493	1.60	-1.08	41.20	8841113287	45151088.71	2.4	153.8616
2012	7.268343	3.05	-0.99	33.30	7069934205	46760829.93	2.7	157.4994
2013	3.204121	1.77	-0.99	39.43	5562873606	55704219.82	2.5	157.3112
2014	0.431263	1.94	-1.18	36.70	4655849170	56230500	2.7	158.5526
2015	0.431263	2.98	-0.95	41.27	3128591679	56854210	2.6	193.2792
2016	0.2	-8.99	-0.95	36.58	4434648308	57000500	2.8	253.4923
2017	0.2	-7.20	-0.96	38.45	4493562423	57542100	2.7	305.62

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