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Analysis of Ghana's Gross Domestic Product from 1960 - 2019

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Abstract

The most popular metric for assessing or predicting global economic progress is the GDP. The objective of this report was to analyze the GDP of Ghana from the period 1960 – 2019. Secondary data was obtained, and trend analysis was done using the linear, quadratic, and exponential trend models to determine which model best fits the dataset. Trend analysis is a technique for examining and forecasting the movements of an item based on current and historical data. The results from the trend analysis showed that the exponential trend model had the lowest Mean Absolute Percent Error (MAPE), Mean Absolute Deviation (MAD), and Mean Square Deviation (MSD). When compared to the other models, the exponential trend model fits the dataset better, which is why it was chosen to forecast Ghana's GDP. The forecast showed that Ghana's GDP is expected to grow in the coming years to about $77 billion by 2026. Agriculture is considered as the backbone of Ghana and the country imports majority if its fertilizer from Russia. The challenges the Ghanaian economy is currently facing due to inflation, the global pandemic (COVID-19), and the Russia- Ukraine conflict could have an impact on the country' economic growth. Moreover, a change in leadership in the coming 2024 presidential election, could also have an impact on the projection. There are both positive and negative effects due to changes in leadership on economic growth.

Keywords: GDP, linear, quadratic, exponential, forecast, economic

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1. Introduction

Gross Domestic Product (GDP) is one of the primary indicators used to measure economic progress; however, it can also be used to determine the standard of living of individuals in an economy. GDP is commonly used as a metric for international comparisons to measure or forecast economic progress. It is a monetary measure of the market value of all final goods and services produced over a given time. This means that instead of adding up the quantities of goods and services, the GDP considers the market value of each good or service (Onuoha *et al.*, 2015). GDP includes all final products and services produced by economic agents based in that country, regardless of ownership, and that are not resold in any form. It is the primary measure of output and economic activity all over the world. GDP is clearly different from gross national product (GNP), which includes all final goods and services produced by resources owned by residents of that country, whether located in the country or elsewhere (Bondarenko, 2016).

The five primary components of GDP are consumption, fixed investment, inventory changes, government purchases (including government consumption), and net exports. The two basic formulas used to calculate GDP are the expenditure approach and the income approach. The expenditure approach is based on the amount of money that various groups spend in the economy (Viet, 2009). With this approach, GDP is expressed as the total of C, G, I, and NX, where C= consumption or total private consumer spending within the economy, G= total government expenditures, I= the sum of a country's investment spent on capital equipment, inventories, and other items, and NX= net exports of total exports and fewer imports (Bondarenko, 2016). The income approach considers the overall income produced by the produced goods and services. GDP = Total National Income + Sales Taxes + Depreciation + Net Foreign Factor Income is one way to mathematically express this (Ross, 2021). The total of all wages, rent, interest, and profits is known as the total national income. The difference between the total income produced by a country's citizens and businesses abroad and the total income produced by foreign citizens and businesses in that country is known as the net foreign factor income. Depreciation is the cost assigned to a tangible asset throughout its useful life (Masood, 2016).

2. A brief overview of Ghana's economic performance and the growth record

Ghana is a country located in West Africa that shares its borders with Togo, Cote d'Ivoire, and Burkina Faso to the east, west, and north, respectively. Ghana's population is estimated to be over 30 million, and the nation consistently ranks in the top three African nations for press and speech freedom (Lasserre and Monteiro, 2022). The early 1960s saw relatively high GDP growth in Ghana, but since then growth has been uneven. As of 1964, the economy's GDP growth was slowing. Since the mid-1960s, growth has been erratic for the most part; however, by 1984, it had started to stabilize. A negative growth rate was observed in 1966, 1972, 1975–1976, 1979, and 1980–1983, which coincided with a change in government and subsequent policy reversals. The unstable growth also coincided with four episodes of *coup d'etats* which also witnessed high inflation (Fosu, 2001).

Following independence, Ghana's economy underwent brief primary industrialization, which can be characterized as transformation. The economy was primarily characterized by high shares of agricultural value-added during the first half of the 1960s and modest increases in shares of the expanding manufacturing sector. Agricultural employment shares decreased from 61% in 1960 to 58% by the 1980s, whereas manufacturing employment shares rose by an average of about 2% per year until the end of the decade, despite remaining static between 1964 and 1967 (Bhorat, Lilenstein and Oosthuizen, 2020). Ghana's agricultural sector is regarded as the country's economic backbone. Ghana's GDP growth rate in 1996 was 4.5%. The agricultural sector contributed 42.7% of GDP, while the service sector contributed 26.7% and the industrial sector contributed 30.6%. Again, the Ghanaian economy grew by 5.8% in 2004, with the agricultural sector alone contributing 41.5%, while the service and industrial sectors contributed 27.1% and 31.4%, respectively (Akondoh, 2013).

Ghana experienced annual average growth of about 5.2% between 1984 and 2010, and it became a lower middle-income country following a rebasing of its national accounts in 2010 with a change in the base year from 1993 to 2006. Between 2007 and 2012, the rebasing increased the country's annual average growth rate to 8.3%. The country began commercial oil production in 2011 and this development contributed 5.4 percentage points to Ghana's 15.0% real GDP growth that year, putting the country in an enviable position as one of the world's six fastest growing economies. Concerns have been raised, however, about the quality of economic growth, particularly in terms of employment, inequality, and general improvement in Ghanaians' standard of living (Alagidede, Baah-boateng and Nketiah-amponsah, 2021).

3. Methodology

The research relied on secondary data in the form of time series covering the period 1960-2019. The data was obtained from https://fred.stlouisfed.org/series/MKTGDPGHA646NWDB. The data were subjected to a homogeneity test of variance using the Pettitt test (Table 4). The Pettitt test showed that the dataset was not homogenous since the computed p-value is lower than the significance level alpha=0.05.

Predicting how GDP will change in the future is a major concern in economics. Forecasts are typically generated using either straightforward linear time series models or models based on economic theory. To find the model that best fits the data, a trend analysis was conducted using the linear, quadratic, and exponential trend models. The exponential model was chosen to predict the GDP since its Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Square Deviation (MSD) were smaller compared to the linear and quadratic models (Table 1). Forecasting is a thorough investigation of the connections between various factors and the advanced estimation of future events.

3.1 Time series forecasting analysis

Time-series forecasts are used in a variety of economic activities, such as setting monetary and fiscal policies, preparing state and local budgets, managing finances, and developing financial products. Selecting the forecasting model(s) appropriate for the problem at hand, evaluating and communicating the uncertainty associated with a forecast, and protecting against model instability are some of the key components of economic forecasting (Stock, 2001). A time series model can offer a fair comparison between the pure explanatory power of the past behavior of the variable and the value added in forecasting by economic theory (Espasa *et al.*, 2017).

Naturally, when dealing with the unpredictable and the unknown, there are limitations. Time series forecasting isn't perfect, and not every situation calls for it. The data teams must understand the boundaries of the analysis and what their models can support because there isn't a clear-cut set of guidelines for when you should or shouldn't use forecasting. When data teams have the necessary data and forecasting capabilities to address a business question, they should use time series forecasting. Realistic trends and patterns in historical data can be found by using clean, time-stamped data and good forecasting (Diebold, 2006; Tableau, 2020).

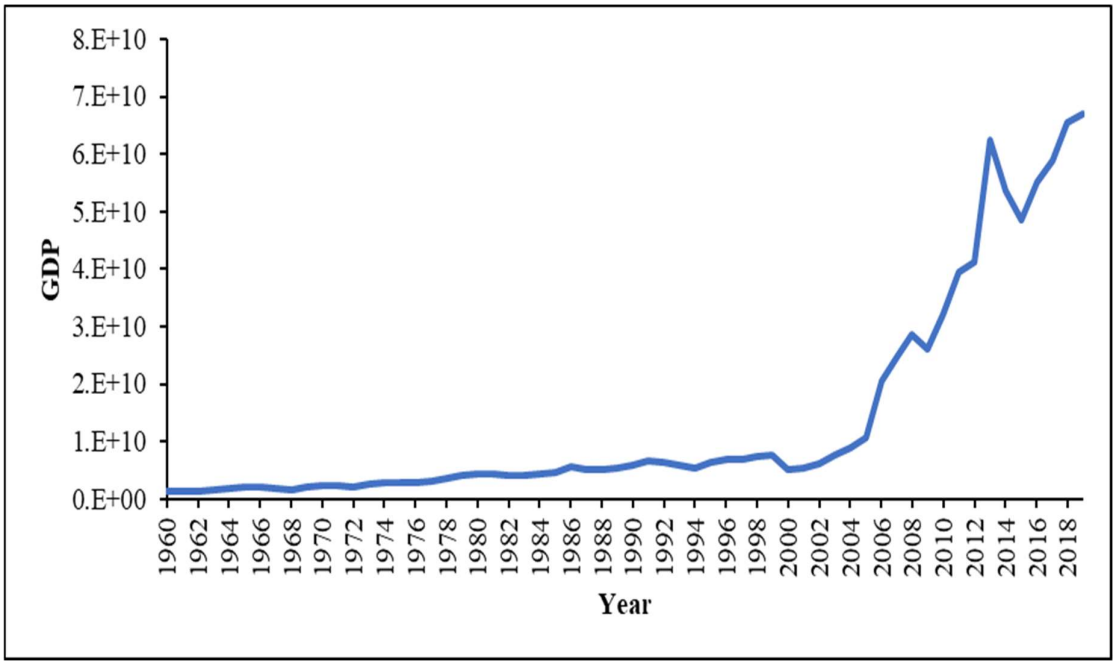

Figure 1. Time series of Ghana's GDP from 1960 – 2019

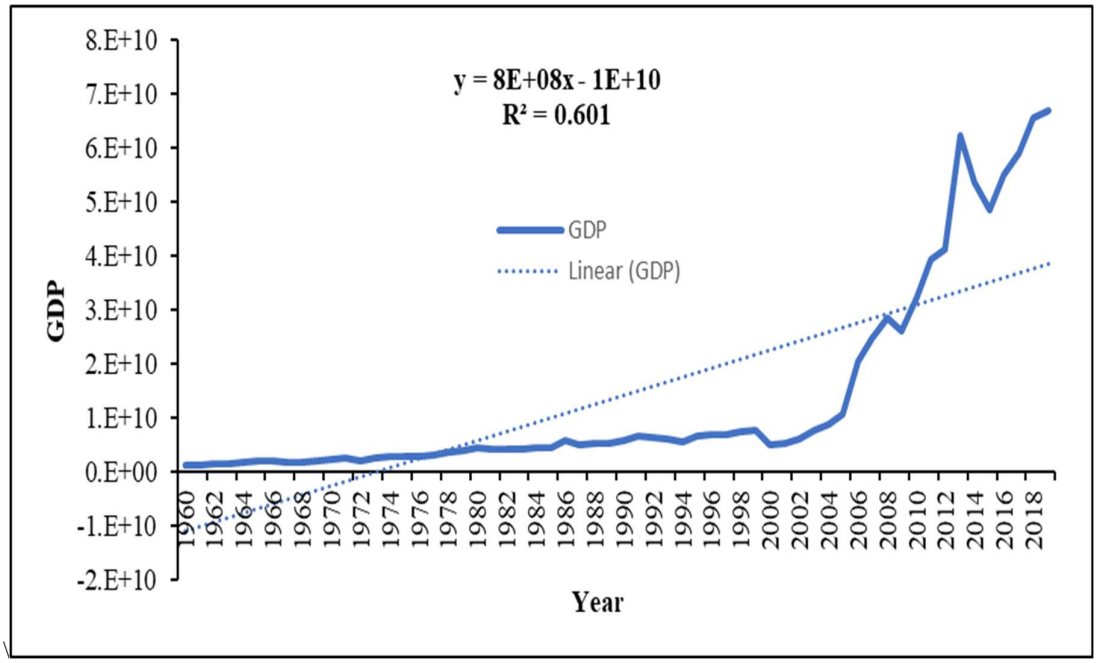

Figure 2. Linear Model

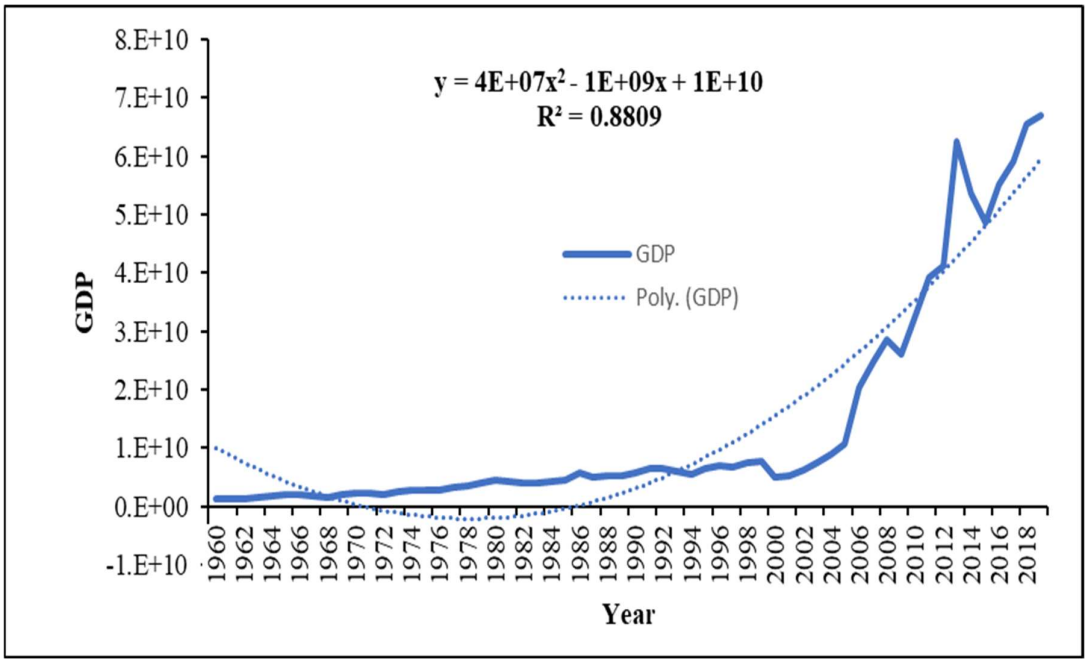

Figure 3. Quadratic model

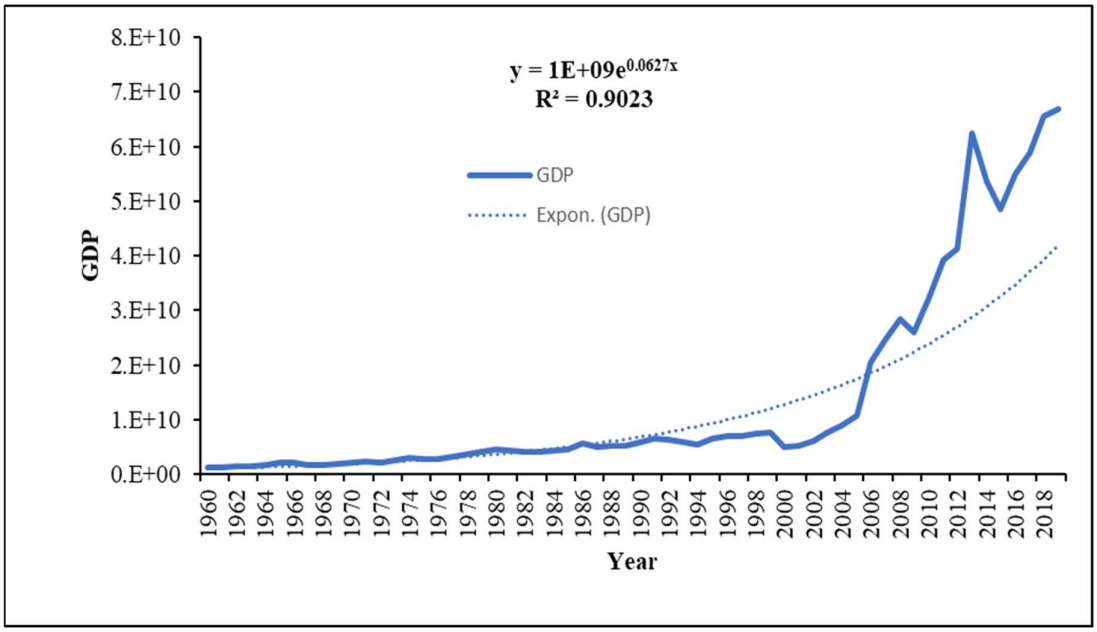

Figure 4. Exponential model

Table 1. Comparing the accuracy of the models

Model	MAD	MSP	MAPE
Linear Trend	16324378777	1.39591E+20	224.3989741
Quadratic Trend	13756350537	4.16821E+19	120.7724792
Exponential Trend	0.124211234	0.025486235	2.14964E-09

Table 2. Forecast

Year	Forecast
2020	68410804400
2021	69837974576
2022	71265144751
2023	72692314927
2024	74119485103
2025	75546655279
2026	76973825454

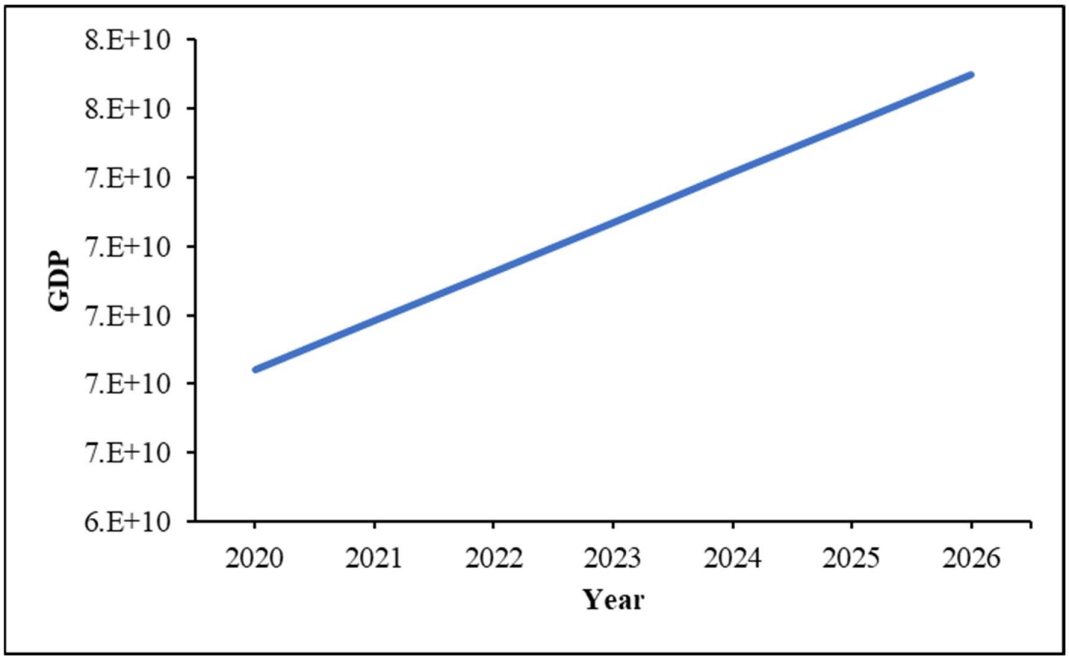

Figure 5. Time series of the forecast from 2020-2026

4. Result and Discussion

From Figure 1, it is observed that the GDP of Ghana has been growing progressively between 1960-2019. However, between 2001-2012, Ghana's economy experienced a significant growth in GDP. According to (Sarpong *et al.*, 2013), between 1993 and 2000, there were some variations in the real GDP growth rate as a percentage; however, from 2000 to 2006, this rate had generally increased.

The result from the analysis showed that the exponential model recorded the smallest Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Square Deviation (MSD) (Table 1). Comparing to the other models, the exponential trend model better fits the dataset, therefore, Ghana's GDP was forecasted using the exponential model from 2020 to 2026 (Table 2). According to the forecasting, Ghana's GDP will be around $77 billion by 2026, indicating that by that year, Ghana's economy will grow more strongly. For the decision-

making process, both at the central administrative (central bank, government) and industry levels, forecasting GDP growth is important (Barsoum and Stankiewicz, 2015).

This projection is likely to increase or decrease due to the challenges facing the economy presently. The 2024 elections could also influence the projection should there be a change in government. Annual economic growth in 2000 was only 3.7 percent (Anaman and Ninson, 2016), a year of elections that resulted in the incumbent government losing power. Low internal production, external trade, financial shocks, and relatively little room for government overspending were the causes of this. In 2008, when the ruling government was overthrown, the growth rate was the opposite. Over 8.4% economic growth was attained in 2008 thanks to very high government spending, which was made possible by the financial space made available by the massive cancellation of foreign debt. Though the type of governmental system of a country had been seen to affect GDP, in the case of Ghana, the impact of the transition to a democratic political system on economic growth is ambiguous, with both positive and negative effects (Anaman and Ninson, 2016).

Ghana's economy is expected to receive a massive growth by 2026. The World Bank predicted that due to macroeconomic insecurity and corrective policy measures, Ghana's GDP growth would slow by 3.5 percent in 2022 and an average of 3.3 percent from 2022 to 2024. The negative effects of high inflation and high-interest rates on private consumption and investment will be amplified by monetary and fiscal tightening. Ghana imports 40% of its fertilizers from Russia which has also been impacted by the cedi's depreciation and the Russia-Ukraine conflict (World Bank, 2020). Agriculture is projected to grow at 2.2 percent in 2023 as compared to 8.4 percent in 2021 due to high input prices as a result of the cedi's depreciation and specific issues with cocoa plants (World Bank, 2020). Between 2000 and 2019, Ghana's economy grew strongly and steadily, but the main problem is that manufacturing and agriculture, which have comparatively better employment-generation effects, continue to record slower growth while the extractive subsector, which is known to have limited job creation impact, has been a major driver of growth (Aryeetey and Baah-boateng, 2015). The loss of agriculture's hegemonic position in terms of its contribution to national output to services following the National Accounts' rebasing is frequently interpreted as an indication that the economy is undergoing structural change (Jedwab and Osei, 2012).

It is difficult to connect the sectoral shift in the nation's output with economic transformation due to the weak growth performance and declining manufacturing, also known as the "missing middle," even though productivity in the agricultural and service sectors is still low"(Aryeetey and Baah-boateng, 2015). Jedwab & Osei, (2012) reported that the decline in agricultural employment or structural change both affect growth, and structural change that is going in the wrong direction is associated with periods of negative economic growth. Since there hasn't been much structural change over the past 50 years, Ghana's economy is still largely agricultural and is still considered to be underdeveloped. Changes in labor productivity across the economy have largely been driven by the fact that all sectors were either becoming more productive or less productive.

5. Conclusion

Gross Domestic Product (GDP) is one of the primary or main indicators used to measure economic progress; however, it can also be used to determine the standard of living of individuals in an economy. One of the nations in Africa with the fastest-growing economies is Ghana. According to a top data and analytics company, GlobalData, Morocco, Kenya, Ghana, Egypt, and South Africa were all projected to have economies with real GDP growth rates of over 4% in 2021. Ghana is expected to achieve a massive economic growth by 2026. Agriculture is viewed as the backbone of the Ghanaian economy, with more than 40% of fertilizer imported from Russia. The Russian-Ukrainian conflict is thought to have an impact on agricultural production and GDP. The COVID-19 pandemic, which rocked the world economy, was the cause of the biggest economic crisis to hit the planet in more than a century. Because of the crisis, inequality both within and between countries dramatically increased. The Covid-19 pandemic has caused significant measurement issues. Among them are challenges with GDP estimation..

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Appendixes

Table 3. Time series of residuals of the exponential model

Year	Actual GDP	Time	log GDP	Predicted log GDP	Residuals
1960	1217230038.26781	1	9.085372661	9.017412563	0.067960098
1961	1302674264.19915	2	9.114835833	9.044624462	0.070211371
1962	1382515590.06942	3	9.140670037	9.071836361	0.068833677
1963	1540797516.79469	4	9.18774557	9.09904826	0.08869731
1964	1731296118.87113	5	9.238371355	9.126260159	0.112111197
1965	2053462872.38275	6	9.312486855	9.153472058	0.159014797
1966	2126300573.17668	7	9.327624656	9.180683957	0.1469407
1967	1747187539.20717	8	9.242339524	9.207895856	0.034443668
1968	1666910166.28900	9	9.221912195	9.235107755	-0.01319556
1969	1962051319.26134	10	9.292710363	9.262319654	0.030390709
1970	2215029450.38050	11	9.345379505	9.289531553	0.055847952
1971	2417107708.25317	12	9.383296003	9.316743451	0.066552552
1972	2112292944.64142	13	9.324754148	9.34395535	-0.0192012
1973	2465492957.74648	14	9.391903766	9.371167249	0.020736517
1974	2894409937.88820	15	9.461560041	9.398379148	0.063180892
1975	2810106382.97872	16	9.448722761	9.425591047	0.023131714
1976	2765254237.28814	17	9.441735066	9.452802946	-0.01106788
1977	3189428571.42857	18	9.50371288	9.480014845	0.023698035
1978	3662478184.99127	19	9.563775047	9.507226744	0.056548302
1979	4020227920.22792	20	9.604250675	9.534438643	0.069812032
1980	4445228215.76763	21	9.647894062	9.561650542	0.08624352
1981	4222441614.97432	22	9.625563653	9.588862441	0.036701212
1982	4035994397.75910	23	9.605950555	9.61607434	-0.01012379
1983	4057275042.82903	24	9.60823445	9.643286239	-0.03505179
1984	4412279843.44423	25	9.644663049	9.670498138	-0.02583509
1985	4504342149.43471	26	9.653631372	9.697710037	-0.04407866
1986	5727602644.71472	27	9.757972881	9.724921936	0.033050945
1987	5074829931.97279	28	9.705421493	9.752133835	-0.04671234
1988	5197840979.13416	29	9.715822989	9.779345734	-0.06352275
1989	5251764264.26802	30	9.720305224	9.806557633	-0.08625241
1990	5889174825.48700	31	9.770054447	9.833769532	-0.06371508
1991	6596546195.65217	32	9.819316608	9.860981431	-0.04166482
1992	6413901601.83066	33	9.807122293	9.88819333	-0.08107104
1993	5966255778.12018	34	9.775701868	9.915405229	-0.13970336
1994	5444560669.45607	35	9.735962842	9.942617128	-0.20665429
1995	6465137614.67890	36	9.810577774	9.969829027	-0.15925125
1996	6934984709.48012	37	9.841045508	9.997040926	-0.15599542
1997	6891308593.75000	38	9.838301698	10.02425282	-0.18595113

1998	7480968858.13149	39	9.873957847	10.05146472	-0.17750688
1999	7719354838.70968	40	9.887581005	10.07867662	-0.19109562
2000	4983024408.14828	41	9.697493014	10.10588852	-0.40839551
2001	5314909953.92992	42	9.725495911	10.13310042	-0.40760451
2002	6166330136.29480	43	9.790026773	10.16031232	-0.37028555
2003	7632406552.83803	44	9.882661496	10.18752422	-0.30486272
2004	8881368538.07671	45	9.948479892	10.21473612	-0.26625623
2005	10731634116.73840	46	10.03066586	10.24194802	-0.21128216
2006	20409668521.54940	47	10.30983595	10.26915992	0.040676036
2007	24758819717.70740	48	10.39372994	10.29637181	0.097358123
2008	28526891010.49250	49	10.45525444	10.32358371	0.13167073
2009	25977847813.74220	50	10.41460317	10.35079561	0.063807556
2010	32197272797.20280	51	10.50781909	10.37800751	0.129811576
2011	39337314809.94340	52	10.59480471	10.40521941	0.189585301
2012	41270954737.24590	53	10.61564452	10.43243131	0.183213207
2013	62405374785.50520	54	10.795222	10.45964321	0.335578788
2014	53660342159.77350	55	10.72965344	10.48685511	0.242798331
2015	48564863888.44020	56	10.68632218	10.51406701	0.17225517
2016	55009730600.03070	57	10.74043952	10.5412789	0.199160613
2017	58998132329.61730	58	10.77083826	10.5684908	0.20234746
2018	65556464048.15390	59	10.81661552	10.5957027	0.220912818
2019	66983634223.94300	60	10.82596871	10.6229146	0.203054105

Table 4. Pettitt's test

K	888.000
t	1989
p-value	<0.0001
Alpha	0.05

99% confidence interval on the p-value

Test interpretation.

H0: Data are homogeneous

Ha: There is a date at which there is a change in the data

Decision rule: As the computed p-value is lower than the significance level alpha=0.05, one should reject the null hypothesis, H0, and accept the alternative hypothesis, Ha. The data are not homogenous.

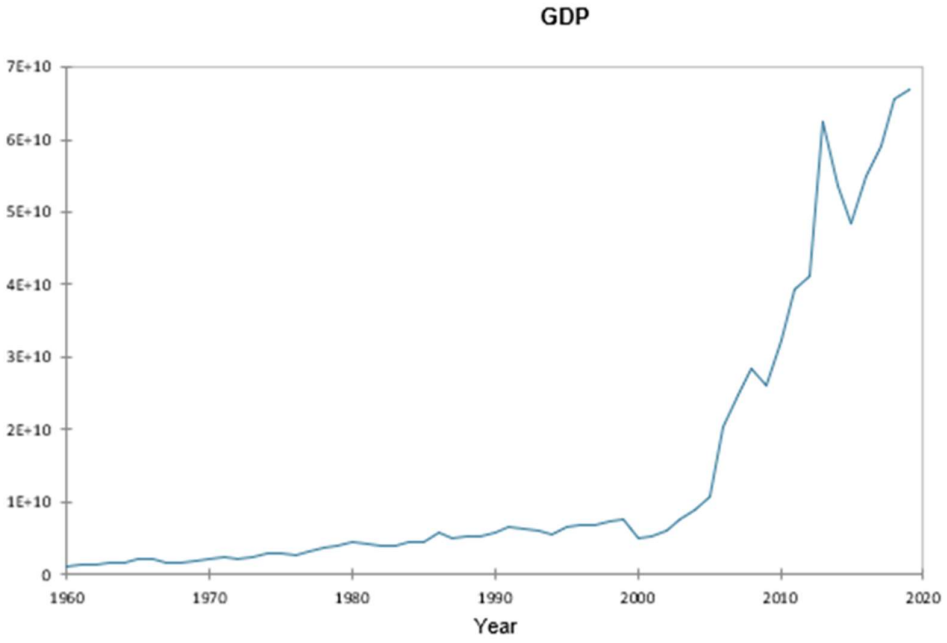

Figure 6. Series before GDP transformation

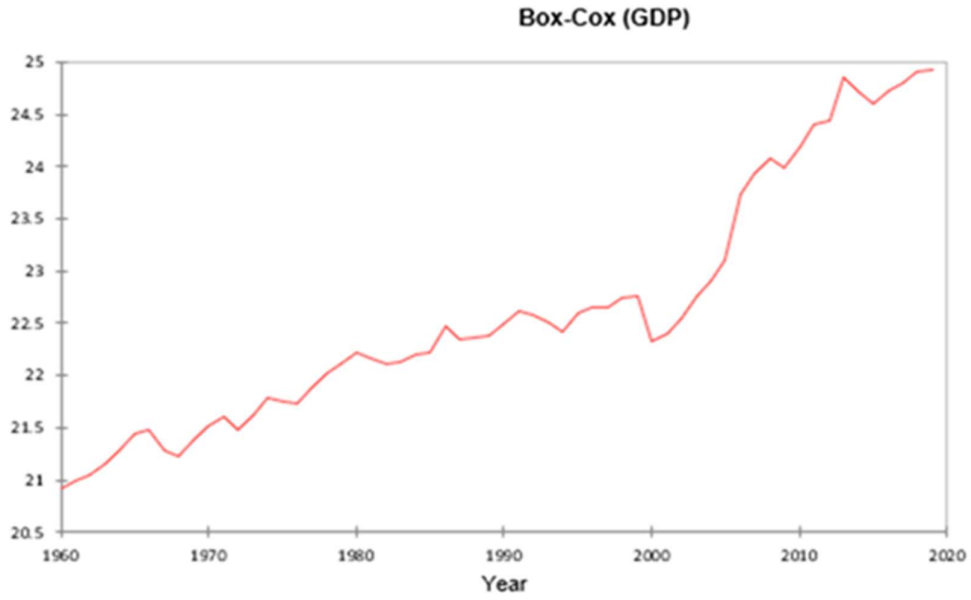

Figure 7. Series after GDP transformation (Box-Cox transformation)