CONSTRUCTION INDUSTRY OUTPUT GROWTH RATE RESPONSE TO INFLATION RATE IN KENYA

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Abstract

Construction industry is a key sector in a nation's economy, and therefore, understanding the effects of inflation on this industry can enable policymakers to ensure its stable growth and contribution to Kenya's Gross Domestic Product (GDP). This study presents empirical findings on the impact of inflation rate (IR) on construction output growth rate (COGR) and its implications for policy formulation. A time series data analysis approach was employed, using data from the Kenya National Bureau of Statistics (KNBS) and Central Bank of Kenya (CBK), covering 47 years (1977–2023). Data was analysed using EViews version 10, incorporating graphical analysis, correlation analysis, stationarity tests, and regression analysis. Construction output growth rate (dependent variable) was regressed against the inflation rate (independent variable) using second-difference transformations. Results showed that IR had no immediate significant impact on the growth of Kenya's construction industry, as indicated by a coefficient of determination (R^2) of 0.000043. However, a lagged regression model demonstrated a stronger explanatory power, with an R^2 value of 0.594232, suggesting that inflation influences construction output growth with a time lag. These findings highlight the delayed effects of inflation on the industry and provide insights for economic and policy interventions.

Keywords: Construction output, Time series, Stationarity, Explanatory power

Introduction

Due to its size, construction industry is important to global economy. Several reasons in support of this notion have been outlined in Hillebrandt[1] who attributed this to Significant Output Contribution (SOC) by the industry. The industry produces a large output, making it a significant part of the economy. It accounts for approximately 10% of the Gross National Product (GNP) globally, which translates to approximately US$3,000 billion as of 1997. The second reason for viewing this industry as important, according to Hillebrandt[1] is due to Investment Goods Production (IGP). The industry produces investment goods, which are essential for further production, infrastructure improvement, social investment, and direct enjoyment. These include factory buildings, roads, hospitals, and housing. Wholesomely, this has a value addition to the country's economy as noted by Hillebrandt[1]. Therefore, performance and management of the industry are a major concern to everyone who is keen on keeping it playing its role in a specific economy. However, it is not clear whether the inflation rate has any bearing on the growth rate of the industry in Kenya. This poses a challenge in policy design and implementation regarding its growth.

The third reason for branding the industry as important is Employment Generation (EG). Construction is more labour-intensive compared to many other industries, which means it generates substantial employment. This can have a multiplier effect, where the wages paid to construction workers are spent on other goods and services, further boosting the economy. Fourthly, as observed in Hillebrandt[1], the industry is an Economic Indicator (EI). The size and activity level of the construction industry often reflect the overall health of the economy. High levels of construction activity typically indicate economic growth, while low levels may signal economic downturns. Finally, there is the Government's Influence (GI) through the industry. Governments often use the construction industry as a tool for economic management. Thus, by increasing or decreasing public sector construction projects, they can influence overall economic activity.

Overall, the construction industry's size and output are crucial for economic stability, growth, and development. Hillebrandt[1] further noted that the actual value, quantified in monetary terms, of all works involving *buildings and civil engineering* works in the industry produced within a specific time duration, usually a single calendar year, is termed the gross output of the construction industry in any economy.

Construction Industry of Kenya

In Kenya, the construction industry depends a lot on borrowed funds. During the year 2023, the industry borrowed Kshs. 602.7 billion from commercial banks [2]. This translates to a 7.2% increase in borrowing from the previous year; 2022. This means the cost of finance is a critical factor which affects the industry and the inflation rate is a major component of this cost. In 2023, year-on-year inflation was 4.16% as compared to 7.1% in 2022[2].

Trends in the construction industry in Kenya have mostly been very slow and have been fluctuating for a very long time. In the past few years; from 2019 to 2023, as reported in an economic survey by Kenya National Bureau of Statistics (KNBS) displayed Kenya's building and construction to have contributed 6.2%, 7.0%,7.1%, 7.1% and 6.6% to the Gross Domestic Product (GDP). The growth of the industry is shown in the table below.

TABLE 1: Construction Industry Growth

YEAR	2019	2020	2021	2022	2023
% **CHANGE**	7.2	10.1	6.7	4.1	3.0

Source: KNBS[2].

Data presented on the table I above demonstrate that Kenya's construction industry growth fluctuates substantively.

Fluctuations in construction output, often referred to as building cycles, are a common phenomenon in the construction industry. These fluctuations can be attributed to several factors, as observed in Hillebrandt[1], as follows:

(a) **Economic Cycles**: Construction industry is closely linked to overall economy. Thus, when the economy is booming, there is typically an increase in construction activity due to higher demand for residential, commercial, and industrial buildings. Conversely, during economic downturns, construction activity tends to decrease as demand falls. (b) **Government Policies**: Government actions, such as changes in interest rates, public sector spending, and taxation policies, can significantly impact construction output. For example, an increase in interest rates can lead to higher borrowing costs, reducing the demand for new construction projects. (c) **Investment and Demand**: The construction industry produces investment goods, which are often expensive and have a long life. Small fluctuations in the demand for these goods can lead to significant changes in construction output. For instance, a slight increase in demand for housing can result in a substantial rise in construction activity. (d) **Technological Changes**: Advances in construction technology can also cause fluctuations. For example, introduction of new building materials or construction methods can lead to a temporary increase in output as firms adopt these innovations. (e)**External Shocks**: Events such as natural disasters, wars, or significant population changes can cause sudden and significant fluctuations in construction output. These shocks can either increase demand for reconstruction of new buildings or decrease is due to economic instability. (f)**Market Dynamics**: Construction market is influenced by availability and cost of resources, such as labour and materials. Shortages or surpluses of these resources can lead to fluctuations in construction output. From the foregoing observations, it is demonstrable that construction industry is sensitive to a wide range of economic, political, and social factors, leading to inherent fluctuations in output. Therefore, it is rational to establish the impact of the inflation rate and how it interacts with the construction industry of Kenya.

Inflation Rates and the Construction Industry

It is a common factor that inflation rate, which is a key component of interest rates, plays out openly and strongly in any general capital investment. This captures other economic factors as elaborated in Akintoye and Skitmore[3]. Policymakers in both public and private sectors, including real estate property developers, require economic and technical knowledge related to investment decision-making in construction industry for them to maximise their analysis of cost-benefits of an investment. This is alluded to in Akintoye and Skitmore[3], where the level of inflation is said to be among other factors considered in construction investment decision-making.

The cost of construction materials is another factor that one must consider when entering an investment in construction. According to Akintoye and Skitmore[3], economic factors that influence construction investment trends include the following, among others:

(a) **Inflation**: Affecting user's cost of capital and investment decisions. (b) **Price Changes**: There is an inverse relationship between construction investment and price changes. (c) **Interest Rates**: Higher interest rates tend to reduce construction investment.

These factors interact in complex ways to influence the overall trends in construction investment. This paper looks at the influence of levels of inflation in Kenya's construction output growth rate.

Method

To test the significance of the relationship between IR and the Construction Output Growth Rate (COGR) in Kenya, the null hypothesis is that annual changes in the construction industry output growth rate are not significantly affected by annual changes in IR.

Time series analysis was employed to examine the time series data, which were gathered using a data abstraction sheet. The procedure involved entering the data into a computer utilising Microsoft Office Excel software and subsequently opening it in Economic Views (EViews) software as foreign data, which was ultimately converted into an EViews work file. The data were then analysed by conducting graphical, correlation, and stationarity tests, as well as regression analysis. Regression model used in this analysis is:

$$\mathbf{COGR_t = \alpha + \beta_1 IR_t + \beta_2 IR_{t-1} + \ldots\ldots\ldots + \beta_8 IR\text{-}7_t + \varepsilon} \quad [1]$$

Where:

$COGR_t$	=	Construction output Growth Rate at a given time
IR_t	=	Inflation rate at any given time
β	=	Coefficient
α	=	(the value of $COGR_t$ when the explanatory variable is set at zero)
ε	=	Error term or residual
t	=	Specific year

Construction Output Growth Rate (COGRt) was regressed on the inflation rate (IR) using the second differences of the time series data.

Data

I. Graphical Analysis

Fig. 1 illustrates the trend in construction output growth rates from 1977 to 2023. The output growth rate has fluctuated significantly. Figure 2 also indicates that the IR has fluctuated throughout the forty-seven (47) year period, while Figure 3 demonstrates the differing trends of the two time series. This analysis reveals that changes in annual IR are significantly affecting annual construction output growth.

Fig.1: Construction Output Growth Rate (%) (1977 - 2023)

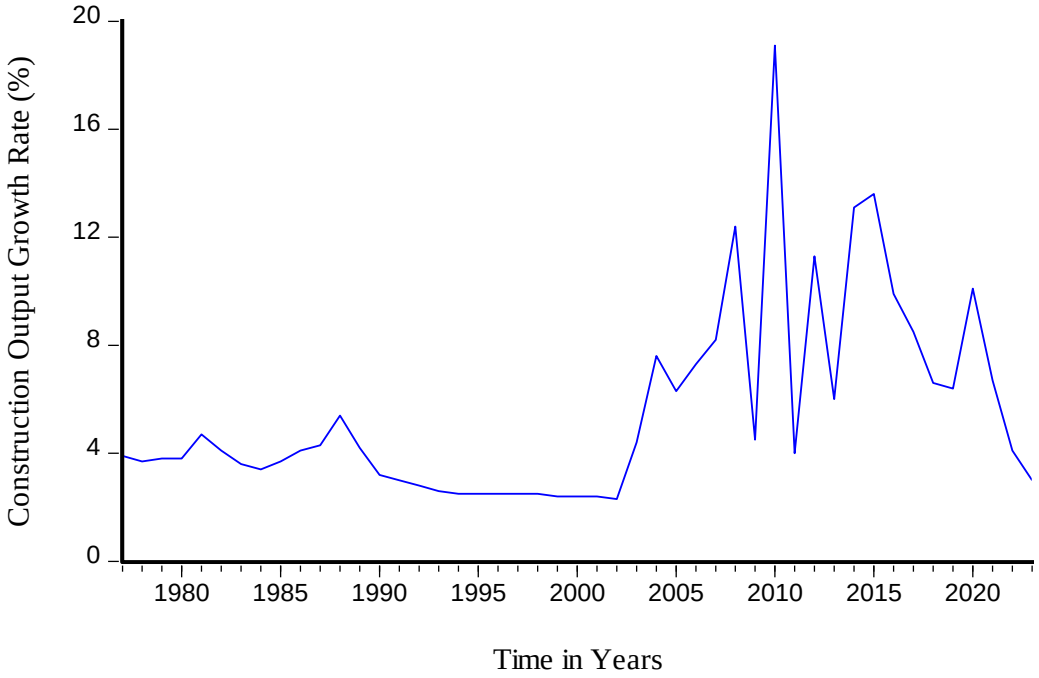


Fig.2: Inflation Rate (%) (1977 -2023)

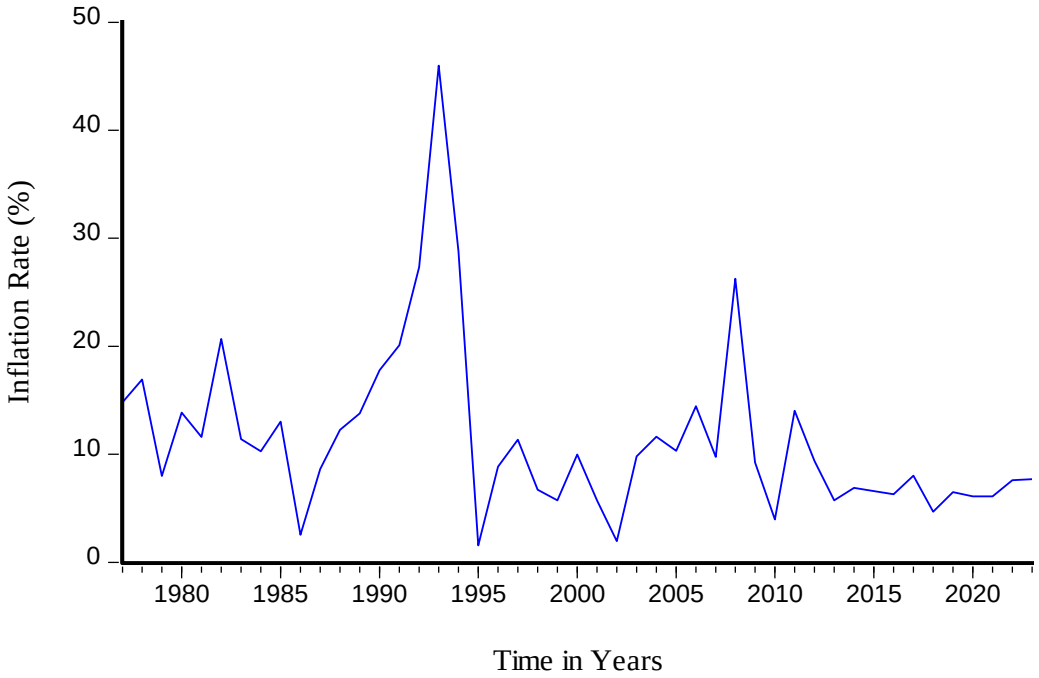
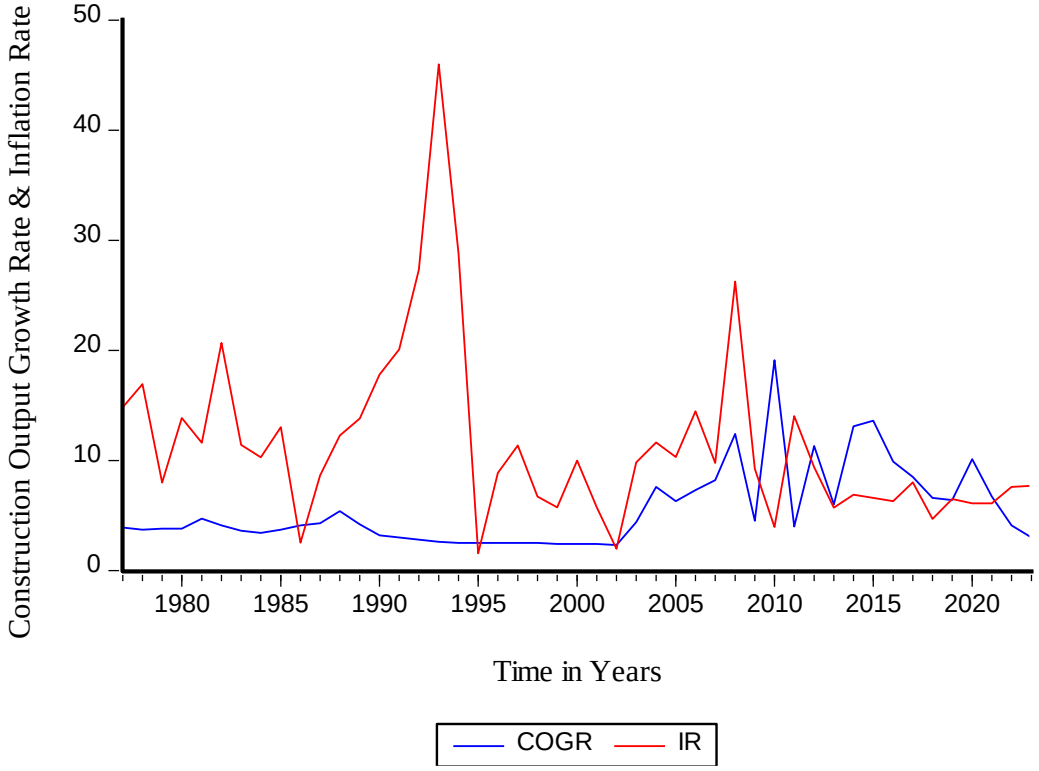


Fig.3: Construction Output Growth Rate and Inflation Rate (%) (1977 - 2023)



II Correlation Analysis

Table 2: Correlation Coefficient (r)

	COGR	IR
COGR	1.000000	-0.202193
IR	-0.202193	1.000000

Correlation analysis showed an inverse correlation of inflation rate and construction output growth rate for the period under consideration; 1977 to 2023. This is observed in Table 2 above, which gives a correlation coefficient (r) of -0.202.

III Stationarity Test

This test comes before regression analysis to ensure the regression analysis is not spurious. The test of stationarity is an important process in time series analysis, as seen in Gujarati and Porter[4]. Thus, time series analysis relies a lot on the stationarity of time series data. This ensures the data analyzed gives reliable results. These tests were carried out at a 5% level of confidence. The augmented Dickey-Fuller (ADF) method of the stationarity test was used for this purpose.

The second differences were found to be stationary. This is observed in Tables 3 and 4, which gave P-values of 0.0000 and 0.0000, respectively.

Table 3: Unit Root Test for Second Differences of Construction Output Growth Rate

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.221155	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

Table 4: Unit Root Test for Second Differences of Inflation Rate

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.974710	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

IV Regression Analysis

Table 5 presents regression results of the second difference of COGR and IR. These results indicate that IR has no significant impact on construction output in the current year. This is evidenced by the low value of $R^{2,}$ which is 0.000043. Regression coefficient β is equal to 0.003995, which could be due to low explanatory power, as seen in the low value of R^2. As observed from Table 6, the R^2 value is 0.5942, which is an indication of strong explanatory power. Regression coefficient β is -0.0488, depicting the adverse influence of IR on COGR when IR is lagged by up to four (7) years.

Table 5: Regression Results of Second Differences of COGR and IR

Dependent Variable: D(COGR,2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.019822	1.145704	-0.017301	0.9863
D(IR,2)	0.003995	0.092629	0.043128	0.9658
R-squared	0.000043			

Table 6: Regression Results of Second Differences of COGR and IR (IR Lagged by 7 Years)

Dependent Variable: D(COGR,2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.259546	0.967386	-0.268296	0.7904
D(IR,2)	0.170698	0.117861	1.448298	0.1583
D(IR(-1),2)	-0.137181	0.157252	-0.872364	0.3902
D(IR(-2),2)	0.309306	0.201786	1.532839	0.1362
D(IR(-3),2)	-0.196622	0.212126	-0.926907	0.3616
D(IR(-4),2)	0.261474	0.212942	1.227913	0.2294
D(IR(-5),2)	-0.212444	0.196921	-1.078829	0.2896
D(IR(-6),2)	0.131489	0.154913	0.848793	0.4029
D(IR(-7),2)	-0.048840	0.109413	-0.446381	0.6586
R-squared	0.594232			

Discussion

Graphical, correlation and regression analyses show similar results that construction output growth rate and IR in Kenya pull in different directions. Thus, it can be seen in Figure 3 that when IR was very high in 1993, construction output was dwindling. A similar picture was portrayed by a correlation coefficient of r = -0.202 and a regression coefficient (β) of -0.0488. However, these results also show that annual changes in the inflation rate (IR) are not the only

factor contributing negatively towards the growth of the construction industry in Kenya. Therefore, other factors affect the construction industry alongside IR.

Since a construction project does not happen at once, this is the reason for having very minimal effects of IR on COGR in the current year. The effects are felt much later after the rise in inflation rates. This is confirmed by lags of the inflation rate up to seven (7) years. Table 6 gives this picture of IR lagged by up to seven (7) years.

Conclusions

Looking at the trends of COGR and IR in Kenya, an observation is made that when IR goes up, COGR drops. This does not happen spontaneously but gradually. A good example is 1993. During this time, construction industry's growth rate was dropping. Very low construction was happening in the country.

Correlation analysis gave a similar scenario by giving a negative coefficient. This is an indication that the relationship between IR and COGR in Kenya is inverse. The two variables showed that their second differences were stationary, and hence the regression, which was carried out thereafter, was not spurious.

Taking the annual Inflation Rate (IR) and lagging it by one to seven years shows a significant relationship between the annual IR and construction output growth rate in Kenya. This shows the effect that a rise in general prices has on the growth of the construction industry in Kenya.

These findings are logical as investment in the construction industry in Kenya is hindered by the inflation rate (IR). It is therefore notable that the link between the construction market and the financial market in Kenya is seen to be strong, and should therefore inform policy formulation in the country.

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