

Assessment of the Price Variation of Building Materials for Housing Development in North-Central Nigeria

By

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High cost of building materials has long been recognized as impediment to housing delivery and affordability in most developing countries. Its manifestation is further evident in significant variations in proportions of materials and labour costs in the procurement process of construction elements of building projects. This study employs an informal procurement/pricing process to determine the variation in total price of standardized retail and bulk building materials for housing development in Lokoja and Minna (both in the North Central Nigeria). A market survey of 12 selected building materials for the construction of 2 and 3 bedroom flats was conducted on 214 major distributors and 226 wholesalers and retailers of the building materials in the two study areas. Findings from this present study provide evidence that differences in retail and bulk prices of building materials do not vary significantly across geographical locations. However, property type alone accounts for 89% of the variance in the retail and bulk price of building materials. A plausible explanation for the significant effect of property type is that the prices of building materials seemingly compensate for the additional or extra bedroom or other extra housing attributes resulting from housing units of different size. The results of the empirical analysis further provide evidence that the type of purchase, geographical location and property type do not depend on the effect of the other in influencing the price of building materials for housing development, even at an intra-urban scale.

Keywords: Building materials; Housing development; Property; Price variation; Residential building

Introduction

Building materials are important inputs in housing production process and represent the largest proportion of the total construction cost (Ogini, Ogunbiyi & Balogun, 2014; Okupe, 2000; Onibokun & Agbola, 1990; Oyediran, & Odeniyi, 2008; Mogbo, 1999). The availability, adequacy or otherwise of building materials partly determine the level of housing production as well as the success or otherwise of any housing policies and programmes. In recognition of the indispensable nature of building materials in housing construction process in Nigeria, it was specifically mentioned in section 6.1 of the 1991 National Housing Policy that building materials and its components constitute

50% to 60% of the total construction input in Nigeria. Fluctuating cost of buildings and the unreliability of cost anticipation and prediction leading to unbudgeted increase in construction costs (Amusan, 2011; Juodis & Stalioraitis, 2006; Ujene, Idoro, & Mbamali, 2013) have placed researchers on continuous search for alternative procurement systems, cost estimation/prediction and control methods (Ujene and Idoro, 2015).

A significant number of studies have therefore discussed the price dynamics and problem of building materials for housing development in Nigeria. Ademiluyi and Solanke (1997), Aje (2000), Arayela (2002), Izekor and Izekor (2011), Jinadu

(2004), Ogini et al. (2014), Ugochukwu, Ogbuagu and Okechukwu (2014) represent a good cross-section of studies in this ever growing area of analysis. However, with the exception of few notable studies like Achuen and Ujene (2006), Mogbo (1999) relatively little attention had been given to studying the impact of informal pricing process in the cost variation of standardized retail and bulk building materials for housing development in Nigeria.

The issue of informal procurement has not been addressed fully at intra-urban scale, although Achuen and Ujene (2006) noted that significant difference in material and labour costs in building elements of private and public projects are largely attributable to the procurement process and execution of such projects. Unlike these prior studies, the present study explores this theme with a minor variant. Against the backdrop of the active involvement of the private sector in housing development in Nigeria, the study limit our analysis to the informal procurement and pricing process of elements of building material for low and middle income private housing projects so as to remove extraneous influences (contract inflation, political risk and bureaucratic delay) that are fraught with public project procurements. The fundamental question considered in this study is whether price differential of standardized retail and bulk building materials for private residential development differ across geographical locations in Nigeria. In other words, does the influence of type of purchase (retail or bulk) on the price of building materials depend on location? Other sub-questions necessitating the present study include: Whether the type of purchase (retail or bulk) influences the price of building materials? Does geographical location influence the retail and bulk price of building materials for housing development in North-Central Nigeria.

Against the background, this study employs a comparative approach in the pricing process for Minna and Lokoja - two geographical locations in North Central

Nigeria- to determine the variation in total cost of building materials in large and small building materials purchases where no discount is given. This paper is structured as follows: Section 1 provides the motivation and background for the study. Section 2 and 3 provide methodology for the study and the results. Section 4 is the conclusion based on the empirical results.

Research Method

To assess the price variation of building materials for housing development a multi-stage sampling technique was employed in the selection of the geo-political zone and study locations. This involves a randomized selection of one (1) of the six (6) geo-political zones in Nigeria, two(2) states from the selected geo-political zone and the selection of an urban city- in this case the state capital- in each of the two(2) states on the basis that housing development in Nigeria is more of an urban phenomenon. As such, we undertake the statistical analysis described above, by collecting data from two study areas: Minna and Lokoja which are the state capitals of both Niger and Kogi State in the north-central geo-political zone. Both cities lie approximately 269 kilometres apart and are administrative centres and commercial hubs for two of the six states within the north-central geo-political zone. With close proximity to the Federal Capital Territory (Abuja), both Minna and Lokoja with population of 201,429 and 196,261 (NPC, 2006) respectively have experienced significant rise in population growth and by extension a major wave of both private and public housing development.

The data for this research is primary in nature and involves two stages. The first stage entails the selection of building materials for the study. The choice of the various building materials available for this study for which the market survey was subsequently conducted is first premised on their availability or otherwise in both study areas. The building materials under consideration were then selected based on systematic random sampling from a list of materials schedule required for the

construction of two and three bedroom flats, which are the predominant property types in both locations. The material schedule which was prepared by the Quantity Surveyor was grouped into seven work sections or trades of a typical building: the concrete work, block work, finishing, roof, reinforcement, and plank for form work, window and doors. From each of these sections, the requisite building materials for each of the sections were selected. In the selection of the building materials, twelve items in all were selected from the prepared materials schedule. The selected materials are cement, iron rods, roofing sheets, timber flush door, ceiling boards, nails, sand, gravel, paint, noggins, sandcrete block and strip battens.

The second stage involves the market survey of building materials conducted on 214 major distributors and 226 wholesalers and retailers of the building materials who were selected through systematic random sampling in the two case study areas. In total a survey of 440 respondents categorized on the basis of distributor, wholesaler and retailer in both study locations was conducted in ascertaining the unit price, bulk price as well the minimum quantity of selected building materials so as to determine their price differential. On the basis of this market survey of retail and bulk

price, and haven sought the expertise advice of the Quantity Surveyor, we estimated the retail and bulk cost of building materials for the construction of 2 and 3 bedroom flats respectively. A breakdown of the selected building materials based on the category of respondents (sellers) is presented in Table 1.

Finally, we employed both one-way and two-way Analysis of Variance (ANOVA) to test the conjecture that price of standardized bulk and retail building materials vary by residential property type and geographical locations. As a follow-up to the research questions, two-way ANOVA was used to examine the main effects of: whether the type of purchase (retail or bulk) influences the price of building materials as well as whether geographical location influences the retail and bulk price of building materials for housing development. It was equally employed in examining the interaction effect of the three variables (type of purchase, location and property type) on price of building materials. As homogeneity of variance is one of the stringent assumptions underlying ANOVA, levvene's test for equality of group variance was therefore conducted to determine whether bulk and retail price of the building materials are approximately equal.

Table 1: Breakdown of Building Materials by Category of Sellers

Building Materials	Minna Major Distributors	Minna Wholesalers and Retailers	Lokoja Major Distributors	Lokoja Wholesalers and Retailers	Total
Cement	5	45	9	41	100
Steel bar	3	17	4	15	39
Paint	9	11	4	16	40
Nails	0	15	2	13	30
Timber flush door	15	0	15	0	30
Ceiling board	8	12	6	14	40
Strip Battens	30	0	30	0	60
Roofing sheet	6	14	8	12	40
Noggins	30	0	30	0	60
Total	106	114	108	112	440

Results and Discussions

Market Survey of Bulk and Retail Price of Building Materials in Minna and Lokoja

The starting point is the presentation in Table 2 of the bulk and retail price per unit

of the 12 selected building materials on the basis of the market survey conducted on the 440 respondents in Minna and Lokoja respectively.

Table 2 by extension also illustrates the differences in prices of buildings materials as they are channelled from major distributors (or producers as the case maybe) to the end users (consumers). In regard to this market survey of price, it can be observed that the percentage change in price of all the building materials vary between 0% and 23% in Minna while that of Lokoja is between 0% and 12.5%.

At a disaggregated level, while the retail and bulk prices of materials as sands, battens and noggins remain constant either in or across Minna and Lokoja, differential in prices exist in blocks and other building materials as these materials are channelled from the producers to the end users. Whereas the result portrays that though price differential exist between bulk and retail price of some selected building materials, can such observed differences be due to any unsystematic oddity in the data? This result sets the stage for the statistical analysis of variance in the price of building materials required for the construction of 2

and 3 bedroom flats in the study locations as provided in Table 3.

Analysis of Variations in the Price of the Selected Materials for Housing Development

Before reporting the results of the analysis of variance, Table 3 indicates the descriptive statistics of the price of the selected 12 building materials aggregated for the construction of 2 and 3 bedroom flats in the 2 case study areas. In both study areas, the mean price of the 12 materials needed for constructing a 2 or 3 bedroom flat is N220,230 and N235,860 based on bulk and retail price respectively. While N 575,000 and N 617,500 are the maximum retail and bulk price in the 2 study areas(further descriptive plots are seen in fig 1).

A striking finding from Table 3 indicates that prices of bulk materials in both locations compared to those of retail are relatively homogeneous or similar as evident from the low level of statistical variability depict by the standard deviation.

Table 2: Market Survey of Bulk and Retail Price of Building Materials

Materials	Minna	Minna	Lokoja	Lokoja	Minna	Lokoja
	Retail Price /Unit Price (N)	Bulk / Unit Price (N)	Retail Price /Unit Price (N)	Bulk / Unit Price (N)	Percentage Difference in Price/Unit (N)	Percentage Difference in Price/Unit (N)
Cement	1600	1550	1600	1550	3.20%	3.20%
Iron rod	800(8mm)	650	900 (8mm)	800	23%	12.50%
	1400 (12mm)	1250	1400 12mm)	1300	12%	7.70%
Roofing sheet	6000	5800	6500	6000	3.40%	8.30%
Gravel	12,000	11,000	12,000	11,000	9.10%	4.30%
Paint	600	500	500	500	20%	0%
	(Emulsion) 1800(Gloss)	1700	(Emulsion) 1700 (Gloss)	1650	5.90%	3%
Battens	50	50	60	60	0%	0%
Ceiling board	1450	1300	1350	1200	11.50%	12.50%
Sand	5000	5000	6000	5800	0%	3.40%
Nails	5000	4800	5500	5300	4.20%	3.80%
Noggins	400	400	300	300	0%	0%
Timber flush door	15,000	13,900	15,000	13,900	7.90%	7.90%
Blocks	120	110	120	110	9.10%	9.10%

Table 3: Descriptive Statistics of Retail and Bulk Price for 2 and 3 Bedroom Flats

Price	N	Mean (N'000)	95% CI		Mean SE	Variance	SD	
Bulk Price	48	220.23	171.52	to	24.216	28148.14	167.77	
Retail Price	48	235.86	183.18	to	26.187	32915.97	181.43	
			268.95					
			288.54					
Price	Minimum (N'000)	1st Quartile	Median (N'000)	95% CI		3rd Quartile	Maximum (N'000)	Inter-quartile range (N'000)
Bulk Price	26.0	72.21	186.00	80.00	to	320.83	575.0	248.63
Retail Price	29.0	75.00	180.00	85.20	to	350.00	617.5	275.00
					320.00			
	N	96						

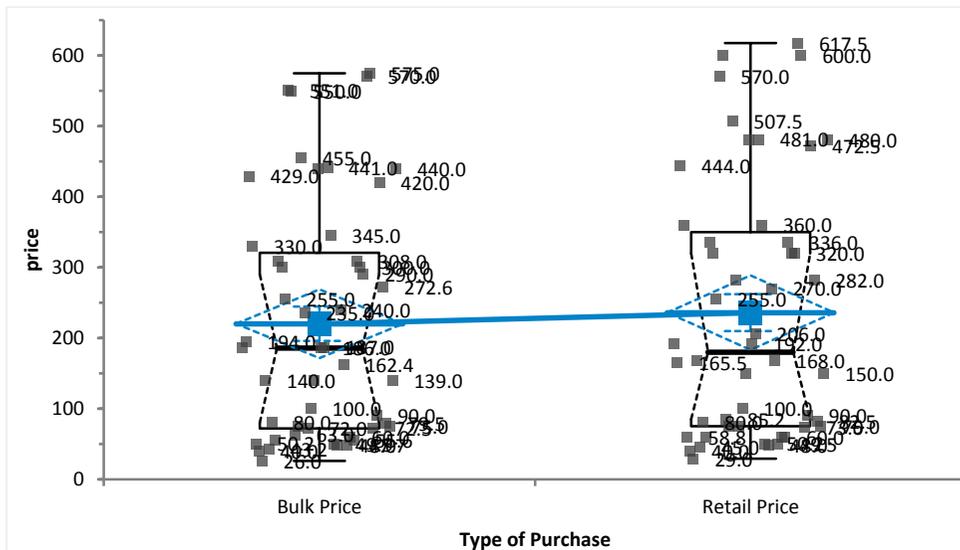


Fig 1: Mean plot and the box plot of the Bulk and Retail Price

Table 4 reports the result of the analysis of variance for retail and bulk price of building materials irrespective of the geographical location. The result implies that differences in retail and bulk prices of building materials do not vary statistically across the study areas. As the F-ratio surpasses (0.19) the tabulated value, when compared with a

5%, F (1, 94), the null hypothesis of differences in retail and bulk price of building materials in Minna and Lokoja is accepted (P-value of 0.6623 > 0.05). An important implication of this finding is that the impact of the price differential between bulk and small quantity purchase is negligible on total cost of construction.

Table 4: One-Way Analysis of Variance on Retail and Bulk Prices of Building Materials for Minna and Lokoja

ANOVA						
Effect	Sum of Squares	Degree of Freedom	Mean Square	F- Ratio	p-value	
Model	5859.38	1	5859.38	0.19	0.6623	
Error	2870013.36	94	30532.06			
Total	2875872.74	95	30272.34			

Given the foregoing result in Table 4 we proceed further to test the main effects of the type of purchase, location and property type on prices of building materials for 2 and 3 bedroom flats and their interaction effect as seen in Table 6. Before turning to the results of the univariate analysis of variance, the result of the Levene's test for homogeneity of variance in Table 5 implies that the null hypothesis of equal variances underlying the analysis of variance has not been violated at 5% level of significance on the basis that the F-test statistic of 1.260 is lower when compared with 5%, F (7, 88).

Table 5: Levene's Test of Equality of Error Variances*

Dependent Variable: Price of Building Material (Retail or Bulk)			
F-Statistic	Degree of Freedom 1	Degree of Freedom 2	Sig.
1.260	7	88	.279

In Table 6, it is interesting to note that unlike a significant relationship which exists between property type and price of building material ($p < .05$), the main effect of type of purchase and geographical location on price of building material is not significant. This means that by controlling statistically for property type, neither the type of purchase (retail or bulk) nor location (Minna and Lokoja) significantly impact on the price of building materials. Isolating these two (2) variables, property type alone accounts for 89% of the variance in the retail and bulk price of building materials. A plausible explanation for the significant effect of property type is that the prices of building materials seemingly compensate for the additional or extra bedroom or other extra housing attributes resulting from housing units of different size.

Table 6: Univariate Analysis of the Main and Interaction Effect of the Three Variables (type of purchase, location and property type) on Price of Building Materials.

Tests of Between-Subjects Effects									
Dependent Variable: Source	Price								
	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Nonce nt. Parameter	Observed Power ^b	
Corrected Model	311487.068 ^a	7	44498.15	1.53	0.17	0.11	10.69	0.61	
Intercept	4992470.60	1	4992470.60	171.32	0.00	0.66	171.32	1.00	
Type of Purchase	5859.38	1	5859.38	0.20	0.65	0.00	0.20	0.07	
Location	5139.23	1	5139.23	0.18	0.68	0.00	0.18	0.07	
Property Type	298061.88	1	298061.88	10.23	0.00	0.10	10.23	0.89	
Type of Purchase * Location	8.17	1	8.17	0.00	0.99	0.00	0.00	0.05	
Type of Purchase * Property Type	689.08	1	689.08	0.02	0.88	0.00	0.02	0.05	
Location * Property Type	1663.33	1	1663.33	0.06	0.81	0.00	0.06	0.06	
Type of Purchase * Location * Property Type	66.00	1	66.00	0.00	0.96	0.00	0.00	0.05	
Error	2564385.67	88	29140.75						
Total	7868343.34	95							
Corrected Total	2875872.74	95							

a. R Squared = .108 (Adjusted R Squared = .037)
 b. Computed using alpha = .05

The descriptive statistics of the ANOVA estimate is shown in Table A1 of the appendix

Moreover, on the basis of the law of diminishing marginal utility, marginal prices of building materials are bound to significantly decrease with a rise in floor area. In addition as the result of the interaction effect is not significant (P-value > 0.05), we can confidently conclude that the effect of either the type of purchase or location or property type does not depend on the effect of the other in influencing the price of building materials for housing development.

Conclusion

The analysis presented in the study has provided insight into the price variation of retail and bulk building materials for housing construction. Prior research on the impact of informal procurement on prices of building materials suggests evidence of price variation in material and labour costs in building elements of private and public projects. Extending this line of research, the findings from this present study provide evidence that differences in retail and bulk prices of building materials do not vary statistically across geographical locations. Overall, the result of the empirical analysis further suggest that the type of purchase or geographical location or property type does not depend on the effect of the other in influencing the price of building materials for housing development even at an intra-urban scale.

However, controlling for type of purchase and location, property type impact significantly on the retail and bulk price of building materials. In this case economic theory support this contention as the marginal price of building materials tends to compensate for the additional housing attributes resulting from different residential property type.

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APPENDIX I:

Table A1: Descriptive Statistics of Retail and Bulk Price of Building Materials by Location and Property Type

Dependent Variable: Type of Purchase	Location	Property Type	Mean	Std. Deviation	N
Bulk Price	Minna	2 Bedroom Flat	164.86	142.67	12
		3 Bedroom Flat	291.64	202.30	12
	Lokoja	2 Bedroom Flat	190.06	146.25	12
		3 Bedroom Flat	296.88	206.71	12
Unit Price	Minna	2 Bedroom Flat	156.83	135.05	12
		3 Bedroom Flat	269.58	188.05	12
	Lokoja	2 Bedroom Flat	177.55	133.95	12
		3 Bedroom Flat	276.97	190.22	12

