Int. j. adv. multidisc. res. stud. 2024; 4(4):1157-1163

Received: 05-07-2024
Accepted: 15-08-2024

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

The Inflation Rate and the Prices of Roofing Sheets in Benin City

Bartholomew Obehioye Obaedo
Department of Building, Faculty of Environmental Studies, Ambrose Alli University, Ekpoma, Nigeria

DOI: https://doi.org/10.62225/2583049X.2024.4.4.3164 Corresponding Author: **Bartholomew Obehioye Obaedo**

Abstract

This research aimed to examine the correlation between the inflation rate and the cost of roofing sheets in Benin City to help minimize the negative impact of inflation on the construction sector. The study analyzed the inflation rate and the prices of selected roofing sheets from 2017 to 2022, and the link between the inflation rate and the prices of these roofing sheets was determined using Spearman's correlation coefficient and Regression analysis. Inflation rate data was sourced from the Central Bank of Nigeria, while the prices of the selected roofing sheets were gathered through a market survey. The study found that the inflation rate reached its peak in 2022. Additionally, the prices of the selected building materials showed an increasing trend from 2017 to 2022. Through the percentage deviation of the variables, it was established that a 1% rise in the inflation rate would result in a 5.27% increase in the price of Corrugated Zinc roofing sheet, a 6.79% increase in the price of Corrugated Zinc roofing sheet from Ghana, a 1.40% increase in the price of Shortspan Aluminium roofing sheet, a 3.16% increase in the price of Coloured longspan roofing sheet, a 4.93% increase in the price of Stucco longspan roofing sheet, and a 2.24% increase in the price of Stone coated roofing sheet. Correlation analysis confirmed the existence of a relationship between inflation and the prices of roofing sheets. Furthermore, Regression analysis indicated that the prices of Corrugated Zinc roofing sheets, Corrugated Zinc roofing sheets from Ghana, Shortspan Aluminium roofing sheets, Coloured Longspan Aluminium roofing sheets, Stucco Longspan Aluminium roofing sheets, and Stone Coated roofing sheets would increase by ₦65.73k, ₦57.89k, ₦63.97k, ₦193.2k, ₦286.6k, ₦62 respectively for every unit increase in the inflation rate. It was recommended that the Government should provide subsidies and tax incentives that will promote the local production of roofing sheets to reduce dependency on imports and effects from inflation fluctuations.

Keywords: Inflation Rate, Roofing Sheet, Percentage Deviation, Spearman Correlation, Building Material, Prices

1. Introduction

The economic landscape of Benin City, a bustling urban centre in Nigeria, has been significantly influenced by fluctuations in inflation rates. One of the critical sectors affected by these economic shifts is the construction industry, particularly the roofing sheet market. Roofing sheets, essential for residential and commercial buildings, have seen varying price trends that mirror the broader economic conditions. Roofing sheets, made from materials such as metal, are vital for protecting structures from environmental elements. The prices of these materials are subject to various factors, including raw material costs, manufacturing expenses, and transportation fees. In Benin City, the volatility in roofing sheet prices has raised concerns among builders, homeowners, and investors. This study explores the relationship between the inflation rate and the prices of roofing sheets in Benin City. Understanding this relationship is crucial for stakeholders to anticipate market changes and make informed decisions regarding construction projects. The primary objective of this research is to analyze the trends in roofing sheet prices and their correlation with inflation rates in Benin City over the past decade. The study will also identify the key factors driving these trends and propose strategies to mitigate the negative impacts of inflation on the construction sector. By examining the interplay between inflation rates and roofing sheet prices in Benin City, this study aims to contribute valuable insights into the fields of economics and construction management. The findings could inform policy decisions and help stabilize the construction market, ultimately supporting sustainable development in the region. Additionally, this research could serve as a reference for other regions experiencing similar economic conditions, providing a framework for understanding and addressing the impacts of inflation on construction materials.

Over the years, the construction industry around the globe has suffered from the implications of inflation. This stems from the relation that the fluctuation in inflation rates causes significant variations in the prices of project resources [4].

Musarat *et al*. (2021) recommended that the relationship between the inflation rate and the prices of building materials in various countries be determined to propagate the adoption of a uniform policy that can mitigate the adverse effects of the inflation rate on the construction industry.

This study aimed to investigate the relationship between the inflation rate and the price of roofing sheets in Benin City to aid in mitigating the adverse effects of the inflation rate on the construction industry. Thus, the study set out to examine the trend in the inflation rate and the prices of building materials, examine the behaviour of the inflation rate and the prices of roofing sheets, and determine the relationship between the inflation rate and the prices of roofing sheets within the study area.

The provision of information on the relationship between the inflation rate and the prices of roofing sheets will lead to a reduction in poverty levels courtesy of policies, promote planning, which will encourage economic growth, help to contain the pressure from inflation, which will promote industry, innovation and infrastructure, contribute to more resilient communities and enable efficient use of resources. These will lead to actualizing Sustainable development goals 1, 8, 9, 11 and 12 (No poverty, Decent work and economic growth, Industry, innovation and infrastructure, Sustainable cities and communities, and Responsible consumption and production), respectively.

Section one of this study presents an introduction, rationale and outline of the study. Section two presents the methodology used. Section three covers Results and discussion. Section four covers the conclusion. Section five covers recommendations.

2. Materials and Methods

There are seven (7) variables in this study: The Inflation rate, which is the independent variable, and the prices of the selected roofing sheets, which collectively form the dependent variables. The methodology utilized was split into parts. The first part was the collection of data from official sources and market surveys. In the second part, the gathered data was assessed to define their behaviour, whether linear or not linear. This is significant because the behaviour of the data will determine the appropriate correlation test [5]. In the third part, the data complied was analyzed by computing each variable's percentage deviation (PD). This will aid in observing the annual change in the variables, and the values will be used for the correlation analysis. Correlation and regression analysis defined the relationship between the independent and dependent variables [5]. Minitab version 17 and SPSS version 29 were used for the data analysis.

2.1 Data Collection and Assessment

The collection of data was carried out for the following variables

1. **Inflation rate:** This is the independent variable. The data for the Inflation rate from 2017 to 2022 was sourced from the Central Bank of Nigeria. Fig 1 shows Nigeria's inflation rate for the period under review.

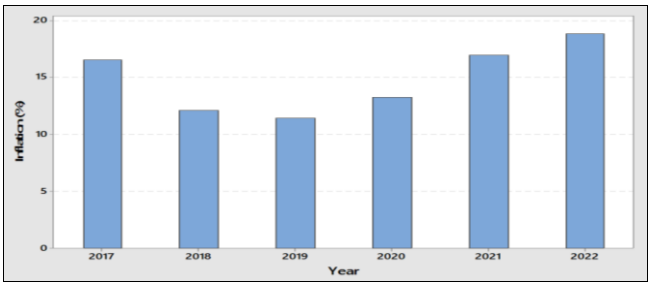

Fig 1: Nigeria's Inflation rate values from 2017 to 2022[8]

2. The price of the roofing sheets (dependent variable) was obtained from a market survey. Data was collected for the following roofing sheets
   1) Corrugated Zinc roofing sheet (CZRS)
   2) Corrugated Zinc roofing sheet from Ghana (CZRSG)
   3) Shortspan Aluminium roofing sheet (SSARS)
   4) Coloured Longspan Aluminium roofing sheet (CLARS)
   5) Stucco Longspan Aluminium roofing sheet (SLARS)
   6) Stone-coated Roofing sheet (SCRS).

The monthly price of each roofing sheet was averaged to get the annual price. The period covered was from 2017 to 2022. The price for a square metre ($1m^2$) was computed from the price obtained during the market survey and presented in Table 1. The data sourced is presented in Table 1.

Table 1: Data on the variables

Year	CZRS(₦)	CZRSG(₦)	SSARS(₦)	CLARS(₦)	SLARS(₦)	SCRS(₦)	Inflation (%)
2017	520.83	312.50	2556.4	2299	1720	2600	16.50
2018	713.73	479.17	2691.73	2450	1810	3200	12.10
2019	868.06	625.00	2872.18	2725	1920	3550	11.40
2020	1041.67	791.67	3007.52	3190	2100	3700	13.25
2021	1234.57	979.17	3187.97	3822	3690	4050	16.95
2022	1523.92	1187.50	3488.72	4500	4300	4200	18.85

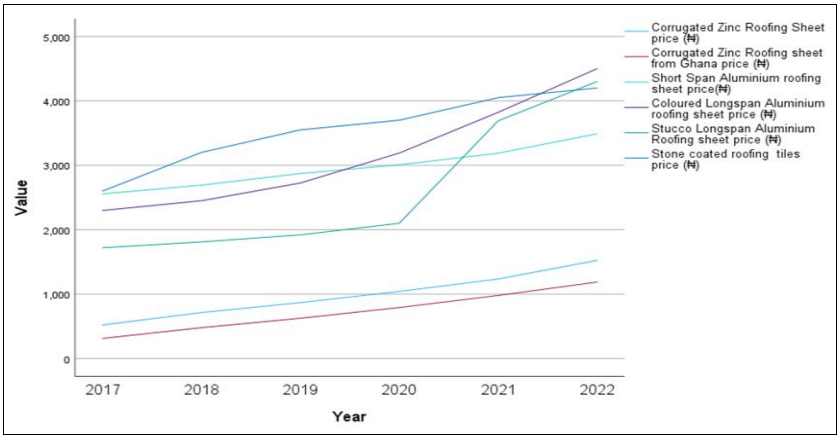

Fig 2: Prices of roofing sheets from 2017 to 2022

2.2 Assessment of the Data's behaviour

The assessment of the data in Table 1 was carried out to determine the data pattern (linear or nonlinear). This information will guide the choice of a correlation analysis. Scatter plots of the data in Table 1 were obtained. These are shown in Figures 3-8. From the figures, the Inflation rate is represented on the *x*- axis, while the prices of the roofing sheets are represented on the *y*-axes respectively. It was observed that all the data associated with the variables of roofing sheets have a nonlinear relationship with the inflation rate. Hence, Spearman's correlation test will be used to examine their relationship.

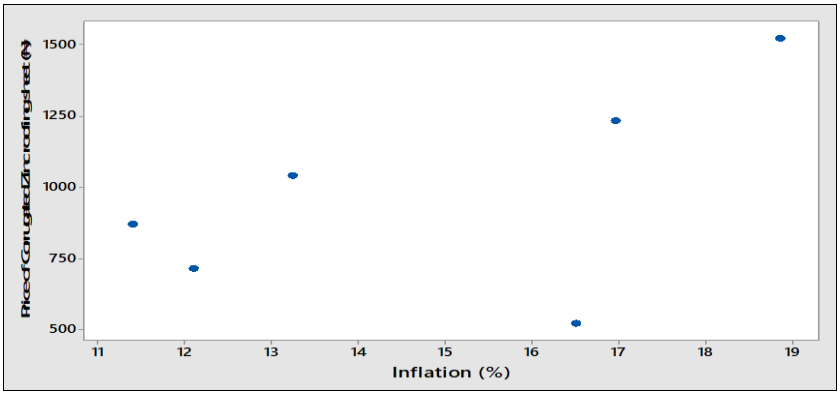

Fig 3: Scatter plot of Corrugated Zinc roofing sheet versus the Inflation rate

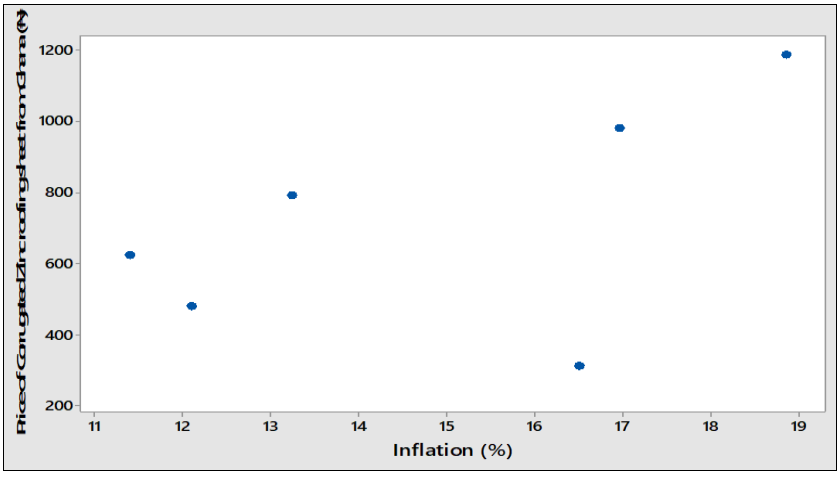

Fig 4: Scatter plot of Corrugated Zinc roofing sheet from Ghana versus the Inflation rate

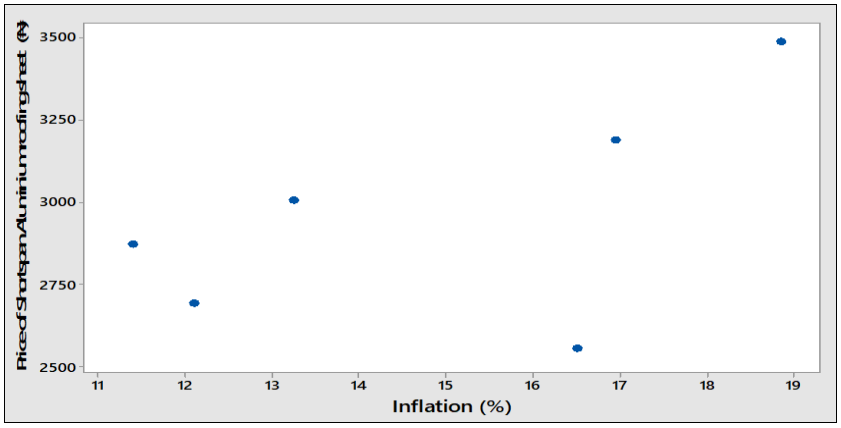

Fig 5: Scatter plot of Short Span Aluminium roofing sheet versus the Inflation rate

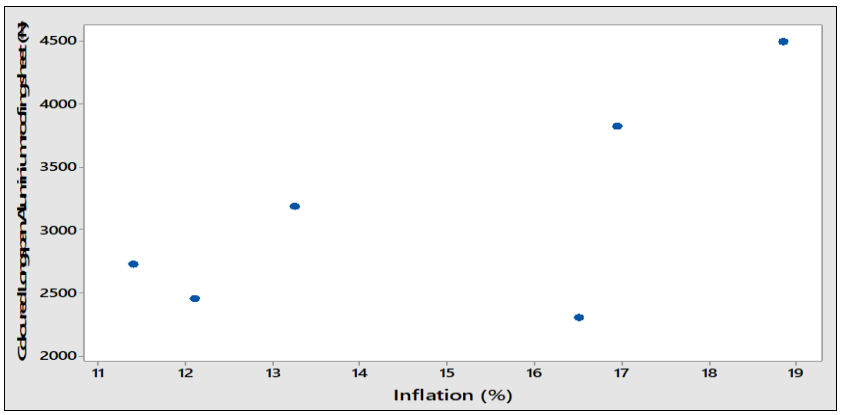

Fig 6: Scatter plot of Coloured Longspan Aluminium roofing sheet versus the Inflation rate

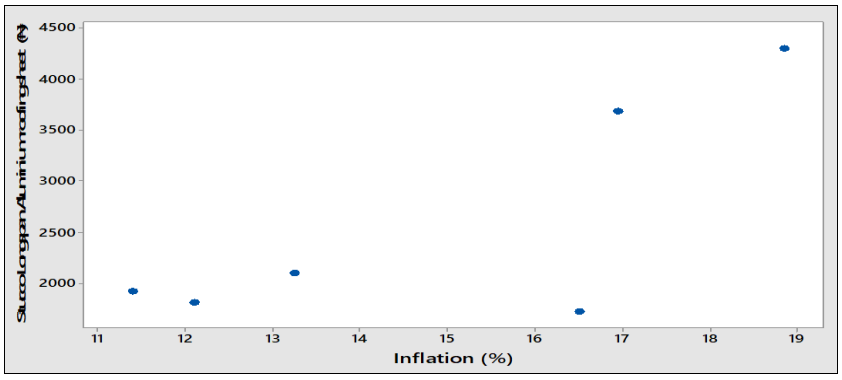

Fig 7: Scatter plot of Stucco Longspan Aluminium roofing sheet versus the Inflation rate

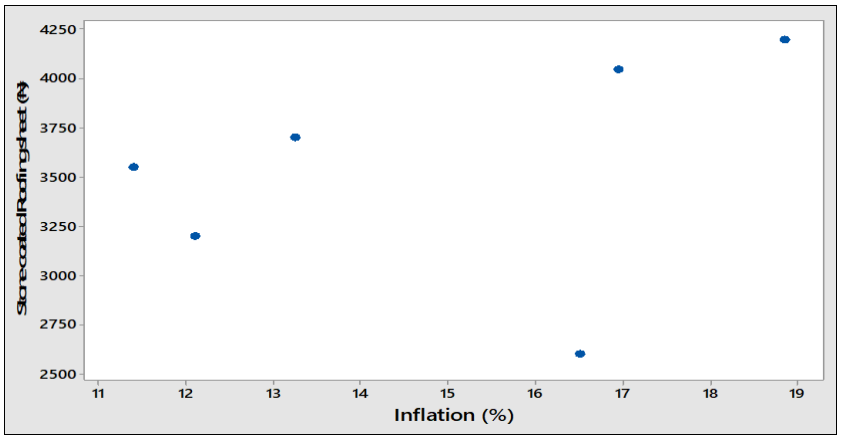

Fig 8: Scatter plot of Stone coated roof tiles versus the Inflation rate

2.3 Analysis of the Percentage deviation

The percentage deviation (PD) is computed by subtracting the current year's value from the previous year dividing by the previous year and multiplying by 100. This is depicted in equation (1).

$$\text{Percentage deviation} = \frac{\text{(Current year - Previous year)}}{\text{Previous year}} \times 100 \quad (1)$$

The percentage deviation is computed for each variable. It can have a positive value or a negative value. A positive value indicates an increase in the value of the specific variable from the previous year, while a negative value indicates a decrease in the value of the particular variable from the previous year. These values will aid in observing the yearly decline or increase in the variables. Using equation (1), values for the percentage deviation of each variable were computed and presented in Table 2.

Table 2: The percentage deviation of the variables

Year	Inflation	CZRS	CZRSG	SSARS	CLARS	SLARS	SCRS
2017-2018	-26.71	37.04	53.33	5.29	6.57	5.23	23.08
2018-2019	-5.78	21.62	30.43	6.70	11.22	6.08	10.94
2019-2020	16.23	20.00	26.67	4.71	17.06	9.38	4.23
2020-2021	27.98	18.52	23.68	6.00	19.81	75.71	9.46
2021-2022	11.17	23.44	21.28	9.43	17.74	16.53	3.70
Average	4.58	24.12	31.08	6.43	14.48	22.59	10.28

2.4 Spearman Correlation test

The Spearman Correlation coefficient was used to determine a simple linear relationship between variables [1]. It has a statistical coefficient (ρ) ranging from -1 to +1. Using the values, a value of +1 connotes an entirely positive correlation. from +0.70 – +0.99 means a strong positive association, from +0.50 to +0.69 means an average positive correlation, from +0.01 to +0.49 means a weak positive correlation and a value of 0 means the relationship is not positive [9]. Meanwhile, the sign also classifies the relationship [5]. The relationship is a direct one if the correlation coefficient is positive, while the relationship is inverse if the correlation coefficient is negative. The PD values were utilized for the correlation analysis, and the results are presented in Table 3.

Table 3: Values of the Spearman Correlation Analysis

S. No	Dependent variable	Spearman Correlation Coefficient (ρ)	Relationship with the Inflation rate
1	Price of Corrugated Zinc roofing sheet	-0.900	Strong negative association
2	Price of Corrugated Zinc roofing sheet from Ghana	-0.700	Strong negative correlation
3	Price of Shortspan Aluminium roofing sheet	-0.100	Weak negative correlation
4	Price of Coloured Longspan Aluminium roofing sheet	+0.9 00	Strong positive association
5	Price of Stucco Longspan Aluminium roofing sheet	+0.900	Strong positive association
6	Price of Stone coated roofing sheet	-0.600	Strong negative correlation

2.5 Regression Analysis

Regression analysis is "a statistical method for analyzing a relationship between two or more variables in such a manner that one of the variables can be predicted or explained by the information on the other variables" [3]. Regression analysis will help to assess the relationship between the variables and aid in making predictions. A simple linear regression equation is depicted in equation (2).

$$Y = a + bX \quad (2)$$

Where

Y - Explanatory or independent variable,
a - The intercept (value of *y* when *x* = 0),
b - Slope of the line,
X - The outcome or dependent variable.

The Minitab software was used to obtain the linear regression line for each building material, and the values in Table 1 were utilized. The results are presented in Table 4.

Table 4: Results from Regression Analysis

S. No	Dependent variable	Parameter	Unstandardized Beta Coefficient (B)	Regression equation
1	Price of Corrugated Zinc roofing sheet	Intercept	8.3	= 8.3 + 65.73 Inflation
		Inflation rate	65.73	
2	Price of Corrugated Zinc roofing sheet from Ghana	Intercept	-129.9	= - 129.9 + 57.89 Inflation
		Inflation rate	57.89	
3	Price of Shortspan Aluminium roofing sheet	Intercept	2018	= 2018 + 63.97 Inflation
		Inflation rate	63.97	
4	Price of Coloured Longspan Aluminium roofing sheet	Intercept	297	= 297 + 193.2 Inflation
		Inflation rate	193.2	
5	Price of Stucco Longspan Aluminium roofing sheet	Intercept	-1663	= - 1663 + 286.6 Inflation
		Inflation rate	286.6	
6	Price of Stone coated roofing sheet	Intercept	2630	= 2630 + 62.00 Inflation
		Intercept	62	

3. Results and Discussion

The analysis will be presented based on the trends in the variables, the percentage deviation of the variables, and the correlation analysis.

3.1 The Trends in the Variables

It can be observed from Figure one that there was a fluctuation in the inflation rate with a downward and an upward trend occurring between 2017 and 2020. The highest inflation rate value was in 2022. However, from Fig 2, the prices of the various roofing sheets were on an upward trend, with the highest prices in 2022.

The prices of the Corrugated Zinc roofing sheet, Corrugated Zinc roofing sheet from Ghana, Short span Aluminium roofing sheet, Coloured Longspan Aluminium roofing sheet, Stucco Longspan Aluminium roofing sheet, and stone-coated roof tiles were presented with the inflation rate. In

Figures 3-8, the scatter plots confirm that each variable displayed a nonlinear behaviour with the inflation rate.

3.2 Percentage deviation of the variables

The annual percentage deviation (PD) was determined for each variable from 2017 to 2022. The positive or negative signs of the PD indicate that the variable's value has increased or decreased from the prior year. A look at the column for prices of roofing sheets reveals the highest positive PD was recorded for Stucco Longspan Aluminium roofing sheet (SLARS), with an increase of 75.71% in 2020-2021. This was followed by corrugated Zinc roofing sheet from Ghana (CZRSG) with an increase of 53.33% in 2017-2018, Corrugated Zinc roofing sheet (CZRS) with an increase of 37.04% in 2017 -2018, Stone coated roofing sheet (SCRS) with an increase of 23.08% in 2017-2018, Coloured Longspan Aluminium roofing sheet (CLARS) with an increase of 19.81% in 2020-2021, and Short span Aluminium roofing sheet (SSARS)with an increase of 9.43% in 2021-2022.

In 2018- 2019, the PD of inflation rate was -5.78% which represented a decrease in the inflation rate. For 2018- 2019, the PD of CZRS was +21.62%, CZRSG was +30.43%, SCRS was +10.94%, SSARS was +6.70%, CLARS was+11.22%, and SLARS was +6.08%. These values represented an increase in the price of the roofing sheets.

In 2021 -2022, the PD of inflation rate was 11.17% which represented an increase in the inflation rate. For the roofing sheets for 2021 -2022, the PD of CZRS was +23.44%, SSARS was +9.%, CZRSG was +21.%, CLARS was 17.74%, SLARS was +16.53, and SCRS was +3.70%. These values represented an increase in the price of the roofing sheets.

From Table 2, when the average PD value for inflation deviated to 4.58%, the average PD values for CZRS, CZRSG, SSARS, CLARS, SLARS and SCRS had risen to 24.12%, 31.08%, 6.43%, 14.48%, 22.59% and 10.28% respectively. Further analysis shows that a 1% increase in the inflation rate will lead to an increase in the prices of CZRS, CZRSG, SSARS, CLARS, SLARS, and SCRS by 5.27%, 6.79%, 1.40%, 3.16%, 4.93%, and 2.24% respectively.

3.3 Correlation analysis

The Spearman correlation coefficients of the dependent variables and their relationship with the inflation rate (Independent variable) are presented in Table 3. A simple linear correlation means there is a relationship between the two variables, which implies when one variable changes, it will lead to a change in the other variable, either by an increase or a decrease [1]. Hence, when the two variables increase and decrease, the relationship between them will be positive. However, when one variable increases with a decrease in the other variable, the relationship between them will be a negative one.

The roofing sheets with the highest correlation coefficient value with the inflation rate are CLARS with $\rho = +0.900$ and SLARS with $\rho = +0.900$, while SSARS has the lowest correlation coefficient with $\rho = -0.100$.

The Spearman coefficient between the inflation rate and CZRS, CZRSG, SSARS, and SCRS were -0.900, -0.700, -0.100 and -0.600, respectively. The prices of CZRS, CZRSG and SCRS have a strong negative relationship with the inflation rate value, while the price of SSARS has a weak negative relationship with the inflation rate value. This implies that an increase in the value of the inflation rate leads to a decrease in the value of the prices of CZRS, CZRSG, SSARS and SCRS, respectively.

The Spearman coefficient between the inflation rate and the following roofing sheets (CLARS and SLARS) are +0.900 and +0.900, respectively. This implies a strong positive relationship between the price of the aforementioned roofing sheets and the inflation rate value, respectively. This means that an increase in the value of the inflation rate leads to an increase in the prices of CLARS and SLARS, respectively.

3.4 Regression analysis

The regression line equation explains the prediction of the variables. Using equation (2), a unit increase in *x* (the independent variable) will result in a change in *y* (the dependent variable). The value of the change in X due to the unit change in Y is restricted to the value of "b", which is the slope of the line.

The regression line equation for the price of a Corrugated Zinc roofing sheet was = 8.3 + 65.73 Inflation, the price of a Corrugated Zinc roofing sheet from Ghana was = - 129.9 + 57.89 Inflation, the price of a Shortspan Aluminium roofing sheet was = 2018 + 63.97 Inflation, the price of Coloured Longspan Aluminium roofing sheet was = 297 + 193.2 Inflation, the price of Stucco Longspan Aluminium roofing sheet was = -1663 + 286.6 Inflation, and the price of Stone coated roofing sheet was = 2630 + 62 Inflation. The regression models indicated that a positive linear relationship exists between the variables, such that as the inflation rate increased, the prices of the roofing sheets increased.

Thus, for every unit increase in inflation, the price of Corrugated Zinc roofing sheet would increase by ₦65.73k, the price of Corrugated Zinc roofing sheet from Ghana would increase by ₦57.89k, the price of Shortspan Aluminium roofing sheet would increase by ₦63.97k, the price of Coloured Longspan Aluminium roofing sheet would increase by ₦193.2k, the price of Stucco Longspan Aluminium roofing sheet would increase by ₦286.6k, and the price of Stone coated roofing sheet would increase by ₦62.

4. Conclusion

This study aimed to investigate the relationship between the inflation rate and the price of roofing sheets in Benin City to aid in mitigating the adverse effects of the inflation rate on the construction industry. The trend in the inflation rate and the prices of the selected roofing sheets from 2017 to 2022 was investigated, and the relationship between the inflation rate and the prices of the selected roofing sheets was determined using Spearman's correlation coefficient and Regression analysis. Data on the inflation rate was collated from the Central Bank of Nigeria, while prices of the selected roofing sheets were obtained from a market survey. Findings revealed that the inflation rate had the highest value in 2022. The prices of the selected building materials had an upward trend in prices from 2017 to 2022. Using the percentage deviation of the variables, a 1% increase in the inflation rate will lead to a 5.27% increase in the price of Corrugated Zinc roofing sheet, 6.79% in the price of Corrugated Zinc roofing sheet from Ghana, 1.40% in the price of Shortspan Aluminium roofing sheet, 3.16% in the price of Coloured longspan roofing sheet, 4.93% in the price

of Stucco longspan roofing sheet, and 2.24% in the price of Stone coated roofing sheet. Correlation analysis indicated the existence of a relationship between inflation and the prices of roofing sheets. Regression analysis indicated that the prices of Corrugated Zinc roofing sheet, Corrugated Zinc roofing sheet from Ghana, Shortspan Aluminium roofing sheet, Coloured Longspan Aluminium roofing sheet, Stucco Longspan Aluminium roofing sheet, Stone coated roofing sheet would increase by ₦65.73k, ₦57.89k, ₦63.97k, ₦193.2k, ₦286.6k, ₦62 respectively for every unit increase in the inflation rate.

5. Recommendations

From the findings, it was recommended that

1. Policymakers should develop policies that consider the operating environment and support the production of roofing sheets to help the construction industry manage inflation-related challenges.
2. Construction businesses should adopt construction management practices that reduce waste and promote the efficient use of roofing sheets during installation.
3. The Government should provide subsidies that will promote the local production of roofing sheets to reduce dependency on imports and reduce the effect from inflation rate fluctuations.

6. References

1. Khawla AA. Spearman's correlation coefficient in Statistical analysis. International Journal of Nonlinear Analysis and Applications. 2022; 13(1):3249-3255.
2. Kar S, Jha KN. Assessing Criticality of Construction Materials for Prioritizing Their Procurement Using Anp-Topsis. International Journal of Construction Management. 2022; 22:1852-1862.
3. Mohr DL, Wilson WJ, Freund RJ. Statistical Methods. 4th ed.: Academic Press, 2021, 301-349. Doi: https://doi.org/10.1016/C22019-0-02521-6.
4. Musarat MA, Alaloul WS, Liew MS. Impact of Inflation rate on Construction project budget: A review. Ain Shams Engineering Journal. 2021; 12:407-414.
5. Musarat MA, Alaloul WS, Liew MS. Inflation rate and labours' wages in Construction projects: Economic relation investigation. Engineering Construction and Architectural Management. 2022; 29(2461-2494).
6. Musarat MA, Alaloul WS, Liew MS, Maqsoom A, Qureshi AH. Investigating the impact of inflation on building materials prices in construction industry. Journal of Building Engineering. 2020; 32.
7. Musarat MA, Alaloul WS, Liew MS, Maqsoom A, Qureshi AH. The Effect of Inflation Rate on CO_2 Emission: A framework for Malaysian Construction Industry. Sustainability. 2021; 13(1562).
8. Central Bank of Nigeria. Inflation Rates (%). Central Bank of Nigeria, 2024. Accessed July 28th, 2024, https://www.cbn.gov.ng/rates/inflrates.asp.
9. Wondimagegn TB, Essubalew TY. Assessing the impact of Cost Inflation on Building Construction Material: A Study in Wolaita Zone, Southern Ethiopia. Journal of University of Shanghai for Science and Technology. 2022; 24(1):339-345.