

Comparative Study of Price Variations of Basic Civil Engineering Construction Materials

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Abstract

A study of varying prices of basic civil engineering construction materials was undertaken. The basic materials considered were two varieties of cement, three types of sand, and different sizes of two types of timber. Prices of these construction materials were collected from local Contractors in Oshogbo region over a period of twenty seven months. The period considered was from January 2010 to March 2012. Variation pattern in the prices was studied on monthly basis. Results indicate that prices of all the basic construction materials follow an annual cyclic pattern. Prices of the two brands of Cement were the same except at months 12, 23 and 24. The prices are stable from April to August of each year (months 4-8, and 16-20). During these periods the price of this material increased by 13.3% from ₦1,500.00 in 2010 to ₦1,700.00 in 2011. There were two rises per annum in the prices of sand. The first rise occurred in March and the second in the following November for sharp and fine sands. Timber prices are relatively stable within 5% variability during the months of November – March and December – March respectively for hardwood and whitewood except types H4 and W1. H4 and W1 prices were the same and they followed the same trend. The trends presented by types H4 and H5, which are same size but different species, are similar, indicating that hardwood specie is not a factor in the price variation of timbers. It can generally be concluded that the prices of the basic construction materials will stabilize during the months of April to August of every year. Although construction activities are light every January, January prices keep increasing from year to year.

Keywords: prices, variation, construction, materials, management, period, cement, sand, timber

1. Introduction

In almost all construction projects, changes or variations are common occurrences during the design and construction phases, (Entrusty Group, 2008). The prices of construction materials fluctuate mainly due to supply, supply environment and the demand for the material for other uses. The prices of sawn wood and other forest products fluctuate mainly due to supply and demand.

The major construction materials in the field of civil engineering include the following:

Cement, Sand (sharp sand, fine/plastic sand), Granite, Hardcore, Reinforcement Bars, Timbers, Structural steel frames.

Construction is a complex process that exhibits a high degree of uncertainty. The following are factors affecting prices of construction materials:

Size of project; Location of the project; Environment of the project; Political climate; Award season; War situation; Economic climate; Exposure of the Contractor; Regional variation; Disparity in pricing – importation.

Ssegawa et al., 2002 indicated that it is hardly possible to complete a project without changes to the plans or the construction process. This makes variation to become so prevalent in construction works. Revay, 2002 stated that this may lead to changes to scope, time, cost and/or quality on most, if not all, construction projects. Various studies have identified variation orders among the causes of project cost and time overruns, which Sterman, 1992 considered as endemic problems in international construction. Tyagi and Kushwaha, 2012 proposed the revision of the price variation clause first in using the price indices to be followed by the use of the revised PVC for updating the rates. Makwana and Pitroda, 2013 used frequency analysis in studying region wise price variation

of construction raw materials. Other workers in this field include Oladapo, 2007; Entrusty Group, 2008; Evija Grege – Staltmane, 2009; Kalu et. al., 2009; Arowosoge et. al, 2011 and Long, 2013.

Generally, it has been estimated that building materials and components constitute between 50 to 60 percent of the total cost of construction. Okupe, 2000, observed that the cost could be about 75 percent in Nigeria. He outlined factors contributing to this to include inadequate infrastructural facilities like bad roads, which may increase the cost of delivery of materials and tariffs charged on the materials that also shoot up the price.

Duration of major Civil Engineering projects on the average is about three years. Within the period of project execution and delivery, major construction materials exhibit price variations. These variations may have a direct impact on the lifespan of the project.

Factors affecting the prices of construction materials vary with the type of construction material under consideration. The materials can be categorized according to the level of local contents and inputs in their production. Cost of production of cement, iron rods and steel frames have low local contents/inputs. Factors contributing to the variation in pricing of these materials in Nigeria include the following:

Cost of production	Impact of production scale	Transportation infrastructure
Regional variation in demand and supply		Disparity in pricing-importation.

Cost of production of sand, granite and timber have high local contents/inputs. Variation in prices of these materials depends on vegetation and climatic factors within the region of the country. They may also be affected by seasonal factors. Aje, 1995 revealed that finishes and substructure are the building elements that attract the highest percentage of variation on building projects. Izekor and Izekor, 2011 revealed that factors that account for variations in the prices of sawn timber in Benin Metropolis, in Nigeria include transportation cost representing 40%, seasonality (42%) and power supply (18%). Variations within an area depends on constraints to delivery within the area, general constraints to delivery within the production center/sector seasons – festival, weather related constraints. The scope of this study is limited to a South Western Nigeria vegetation zone.

2. Materials and Methods

The construction materials considered in this study are as follows:

- 2 brands of Cement, Elephant cement and Dangote cement
- 3 types of sand, laterite, fine sand and sharp sand
- 2 types of timber, hardwood and whitewood

The 2 types of timber are further considered on the basis of the following sizes:

- 25mm x 300mm x 3600mm
- 50mm x 75mm x 3600mm
- 50mm x 100mm x 3600mm
- 75mm x 100mm x 3600mm (50mm x 150mm x 3600mm)

The various types of hardwood are denoted as H1, H2, H3, H4, and H5 and are described respectively as indicated below:

- Type H1** - Harwood (Ayunre, ire, ila, ayo ire) 25mm*300mm*3600mm
- Type H2** – Hardwood (Mahogany, Idigbo, Osun) 50mm*75mm*3600mm
- Type H3** - Harwood (Ayunre, ire, ila, ayo ire, e.t.c) 50mm*100mm*3600mm
- Type H4** - Harwood (Ayunre, ire) 75mm*100mm*3600mm(50mm*150mm*3600mm)
- Type H5** - Harwood (Mahogany, etc) 75mm*100mm*3600mm(50mm*150mm*3600mm)

Types H4 and H5 are of the same size but of different species.

The various types of whitewood are denoted as W1, W2, and W5 and described as indicated below.

- Type W1** - Whitewood (Oro, Opon, Eapu, Ofee) 25mm*300mm*3658mm type prices
- Type W2** - Whitewood (Oro, Opon, Eapu) 50mm*75mm*3658mm type prices
- Type W3** - Whitewood (Oro, Opon, Eapu, Ofee,) 50mm*100mm*3658mm type price

2.1 Data Collection

Monthly prices of the construction materials were collected for the 2 brands of cement, 3 types of sand, and 2

types timbers (of various sizes), from Retail Dealers around Olaiya area in Oshogbo, Osun state. The data collected was for a period of twenty seven calendar months spanning from January 2010 to March 2012.

The prices of the two brands of cement and three types of fine aggregates, sharp sand, fine sand and lateritic soil materials considered in the study are presented in Table 1.

Table 1. Monthly prices of 2 brands of cement (Dangote and Elephant) and 3 types of sand

Year	Month	N th month	Cement Price/Type (₦/bag)		Sand Price / Type (₦/5m ³ Tipper load)		
			Dangote	Elephant	Sharp Sand	Fine Sand	Laterite
2010	January	1	1625	1625	3000	3000	4500
2010	February	2	1625	1625	3000	3000	4500
2010	March	3	1575	1575	3500	3500	5000
2010	April	4	1500	1500	3500	3500	5000
2010	May	5	1500	1500	3500	3500	5000
2010	June	6	1500	1500	3500	3500	5000
2010	July	7	1500	1500	3500	3500	5000
2010	August	8	1500	1500	3500	3500	5000
2010	September	9	1625	1650	3500	3500	5500
2010	October	10	1625	1650	3500	3500	5500
2010	November	11	1700	1700	4000	4000	5500
2010	December	12	1750	1900	4000	4000	5500
2011	January	13	1900	1875	4000	3500	4000
2011	February	14	1900	1875	4000	3500	4000
2011	March	15	1800	1800	4500	4000	4500
2011	April	16	1700	1700	3500	4000	4500
2011	May	17	1700	1700	3500	4000	4500
2011	June	18	1700	1700	3500	4000	4500
2011	July	19	1700	1700	3500	4000	4500
2011	August	20	1700	1700	3500	4000	4500
2011	September	21	1900	1875	5000	4000	5000
2011	October	22	1950	1950	5000	4000	5000
2011	November	23	1950	2000	5000	4500	5000
2011	December	24	2300	2300	5000	4500	5000
2012	January	25	2250	2150	6000	3000	6000
2012	February	26	2150	2150	6000	3000	6000
2012	March	27	1725	1750	6000	3500	6000

Prices of the two types of timber, (hardwood and whitewood) for basic sizes which are used in construction works, denoted as H1, H2, H3, H4, H5, W1, W2, and W3 are shown in Table 2.

Table 2. Monthly prices of wood types

Year	Month	N th month	Price/ Wood Type (₦)								
			H1	H2	H3	H4	H5	W1	W2	W3	
2010	January	1	1300	330	430	660	600	660	200	320	
2010	February	2	1300	330	430	660	600	660	200	320	
2010	March	3	1300	330	430	660	600	660	200	320	
2010	April	4	1350	345	435	690	650	690	230	340	
2010	May	5	1350	345	435	690	650	690	230	340	
2010	June	6	1350	345	435	690	650	690	230	340	
2010	July	7	1350	345	435	690	650	690	230	340	
2010	August	8	1350	345	435	690	650	690	230	340	
2010	September	9	1300	335	430	670	650	670	230	340	
2010	October	10	1300	335	430	670	630	670	200	330	
2010	November	11	1350	345	430	670	630	670	200	330	
2010	December	12	1350	345	430	670	650	670	230	340	
2011	January	13	1350	350	440	700	650	700	230	340	

2011	February	14	1350	350	440	700	650	700	230	340
2011	March	15	1350	350	440	700	650	700	230	340
2011	April	16	1450	380	445	760	700	760	250	350
2011	May	17	1450	380	445	760	700	760	250	350
2011	June	18	1450	380	445	760	700	760	250	350
2011	July	19	1450	380	445	760	700	760	250	350
2011	August	20	1450	380	445	760	700	760	250	350
2011	September	21	1350	360	440	720	700	720	250	350
2011	October	22	1350	360	440	720	680	720	230	350
2011	November	23	1450	380	440	720	680	720	230	350
2011	December	24	1450	380	440	720	700	720	250	350
2012	January	25	1450	400	450	800	700	800	250	350
2012	February	26	1450	400	450	800	700	800	250	350
2012	March	27	1450	400	460	800	700	800	250	350

3. Results and Analysis

3.1 Cement Price Variation

The variation in price of Cement not minding the brand can be seen to follow an annual pattern. The price presents an annual variation. These are shown in Fig. 1.

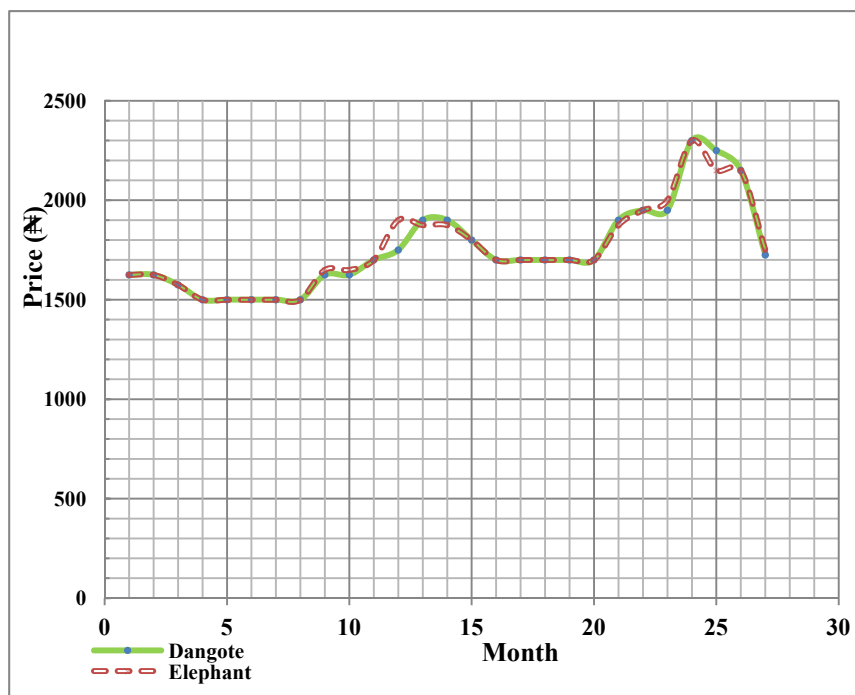


Fig. 1. Variation of Dangote and Elephant cement prices from Jan 2010 - March 2012

Price of Elephant cement has two peaks during the period of study. The first peak was at month 12 while the second was 12 months later at month 24. Price of Dangote cement also has two peaks during the period of study, though it reached its first peak, a month after that of Elephant Cement at month 13 through month 14. This implies that Dangote cement prices had to wait a month after Elephant cement prices. Generally the prices of the two brands of Cement were the same except at months 12, 23 and 24 as shown in Fig. 1. It can also be observed that there is price stability from April to August of each year (months 4-8, and 16-20). During these periods the price of this material increased by 13.3% from ₦1,500.00 in 2010 to ₦1,700.00 in 2011.

3.2 Analysis of Price Variation of Sand

The first eight months of year 2010, showed that from January, the prices of fine sand, sharp sand and laterite rose from ₦3,000, ₦3,000 and ₦4,500 respectively in February by ₦500. This implies a 16.67% increase for the fine and sharp types of sand, and just 11.11% for laterite. These prices remained stable for eight months after which it experienced another rise of ₦500, except that of laterite that was stable for 6 months before the rise of another ₦500 in the following month 9. These are shown in Fig. 2.

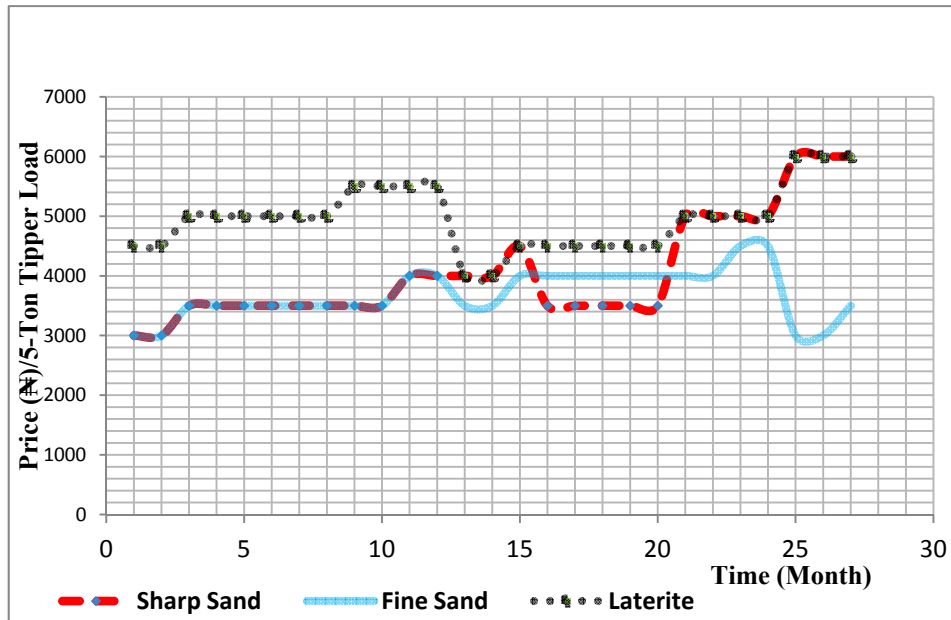


Fig. 2. Price Variation of fine sand, sharp sand and laterite from Jan. 2010 - Mar. 2012

Prices of fine sand and laterite stabilized for 2 and 4 months respectively from November and September to December of year 2010. Price of sharp sand stabilized for 4 months at ₦4,000 from month 11 to month 14 (February 2011) before another ₦500 increase in a unit of 5-ton tipper load. This is followed by a fall of ₦1,000 in month 16 which then stabilized for 5 months from month 16 to 20. This price rose by ₦1,500 in month 21 and stabilized for the next 4 months, another end of year (month 24). It then rose by ₦1,200 stabilizing there till month 27. The price of laterite followed similar pattern to that of fine sand, except in month 24 when price of laterite fell sharply by ₦1,500 from ₦4,500 to ₦3,000.

Generally all the sharp and fine sands and the laterite experienced 5 rises or 4 rises in 2 years at the rate of twice / year. The first rise was observed in March while the second was observed in November for sharp and fine sands. Laterite and sharp sand experienced only one fall in price, while fine sand had two falls during the study period. Prices of these materials can be said to follow an annual pattern of rise and fall dictated by end of year festivity periods, and the level of economic activities within the year using cement price pattern as an indicator of the level of economic activity. Increases are mostly ₦500/5-Ton tipper load considered except after the second year. It is also observed that when the price of cement begins to fall, that of sands begins to rise.

3.3 Analysis of Price Variation of Timber Types, Species and Sizes

The general trend in price variation of hardwood types and sizes except type H3 are noticed during the months of March and April, as indicated in months 3 and 4 and months 15 and 16 respectively. These trends are shown in Fig. 3. April to August experienced stable timber prices. Lower prices are experienced in the months of September and November. Price of timber Type H3 increases steadily at the rate of 0.26% from January 2010 to 7% in March 2012.

Timber prices are relatively stable within 5% variability during the months of November to the following March, as indicated in months 11-15 and 23-27 in Fig. 3, with the exception of type H4. The trends presented by types H4 and H5, which are same size but different species, are similar. This indicates that specie is not a factor in the price variation of timbers.

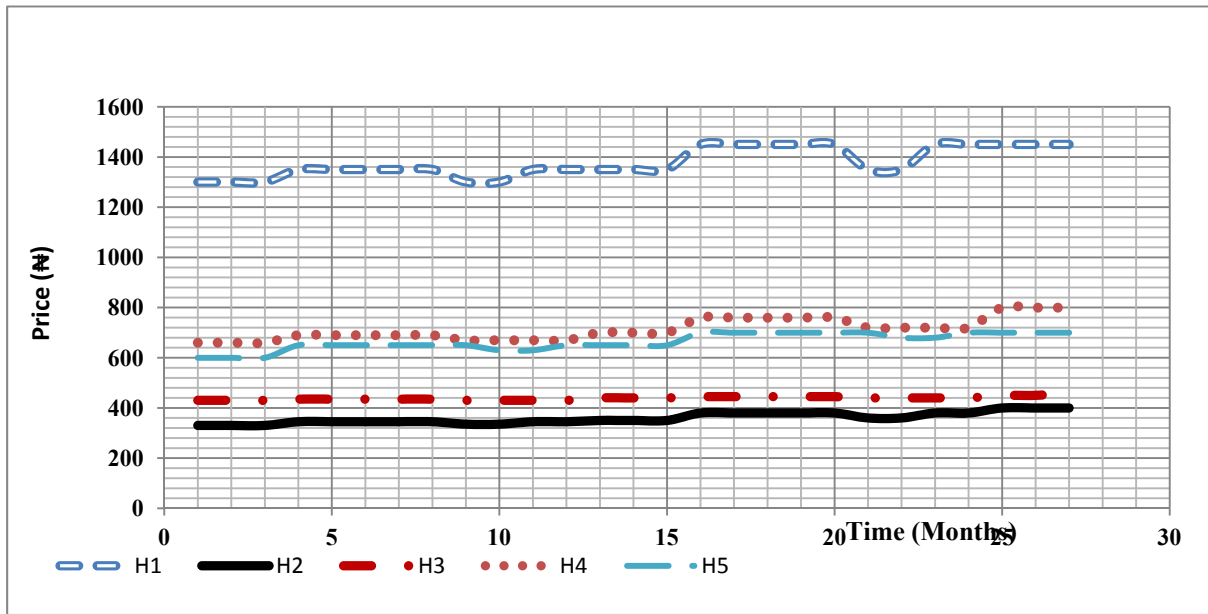


Fig. 3. Variation in prices of hardwood of different species and sizes from Jan. 2010 - Mar. 2012

A general trend of price increase for whitewood types and sizes is noticed between the months of March and April, as indicated in Fig. 4 for months 3 and 4 and months 15 and 16 respectively. The price stabilized for at least five months for type W1 and six months for Types W2 and W3. This implies that the months of April to August experience stable timber prices. Generally, relatively lower prices are experienced in the months of October and November.

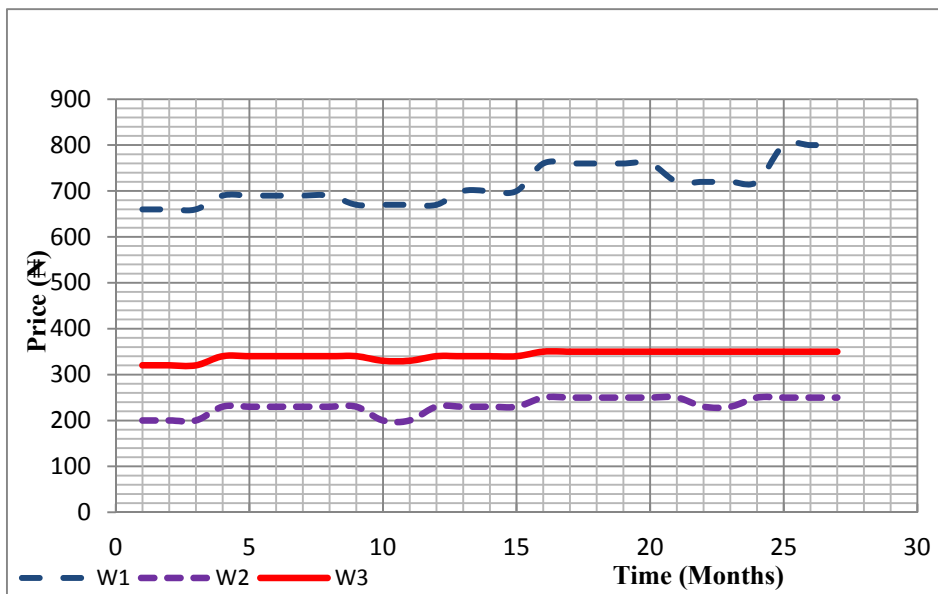


Fig. 4. Variation in prices of whitewood of different sizes from Jan. 2010 - Mar. 2012

Whitewood prices are relatively stable within 5% variability during the months of December to the following March, as indicated in months 12-15 and 24-27, with the exception of type W1.

H4 and W1 prices are the same and they follow the same trend.

Probable reasons for the cyclic trend in the variation of the prices of the basic construction materials are that

more construction works take place during the annual dry season. Most people want to complete especially their building construction works so as to have something to show for the year before it runs out. This makes December the peak of civil engineering construction activities, with associated temporal peak demand for construction materials.

4. Conclusion and Recommendation

Analysis of the price variations for the basic construction materials investigated revealed as follows:

Prices of all the basic construction materials follow an annual cyclic pattern.

By February of each year, the price of cement begins to fall while that of sand begins to rise with the exception of fine sand which had a delay of rising by a month in the third year of study.

Prices of the two brands of Cement were the same except at months 12, 23 and 24 and there is price stability from April to August of each year (months 4-8, and 16-20). During these periods the price of this material increased by 13.3% from ₦1,500.00 in 2010 to ₦1,700.00 in 2011.

Increases in price of sand are mostly ₦500/5-Ton Tipper load except in the beginning of 2012. It can be concluded that there are 2 rises per annum in the prices of sand. The first rise occurred in March and the second in the following November for sharp and fine sands.

Prices of all types of timber except H3, increases by April and stabilizes through August. Lower prices are experienced in the months of September and November for types H1, H2, H4, H5, and W1; and October and November for types W2 and W3. Price of timber Type H3 increases steadily at the rate of 0.26% from January 2010 to 7% in March 2012.

The trends presented by types H4 and H5, which are same size but different species, are similar, indicating that hardwood specie is not a factor in the price variation of timbers.

Timber prices are relatively stable within 5% variability during the months of November – March and December – March respectively for hardwood and whitewood except types H4 and W1. H4 and W1 prices are the same and they follow the same trend.

It can generally be concluded that the prices of the basic construction materials stabilize during the months of April to August of every year. Although construction activities are light every January, January prices keep increasing from year to year.

Considering that price variation of construction materials can be a function of local contents factors, political, festival and weather related factors, it is recommended that more work can be extended to determine the levels at which each factor can affect price variation.

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