DIESEL (AGO) PUMP PRICE INCREASE AND THE PRICES OF SELECTED BUILDING MATERIALS IN NIGERIA 1990 – 2009

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This paper investigates the effect of increase in diesel pump price on the prices of selected building materials in Nigeria. The objective is to establish the statistical relationship existing between diesel price increase and the price of selected basic building materials. Using a simple interactive polynomial method and working at 95% confidence limit a computation was made of the research variables. The result showed a significant relationship between the variables tested. Also the result revealed different degrees of relationships of the variables analyzed. Prices of cement, blocks and paint had linear, quadratic and cubic relationships respectively with increase in diesel price. Coefficients of determination of 96.04% for cement, 96.63% for blocks, 95.76% for iron rod, 94.52% for paints, 90.12% for sharp sand and 96.49% for timber were discovered for these tested variables. The results of the study indicate that the relationships were either linear or non linear in the tested variables. This reveals that diesel price increase will cause the price of building materials to rise at various degrees, thereby exerting an enormous financial pressure on the building developers as a result of its multiplier effects on haulage and production of building material. Therefore government fuel price hike policies should be implemented with caution in order to prevent rise in prices of building materials.

Keywords: building material, diesel price, energy, price hike, road haulage.

INTRODUCTION

Diesel is a refined product obtained from petroleum or crude oil which is a naturally occurring flammable liquid found in rock formation in the earth. Petroleum consists of a complex mixture of hydrocarbons of various molecular weights and other organic compounds (Hyne, 2001). The term "petroleum" was first used in the treatise *De Natural Fossilium* published in 1546 by a German Mineralogist. (Wikipaedia, 2009).

In its strictest sense, petroleum includes only Crude oil but in common usage it includes crude oil and natural gas. Both crude oil and natural gas are predominantly a mixture of hydrocarbons. The proportion of hydrocarbons in the petroleum mixture is highly variable between different oilfields and ranges from as much as 97% in weight in the lighter oils to 50% in the heavier oil and bitumen. The chemical structure of petroleum is heterogeneous, that is, it is composed of hydrocarbons chains of different lengths. As a consequence petroleum may be taken to oil refineries for the separation of the hydrocarbon chemical by distillation and further treatment by other chemical processes so as to be used for a variety of purposes. The most common distillation products of petroleum are fuels, which include ethane, diesel fuels (petro diesel), fuel

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oil, gasoline (Petrol), jet fuel, kerosene and liquefied petroleum gas, (Speight, 1999). The refined oil is moved to the end user through pipelines, by ships and by tanker trucks.

Petroleum in one form or another has been used since the ancient times, and is still very important in the economy of many nations. The rise in importance was mostly due to the invention of the internal combustion engine. More than 4000 years ago asphalt was used in the construction of walls and towers in Babylon. Great quantities of it were found around the River Euphrates (Wikipaedia, 2009). Today, about 90% of vehicular fuel needs are met by petroleum oil. Petroleum's worth as a portable, dense energy source powering the vast majority of vehicles and as the base of many industrial chemicals makes it one of the world's most important commodities. In Nigeria, petroleum industry is the largest industry and main generator of gross domestic product in the nation. Since the British discovered oil in the Niger Delta at Oloibirir in 1956, the oil industry has been marred by political and economic strife largely due to complexity of multinational corporations. Petroleum production and export play a dominant role in Nigeria's economy and account for 90%of her gross earning. Nkoro (2005) observed that increase in fuel prices has worsened the economic crisis in the Nigerian economy. He said that whenever the fuel price increases the GDP tends to decrease. His analysis showed a negative relationship between the fuel price increase and GDP.

GASOLINE AND DIESEL USAGE AND PRICING

The usage pricing of gasoline or diesel results from factors such as crude oil prices, processing and distribution costs, local demand, the strength of local currencies, local taxation and the unavailability of local sources of diesel (supply). Since the trading of fuel is globally the trade prices are similar, the price paid by consumer largely reflects national pricing policy. Some nations such as Europe and Japan impose high taxes on diesel: other, such Saudi Arabia, Venezuela and Nigeria subsidize the cost (Deutsuhe 2007.)

The Cambridge Energy Research Association reported that 2007 had been the year of peak gasoline usage in the United States and that record energy price would cause an enduring shift in energy consumption practices. Despite high demand in the United States and rising fuel costs, gasoline prices are low in the States when compared with most other Western countries. (Campoy 2008)

Other nations with subsidies on fuel include Iran, Egypt, Burma, Malaysia, Kuwait, China, Taiwan, South Korea, Trinidad and Tobago, and Brunei. The purpose of subsidies is to make transport of people and goods cheaper. This has been viewed to discourage fuel efficiency. In some of these countries, the soaring cost of crude oil since 2003 has led to these subsidies being cut, moving inflation from the government debt to the general populace, something resulting in political unrest. Pricing is a federal concern in order to ensure supply and demand is kept within limits to the consumer.

Outcome of diesel price increase on goods and services

The construction industry is a significant and productive sector that plays a vital role to stimulate growth through its linkage with other industries and professional services. Favourable energy prices have helped to mitigate the impact of declining volumes on the operating leverage of the aggregates business. Production costs in the aggregates business are also sensitive to energy prices both directly and indirectly. Production

costs directly affect diesel price through consumption and indirectly by the increased cost of energy related consumables, namely steel, paint and conveyor belts. Changing diesel costs also affect transportation costs, primarily through fuel surcharges in the long-hand distribution network. (Raleigh, 2009).

In Malaysia, the negative impact of the recent price increase of fuel was viewed with concern by the Master Builders Association of Malaysia. Wong (2008) observed that the increase cost of diesel is affecting the construction contractors very deeply. Contractors are sandwiched between the need to fulfil their contractual responsibility to deliver on time at fixed tender price and on the other hand to meeting up with the rising cost of fuel which has become a tightening noose on the cash flow, financing and continuous survivability of the construction industry. Furthermore, he noted that machineries such as Bulldozers, various tower and mobile cranes and off-highway trucks are insatiable users of fuel and observed that this will definitely cut into contractors' profit margins. Kemp (2008) stated that increasing energy prices invigorated the surge in bio-fuels, leading to rise in prices for grains and ultimately boosting demands for natural gas to make fertilizers. Rising gas and energy prices have filtered back into higher costs for aluminium smelters, steelmakers and shipping companies.

Wong (2008) pinpointed that due to fuel increases, there has been a rise in cost of living. According to him transportation of workers has led to extra labour cost. This has resulted in the escalation of site labour cost in recent times. Contractors have considered the effect as a major cost item in their estimates. The increase in diesel price was also observed as having a multiplier effects on other energy sources such as power and gas used in manufacturing of construction materials, thus leading to increase in prices of materials. He further noticed that many contractors would be unable to continue in business if the increase is not kept in check.

Simonson (2008) observed that the American producer price index has gone up 6.5 percent as a result of 24 percent increase in diesel fuel cost. The consequences of this increase was a 5.5 percent rise in prices of steel reinforcement bars including other steel sections, and multiple problems on contractors using diesel to power off-road equipment and construction vehicles and also payment on fuel as result of numerous inflow and outflow of deliveries at a large job site.

Bureau for Labour Statistics (2008) reported that construction materials cost rose by 6.5 percent in the United States due to high prices of diesel fuel. Simonson (2007) stated that increase in diesel fuel has affected highway and heavy construction projects. The effect was noticed in the 2004 producer price index which rose from 5.6 to 14 percent within three years period (2001 to 2004).

PURPOSE OF THE STUDY

The purpose of this study is to examine the relationship existing between increase in price of diesel from 1990 to 2009, and prices of some selected construction material. The objectives then will be to measure statistically the relationship existing between the price of each of these construction materials (cement, 225mm block, Iron rod, sharp sand, paint and timber) with the pump price increase of diesel over the period of twenty years. Also the study further seeks to examine or compare previous analysis (Idiake 2010) carried out on the effect of increase in petrol pump price with that of current study on diesel so as to build up empirical data for policy makers, budget planners and others involved in funding and designing infrastructures.

RESEARCH METHOD

The data used for this study spanned a period of twenty years from 1990-2009, a period which covered both military and civilian administrations. The data were collected from two sources, primary and secondary sources. The data for prices of building materials used in this study were obtained through market survey from dealers in the building materials; this was also complemented by prices obtained from Building Material Price Book (2009). The data for diesel pump price were obtained from secondary sources only provided by CBN and NNPC publications. The data collected as shown in Table 1 were weighted and subjected to simple statistical analysis of polynomial modelling with graphical presentation. From these presentations, discussions and inferences were drawn out for decision making.

Scope of the Research

(i) Factors of production of selected building materials were not considered in this study.
(ii) Variations in production dynamics not taken into account in the analysis of this study.
(iii) Assessment of relationship between variables was simply based on pump price of diesel and market price of building materials.

Assumptions

The following assumptions were made for this research work;

(i) Inflation was considered to be constant throughout the period under review.
(ii) No significant lag effects existed over the period considered for the research work.

DISCUSSION OF RESULTS OF RESEARCH ANALYSIS

Figure 1 shows the graphical presentation of the relationship between increase in price of diesel and price of cement. The coefficient of determination for the analysis is 96.04% with corresponding P-value of 0.018 which is lower than 0.05 level of significance. The R-square value of 0.964 shows that 96.04% variation in the price of cement is accounted for by the increase in the price of diesel. The relationship between the variables establishes a cubic or 3rd degree polynomial model (Eqn.1).

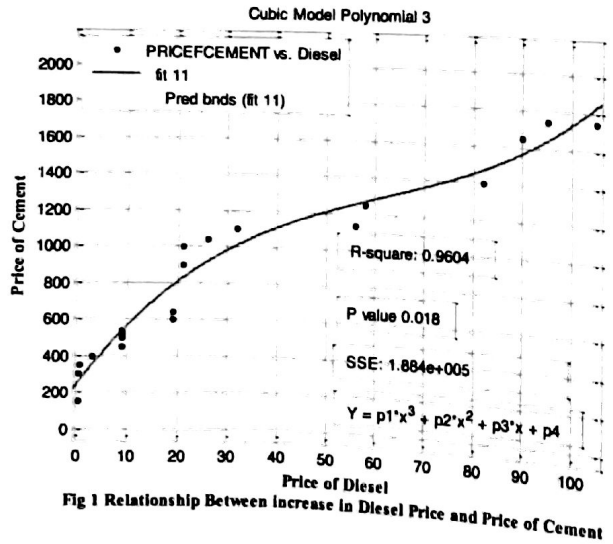

Fig 1 Relationship Between Increase in Diesel Price and Price of Cement

$$\text{Cement Price} = 239.4 + 36.79x - 04793x^2 + 0.002605x^3 \quad (1)$$

From the equation model, the intercept on Y axis is 239.4 and for every increase of one unit of diesel there is an increase of about 36.79 in cement price. But it was observed that for every unit increase in price of diesel raised to the power of two, there is a decrease of about 0.4793 in cement price. Similarly an increase of about 0.002605 occurred for every unit increase of diesel price raised to the third power.

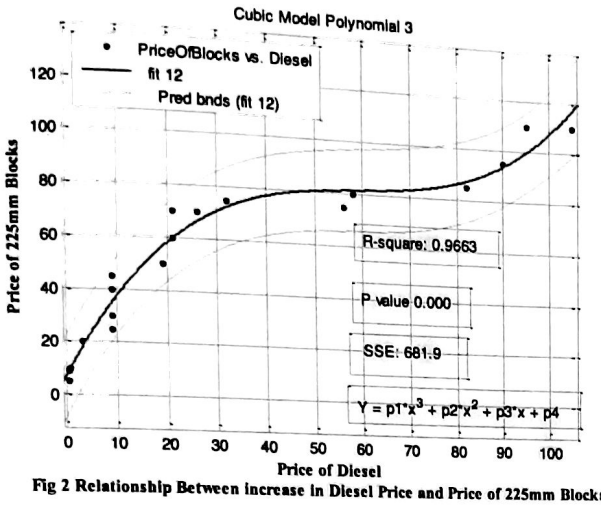

Fig 2 Relationship Between increase in Diesel Price and Price of 225mm Blocks

Figure 2 is showing the relationship between price of 225m block and increase in price of diesel. The coefficient of determination is 96.63% with a P-value of 0.000 which is less than 0.05 confidence limit set for the study. With R-square of 0.9663, it means that 96.63% variation in price of 225mm block is accounted for by the increase in price of diesel. The graphical relationship between the variables tested gives a 3rd degree polynomial model as stated in equation 2.

$$\text{Blocks Price} = 7.263 + 3.576x - 0.05869x^2 + 0.0003291x^3 \quad (2)$$

The model has an intercept of 7.263 on the Y axis and showed that every increase of one unit of diesel there is an increase of about 3.57 in 225mm block price. Also it was noticed that for every unit increase in the price of diesel raised to the second power a decrease of about 0.05869 was experienced. Similarly an increase of about 0.0003291 was observed for every unit increase of diesel price raised to the third degree.

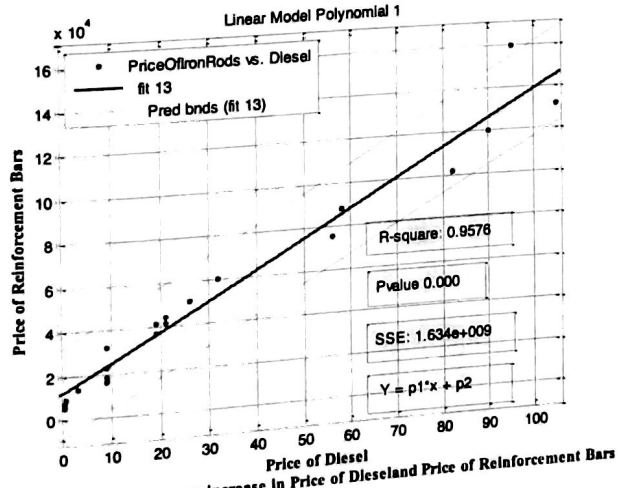

Fig 3 Relationship Between increase in Price of Dieseland Price of Reinforcement Bars

Figure 3 is the result of the analysis for the relationship between prices of iron rod and increase in pump price of diesel. The R-square for the analysis is 95.76% which is a very strong relationship. The P-square is 0.000 which is less than 0.05 level of significance, which means that the results were highly significant. The R-square result shows that 95.76% variation in price of iron rod is accounted for by the increase in price of diesel during the time under review. The variable tested gives a relationship of linear model with a straight line equation (Equation 3). This suggests that as the price of diesel changes, there is a corresponding increase in the price of Iron rod.

Iron rod = $1.201 \times 10^4 + 1269x$ (3)

The model has an intercept of 1.201×10^4 on the Y axis and for every increase of one unit of diesel there is an increase of about 1269 in the price of iron rod.

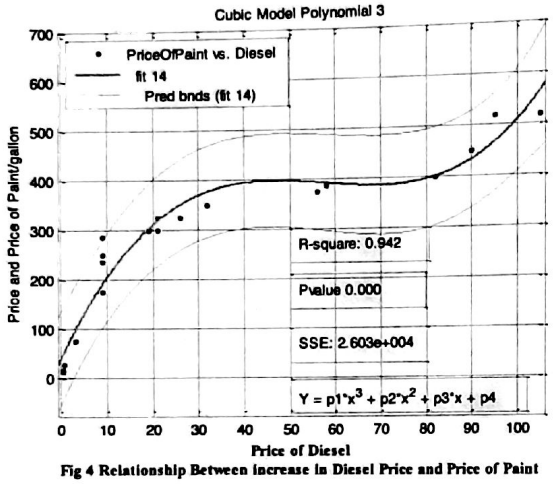

Fig 4 Relationship Between Increase in Diesel Price and Price of Paint

Figure 4 shows the result of the relationship between the market price of paint and increase in pump of diesel. The coefficient of determination from the analysis is 94.2% and has P-value of 0.000 which is less than the allowable level of significance of 0.05, which depicts that the result is highly significant. The R-square of 0.942 suggest that 94.2% variation in the price of paint is accounted for by the increase in changes in price of diesel. These variables, prices of paint and diesel, maintain a 3rd degree polynomial relationship with a model equation (Equation 4)

Paint = $40.44 + 19.79x - 0.354x^2 + 0.002029x^3$ (4)

From this model the intercept on Y axis is 40.44 and for every increase of one unit of diesel there is an increase of about 19.79 in the price of paint. But it was noted that for every unit increase in price of diesel raised to the second degree there is a decrease of about 0.354 in cement price. Comparably an increase of about 0.002029 was witnessed for every unit increase of diesel price raised to the third power.

Figure 5 describes the result of the relationship between the market prevailing price of sharp sand per trip and increase in price of diesel per litre. This relationship has a coefficient of determination of 90.12% and P-value of 0.025 which is less than 0.05 level of significance. The R-square result of 0.9012 shows that 90.12% variation in the price of sharp sand is accounted for by the increase in price of diesel. The graphical relationship in this analysis has a quadratic or 2nd degree polynomial model, which is represented in the following mathematical model (Equation 5)

Sharp Sand = $294.6 + 88.39x - 0.1673x^2$ (5)

The model developed has the intercept of 294.6 on Y axis and subsequently for every increase of one unit of diesel there is an increase of about 88.39 in the price of sharp sand, but a decrease of about 0.1673 was seen in the price of sharp increase in the price of diesel raised to the second degree.

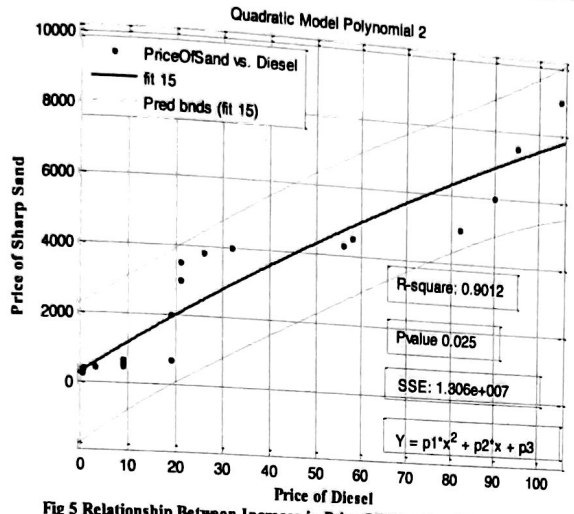

Fig 5 Relationship Between Increase in Price OF Diesel and Price of Sharp Sand

Figure 6 represents the result of regression analysis between the price of Timber and increase in price of diesel per litre. The analysis has the coefficient of determination to be 96.49% and P-value to be 0.009 which is less than 0.05 level of significance. The R-square value of 0.9649 reveals that 96.49% variation in the prevailing price of Timber in the market is accounted for by the increase in the price of diesel. The relationship between the variables shows a cubic or 3rd degree polynomial model with an equation (Equation 6)

$$\text{Timber} = 1.66 + 7.86x - 0.1036x^2 + 0.0005231x^3 \quad (6)$$

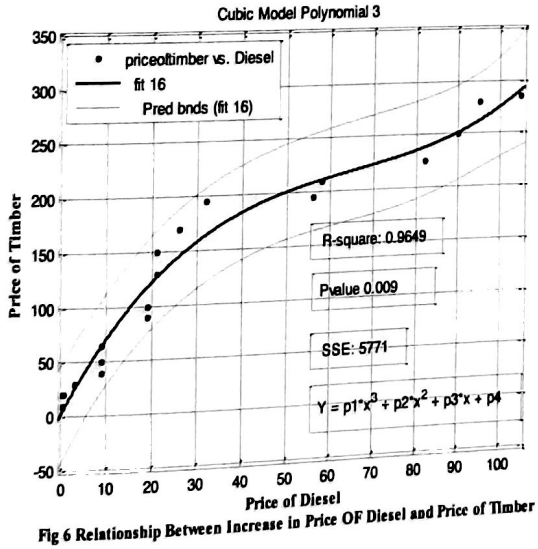

Fig 6 Relationship Between Increase in Price OF Diesel and Price of Timber

The model showed an intercept of 1.66 on Y axis and consequently for every increase of one unit of diesel there is an increase of about 7.86 in the price of timber but it was noted that for every unit increase in price of diesel raised to the second degree there is a decrease of about 0.1036 in timber price. Comparably an increase of about 0.0005231 was observed for every unit increase of diesel price raised to the third

power. Table 1 shows the comparison between the regression analysis results on increase in petrol pump price and diesel pump price on prices of building materials.

Table 1. Comparative Analysis of the Effect of Petrol and Diesel Price increase on Selected Construction Materials

S/N	Building Materials	Regression Analysis Results on increase in Petrol Pump Price from Previous Study			Regression Analysis Results on increase in Diesel Pump Price from Current Study			Remarks
		R-square	P-value	Curve fitting Relationship	R-square	P-value	Curve fitting Relationship	
1	Cement per 50kg	93.92%	0.000	Linear	96.04%	0.018	3rd degree polynomial	Superior R^2 and relationship
2	225mm Sandcrete Block per unit	92.89%	0.002	2nd degree polynomial	96.63%	0.000	3rd degree polynomial	Superior R^2 and relationship
3	Iron Rod per ton	92.76%	0.000	Linear	95.76%	0.000	Linear	Same relationship with minor difference in R^2
4	Paints Per gallon	94.52%	0.002	3rd degree polynomial	94.20	0.000	3rd degree polynomial	Same relationship
5	Sharp Sand per trip	85.54%	0.000	Linear	90.12%	0.025	2nd degree polynomial	Superior R^2 and relationship
6	Timber per length	94.59%	0.015	2nd degree polynomial	96.49	0.009	3rd degree polynomial	Superior R^2 and relationship

Source: Idiake 2010, Journal of Environment Studies University of Lagos and Author's Analysis of Data 2010

It will be observed that from the previous study (Idiake 2010), about 50% of the selected building materials tested, such as cement, iron rod and sharp sand, had linear relationship, while the other 50% are polynomial in nature. In the present study, 15% of the result showed linear relationship, while the remaining 85% revealed polynomial model. The reason for this could be linked to the fact that most of the haulage vehicles are fuelled with diesel. This means that the effects of increase in petroleum products on prices of building materials could be better captured by the analysis in this study, rather than the one done in the earlier study (Idiake 2010). Moreover, the predictive power of the model in the earlier study is between 85.54% and 94.60% but ranges between 90.12% and 96.63% in this present study, which indicates that the present study gives a better predictor of the fuel-material price relationship. This is an improvement to the earlier research done. This also shows that, judging from the dynamics of market forces, the relationships between the variables tested are highly indirectly proportional to one another, indicating a multiplier effects.

CONCLUSION

The result of the study revealed that greater proportion of the relationships existing between the variable tested were non linear in nature except in the relationship between the price of iron rod and that of diesel which was linear in nature. Also the analysis showed a high level of significant relationships between the tested variables. This indicates that the relationships between the variables could be used to predict the prices of the building materials as it affect construction industry. Therefore it is suggested that government fuel price hike policies should be implemented with caution in order to prevent rise in prices of building materials. Secondly, government should stabilise and regulate prices of petroleum products. Thirdly, professional

estimators (Building Planners, Quantity Surveyors, Cost Engineers, etc) should note and consider the predictive power of the model in this study in their preparation of budgets, estimates and tender bids.

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