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Original Research Article

# Asymmetric Cost Behaviour: Evidence from Nigerian Companies

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**Abstract**

*This study examines the consequence of the managerial operating decision on cost behaviour through the lens of asymmetric cost behaviour. Cost behaviour is of considerable significance to managers and analysts as well as management accountants. Traditionally, cost function has been assumed to be always linear in function. However, the contemporary empirical studies refuted the assumption that sometimes costs are asymmetric in function due to resource adjusting decision. Cost asymmetry affects the predictive ability of analysts' and management accountants' measurement. In order to examine the asymmetric cost behaviour, pooled data were collected from companies listed on the Nigerian Stock exchange. The study utilisedthe pooled research design. The study obtained 1,089 firm-year observations for ten years. The hypotheses of the study were tested using pooled ordinary least square regression. Results of the study revealed that operating cost was asymmetric. Operating cost decreased by only 84.1% when 100% decrease was expected. Furthermore, the result showed that asymmetric cost behaviour increases with a positive increase in free cash flow. However, asset and employee intensity do not significantly increase cost asymmetry. Hence, the study recommends that analysts, management accountants and managers should take into consideration that cost behaviour is not always linear in function. Managers may adjust resources based on prudent cost management strategy to avoid a higher degree of cost asymmetry.*

**Keywords:**asymmetric cost behaviour, adjustment cost, asset intensity, free cash flow, employee intensity**.**

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## 1. INTRODUCTION

Providing improvedproducts and customer services are constantly difficult due toglobal competition, rapid changes in manufacturing and information technology, the pressure to adopt high ethical standards, changing product life cycles, customer orientation, and focus on value creation. Such improvements include the development of a reliable information system that allows managers to track and manage costs and to increase production efficiency. The success of a business in one part is critically dependent on the managerial ability to assess, and control product costs realistically.This is perhaps one of the most critical assessment a manager must make. Managerial accounting techniques that are used in evaluating the viability of business activities basically depends on estimating and forecasting thestreams of outflowsas costs and inflow as revenues, ofwhich understanding how cost behaves in response to change in activity is fundamental.

Therefore, understanding cost behaviour is at the core of decision making such as planning and control, performance evaluation, cost allocation, earnings forecast and product pricing. Deloitte (2016) in a survey report of 210 senior executives of US-based Fortune 1000 companies, found that the poor understanding of cost behaviour represents a major obstacle to effective cost managementin this 21st century. This could be attributed to the rapid changes in technology, dynamic economic challenges, and globalisation that may have a direct impact on the conventional cost management strategies.

Cost analysis involvesin-depth analysis of costs down to the specific types of cost and their unique attributes and reaction to activity levels. There are a handful of researches (Ibrahim &Ezat, 2017; Banker &Byzalov, 2014; Kama & Weiss, 2013; Anderson &Lanen, 2009; Anderson, Banker &Janakiraman, 2003) that advanced evidence that costs do not always behave symmetrically to changes in the activity levels as predicted by the conventional cost behaviour theory. Anderson, Banker and Janakiraman (2003), Cooper and Kaplan (1998), and Noreen and Soderstron (1997) empirically found evidence supporting the asymmetric behaviour of cost (sticky and anti-sticky). They found that the magnitude of change in costs does not only depend on the change in the activity levels but also in the direction of increase and decrease. The existence of asymmetric cost behaviour (also known as “sticky” cost behaviour) threatens the managerial ability to

predictand control costs as well as forecasting earnings.

Empirical studies like Ibrahim and Ezat (2017), Kamaand Weiss (2013), and He, Teruya, and Shimizu (2010) and Anderson, et al. (2003) examined Asymmetric Cost Behaviour (ACB) models using single cost driver – sales. These and many more prior empirical studies could not clearly explain whether cost stickiness is as a result of managerial discretionary resource adjustment during change in activity levels (Anderson et al., 2003) or driven by factors like cost structure and demand uncertainty (Kwon, 2019; Balakrishnan, Labro, Soderstron, 2014). This study expanded the single independent variable model by adding threeadditional cost driver activities, which is free cash flow as a measure for managerial incentives,employee intensity and capital intensity. This study presumed that between periods, managerial incentives, employee intensity, and assets intensity are cost factors that can influence cost behaviour to be asymmetric.

The primary objective of this study was to investigate from companies quoted on the Nigerian Stock Exchange (NSE), the determinants of asymmetric cost behaviour. The specific objectives are to: examine whether asymmetric cost behaviour is related to only volumes of the activity or also related to other factors likeassets intensity, employee intensity and free cash flow.Operating cost (OC) was used as a proxy for costs because of its critical position in cost control and directly related volumes of activity.In the profit function of the sampled firms, OC constituted about29.6 % of the sales revenues.

Following the introduction, the rest of the paper is structured as follows: section two present literaturereview. Section three focuses on methodology, with emphasis on model development and specification. Section four addresses estimation result and discussion of findings. Section five presents the conclusion and recommendation.

## 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

In this section, we reviewed the concept of asymmetric cost behaviour, the theoretical literature and empirical literature and the hypotheses development.

### Concept of Asymmetric Cost Behaviour

Costs are basically incurred because of the resources used in the productionof goods and services. Traditionally, these costs are divided into fixed costs (incurred before actual activity take place and does not change with the level of activities over a short period) and variable costs (incurred when actual activity takes place and varies with changes in activity levels). The knowledge of how costs respond to different levels of activity or volume is known as cost behaviour. Traditionally, cost behaviour assumes a mechanistic relationship between cost and its drivers. Therefore, the concept of cost behaviour explains the relationship between costs and activities and by extension, revenue (sales volume). According to Bornemann (1945), the study of cost behaviour is significant because of its critical role in the determination of the most effective adjustment of activities of an enterprise concerning its environment. This particular view of the importance of studying cost behaviour is more valid now due to rapid changes in the business environment that can erode revenue through costs if care is not taken. Cost behaviour was identified as a factor that affects the volatility of earnings through its effect on the accuracy of earnings forecast (Weiss,

2010). This means that the traditional investigation of cost behaviour involved the measurement of the relationship between costs and outputs within the organisation's operations.The point is that volume of activity was traditionally recognised as the only cost driver. This view failed to recognise the role of management decision about resource adjustment in cost behaviour when activities changes.Empirical studies revealed that the interaction of managerial decisions about adjusting resources when activities change led to asymmetric cost behaviour (Anderson et al., 2003).

Cost function is at the foundation of understanding asymmetry in cost behaviour. Conventionally, cost function assumes a linear and proportional relationship between costs and cost drivers.It means that the correlation between costs and volume of activitiesare symmetric for volume increase and decrease. However, the contemporary cost management studies revealed that managerial operating decisions cause some costs as a response to various constraints such as decrease in demand, excess capacity and resource adjustment costs(Banker et al., 2018; Subramaniam & Watson, 2016).

Asymmetric cost behaviour refers to both sticky and anti-sticky cost behaviour. Asymmetric cost behaviour is the failure of cost behaviour to follow the traditional assumptions of proportional responsiveness to changes in the volume of activity resulting in stickiness and anti-stickiness. "Costs aresticky if the magnitude of the increase in costs associated with an increasein volume is greater than the magnitude of the decrease in costs associatedwith an equivalent decrease in volume" (Anderson et al., 2003, p48). Anti-sticky cost is when the magnitude of decrease in cost associated with a decrease in volume of activity is greater than the magnitude of increase in cost with an equivalent increase in activity (Weis, 2010). Empirical research confirmed that the decline in costs is smaller for decreasing inactivity than the rise in costs for increasing activity levels for the same proportion of change (Gunder, Riehl&Robler, 2014; Anderson et al., 2003). Noreen and Soderstrom (1994) empirically tested whether costs are ~~really~~ strictly proportional to activity in specific industries. They used data collected from the Washington State Department of Health for about 100 hospitals budgeted data for 1989 and 1990. The regression result showed that average cost decreases as activity level increases. This implies that costs are not strictly proportional to changes in activity as posited in accounting text. Following the argument that costs are not driven by volume alone, Banker, Potter, and Schroeder (1995), empirically validated the claim by testing whether overhead costs are driven by volume or manufacturing transactions. The manufacturing transactions are logistical, quality, balancing (purchasing and production personnel) and change (number of engineering change over). The cross-sectional data collected from 32 manufacturing companies were subjected to regression analysis. The study found that the measures of manufacturing transactions explain most of the variation in overhead costs.

The Sticky Costs theory postulates an explicit role of manager's involvement in affecting cost behaviour. Cost changes resulting from their deliberate decisions on adjustment ofcommitmentresources. Managers maintain idle resources after sales volume declines, and as a result,costs decrease less with equivalent decreases in the volume of activities than rising with

increases.The deliberate managerialdecisions to retain some unused (slack) resources lead to the disturbance of the traditional symmetric changes in costs.

Balakrishnan, et al. (2004), Weiss, (2010), and Banker, et al., (2013) noticed that in some cases (e.g. when afirm experience excess capacity),the cost response in an activity level decrease is greater than in the case of an activityincrease. Anderson et al.(2003) suggested differential slopes that are based on whether an activity is increasing ordecreasing. When activity decreases, the slope is smaller in the case of sticky cost behaviour and larger in the case of Anti-Sticky Cost behaviour. The degree of sticky cost behaviour is likely to vary systematically acrossdifferent cost drivers, firms, industries and countries (Banker et al., 2013b; Weiss, 2010). Also, there is a possibility ofno stickiness (presence of cost symmetry) in some cases (Naoum, 2014).

**Theoretical Review**

The theoretical foundation for asymmetric cost behaviour in this study was premised on three observations. The first observation is that some costs arise because of a deliberate managerial decision on committed resource adjustment during changes inactivity. The second observation is that some costs cannot be adjusted within the short-run period without incurring resource adjustment costs, like severance payments. The third observation is that some costs are incurred as a result of the adjustment in assets between periods. According to Banker and Byzalov (2014, p. 43), “the interaction of deliberate managerial discretion and resource adjustment costs introduces complex dynamics in the choice of levels”. The complexity arises from the fact that managerial incentives (like meeting earnings target and empire building) and behavioural biases have a direct influence on resource adjustment. In addition, the committed resources of the past period and the expected activities (sales) affect future adjustment costs and managerial biases towards incentives.

This study was anchored two theories, resource adjustment cost theory and agency theory. The theory holds that when shocks (such as change in demand, change in government policies, economic recession, growth, financial crisis) occur, a firm cannot immediately change its factors of production without incurring costs(Lucas, 1967). This means that changes in the prior factors of production or committed resources as a response to shocks would result in some implicit costs. Resource adjustment costs could be labour or capital (Pichetkun, 2012). The labour adjustment costsare costs associated with labour turnover, which could beseverance pay, cost of searching for employees, training costsand cost of demotivation of other employees. Capital adjustment costs could be costs of disposing or installing new equipment, purchasing and delivery of new equipment, and change in capital structure because of financing. As a result, managers may hesitate in cutting costs as a response to change in volume in anticipation of future demand rebound, thereby making costs sticky.

In the period of uncertain future demand, managers must incur adjustment costs for reducing or retaining prior committed resources based on the anticipation of the future and until when there isa certainty of the permanence of the situation. When demand falls, managers are faced with the decision of whether to maintain the level of committed resources and bear the costs of

unutilised capacity or reduce the committed resources and incur the adjustment cost of retrenching, disposal of assets, and costs of replacing committed resources in the future if the demand is restored. Anderson, et al. (2003) suggested that cost asymmetry would be stronger in the circumstance where the assessed probability of a decline in volume (demand) is not permanent, or where costs of adjusting the committed resources are high.

Agency theory posited that managers are predicted to engage in activities that seek to benefit them rather the benefits of the firm's shareholders. Jensen and Meckling (1976, p5) defined agency relationship as a "contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agents".Costs can be asymmetric during a change in activity volume because managers are trying to protect their interest and other incentives that are not tied to cost, like the budget. It could be because managers want to avoid takeover in long-run (i.e. avoidance of bounding costs), they may decide to hold some slack resources in anticipation of better future or refuse to lay-off labour under them to secure more budget and relevance. This could likely lead managers to increase OC costs rapidly when demand increases. An agency problem that is usually referred to in literature is "empire building", which refers to managerial tendencies to grow firm beyond its optimal capacity. This is done by retaining unutilised resources to maximise their ~~personal~~ interest, such as compensation, power, and prestige (Chen, Lu, &Sougiannis, 2012; Jensen, 1986). OC is essential because it captures most of the overheads cost incurred in business operation (such as selling expenses, office payroll, petty expenses, entertainment and travelexpenses), managers with interest for empire building are likely to rapidly increase OC when activities increase than decrease it when activity decreases. This implies that the more influential the agency problem, the higher the asymmetric cost behaviour.

### 2.1 Review of Empirical Studies and Hypotheses Development

In this section, we presented the development of the hypotheses based on the relevant prior empirical studies.

**Asymmetric Cost Behaviour and Changes in Volume of Activities**

The foundation of the asymmetric cost behaviour (sticky cost) was based on the relationship between Selling, General and Administrative (SG&A) cost or OC cost and volumes of activity (sales). Contemporary studies on cost behaviour found that costs increase more with increases in activity than they decreasein response to equivalent decreasesin activities (Anderson et al., 2003). The asymmetric cost behaviour model predicts that costs incurred in a period depend to some extent on the degree of costs incurred in the preceding period (Balakrishnan&Gruca, 2008). The empirical models proxied volumes of activity with sales volume. Asymmetric cost behaviour occurs because there are more restraining forces that act in a slowing downward adjustment of resources than an upward adjustment process. When demand increases, there are tendencies for managers to increase committed resources to accommodate the increase in sales. On the other hand, when demand falls, some committed resources become unutilised and cannot be immediately removed without incurring costs. As predicted adjustment cost theory, costs severance pays when

employees are dismissed and loss of morale for the remaining employees, cost of searching and training of workers when demand is restored, cost of disposing of assets when activities are disrupted and cost of reacquiring assets when demand is restored causes friction in resource adjustment process.

Based on the prediction of the agency theory, a manager may decide to retain unutilised resources to maximise personal utility which may not be optimal from the view of the shareholders (Jensen &Meckling, 1976). Also, managers may not remove unutilised resources in order to avoid consequences like the loss of status andthe pain of dismissing familiar employees (Anderson, et al., 2003). These factors contribute to asymmetric cost behaviour.

The first hypothesis of this study tested asymmetric cost behaviour by comparing changes in OC with sales revenue in periods when sales revenue increases and decreases.
H1: there is no significant difference between an increase in OC when sales revenue increases and decrease in OC when sales revenue decreases.

Prior empirical studies like Anderson, et al. (2003), He, Teruya, and Shimizu (2010), Armanto, Tiono, and Suthiono (2014), Subramaniam and Watson (2016), and Ibrahim and Ezat (2017) found evidencesupporting the sticky cost behaviour. However, studies like Abu-Serdaneh (2014) and Soenjoto and Alfiandri (2019) found evidence of anti-sticky cost behaviour in cost of goods sold which a component of OC. The degree and direction of asymmetric cost behaviour are expected to vary across different cost accounts, industries and countries due to differences in factors like demand stochastics, capital market sophistication and degree of the agency problem.

**Asymmetric Cost Behaviour and Asset Intensity**

This study posits that cost behaviour is the function of various forces, not only the volume of activities which is proxied by sales revenue in previous cost behaviour studies. The determination of the functional relationship between cost behaviour and property, plant and equipment (PPE) or assets provide information for cost forecasts and estimates of alternative costs of providing goods and services. Assets (PPE) are factors of production that are not easily scaled-down when activities drop. Disposing PPE is costly because the company must incur the cost of selling and loss of firm-specific investment associated with the assets (Abu-Serdaneh, 2014). When activity increases, adding physical capital to create more capacity are likely to happen. Thus, the general, administrative and overhead expenses are likely to grow. In the situation of declining activities, some of the costs associated with PPE would be difficult to removedimmediately, thereby making the cost to be sticky. If the excess capacity is easily transferable to alternative uses, the cost asymmetry may not exist, or at least the degree would be less.

Hence, capacity utilisation is a potential and powerful driving force behind business cycles and output elasticity (Wen, 1998). Capacity utilisation and diseconomies of scale both affect cost behaviour which translates into asymmetric behaviour of costs. Assuming sales or demand is certain and constant, if capacity is under-utilised, the period cost of property, plant, and equipment (PPE) at full would have to be absorbed into the few outputs, thereby

reducing the profit by increasing costs of production. In a situation where there is a constant return to scale and full capacity utilisation, any observed asymmetry in cost behaviour could be attributed to opportunistic behaviour. However, when there isan explosion in demand resulting to over-utilisation of capacity, managers would resort in short-run actions like, outsourcing, motivational tools like bonuses and overtime, thereby increasing costs more rapidly and retained the resources to be carried over into the subsequent period. This scenario could lead to a disproportionate response of cost to change in activities in the subsequent period, even when activities fall.

Balakrishnan,et al. (2004) argued that there is a causal relationship between the level of capacity utilisation and managers' response to a change inactivity level. Thus, "if capacity utilisation is high, the firm's managers are not likely to immediately cut resources in response to a decrease in activity level because the decrease may be temporary" (Weiss, 2010, p. 1443). When there is an increase in activity levels under high-capacity utilisation, it is likely to add more capacity to accommodate the increase. Assuming high-capacityutilisation, the response to a decrease in activity level will be smaller than the response to a similarincrease in activity level, resulting in sticky costs. Therefore, higher capacity utilisation leads to higher asymmetric cost behaviour. Based on this assertion, the second hypothesis of this is thus:

H2: assets intensity does notsignificantlyincrease operating cost stickiness.

Karar, Han, and Donata (2018) found that there is a positive relationship between assets capacity utilisation and SG&A cost stickiness. More so, Anderson et al. (2003), Via and Perego (2013) and Anderson, Lee, and Mashruwala (2016) found empirical evidence that firm's physical capital or asset intensity are positively related to asymmetric cost behaviour. This implied that firms with higher assets are predicted to have a higher degree of cost asymmetry.

**Asymmetric Cost Behaviour and Employees Intensity**

Another proposed asymmetric cost driver is the labour resources expressed as employees headcount. Labour resources are associated with adjustment costs such as severance pay of lying-off employees, cost of searching and training new employees when there is a need for additional labour capacity, as well as the cost of demotivation of the reaming employees during activity downturn. It is important to note that labour resources form the companies' intellectual capital without which organisation cannot function well. Therefore, due to the adjustment cost and agency theory factors such as empire building, managers tend to retain some slack labour resources when demand decreases, thereby making costs to be sticky. Based on this view, the next hypothesis was stated.

H3: *employee intensity does not significantly increasethe degree of operating cost asymmetry.*

Bradbury and Scott (2018), Anderson, et al. (2016), Dierynck, Landsman, and Renders (2012) and Anderson, et al. (2003) found corroborating evidence that stickiness increases with increase in employee intensity.

**Asymmetric Cost Behaviour and Free Cash Flow**

According to Jensen (1986), managers are likely to grow their firms beyond optimal size. Firm growth enables managers to have

power by having more resources under their control and increased compensation. Pay-out to shareholders also create another problem because it reduces the resources under managers' control, thereby limiting empire building opportunities and incur more monitoring cost of external sources of capital when the firm must source capital. Therefore, managers that have incentives for empire building can cause their firms to grow beyond optimal capacity according to the availability of free cash flow (FCF). When there is a large amount of FCF, managers may invest more in OCs that is beneficial to their ~~personal~~ benefits. During a period of downturns, managers may hesitate to adjustidle resources related to OC depending on the level of FCF. When activity increases, managers may spend more on OC depending on the availability of FCF. Hence, FCF was predicted to have a direct positive relationship with asymmetric cost behaviour. Thus, the hypothesis for the relationship between OC and FCF is:

H4: The nature of a firm's FCF does not increase the degree of operating cost asymmetry.

Studies that examined the association between asymmetric cost behaviour and FCF such as Zhang (2016) and Chen, et al. (2012) found corroborating evidence that cost asymmetry increases with an increase in positive FCF.

## 3. METHODOLOGY

The researchdesign adopted for this study was the pooled research design, comprised of both time series and cross-sectional data. The pooled design was used because the data were collected from firms with different attributes such as sector, time, and size. The population of the study consist of 171companieslisted on the Nigeria stock exchange (NSE) as at 31st December 2018. Firms were picked into the sample using judgemental sampling technique through filtering of firms that do not have complete data for all the variables and ~~for~~at least three years period within the study period. The study used 1,089 firm years observation out of the 1,217 observations collected. The data of the study were analysed using pooled Ordinary Least Square (OLS) regression.

**Model Specification**

The first model was specified to examine whether OCs of firms in Nigeria are sticky. This was done by examining the differences in the OC function slope between when the volume of activity increases and decreases. The volume of activity was proxied by sales revenue as used by previous studies (Anderson, et al., 2003; Bradbury & Scott, 2018; Han, Rezaee, &Tuo, 2019).

$$log\left[\frac{OC_{i,t}}{OC_{i,t-1}}\right] = \beta_0 + \beta_1\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) + \beta_2 DDum_{i,t} * log\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) + \beta_3 \Delta SALES + \varepsilon_{i,t} \quad (1)$$

The second model of the study tested how the degree of cost stickiness is increased or decreased by asset intensity, employee intensity and free cash flow.

$$log\left[\frac{OC_{i,t}}{OC_{i,t-1}}\right] = \beta_0 + \beta_1\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) + \beta_2 DDum_{i,t} * log\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) * \Delta ASINT_{i,t} + \beta_3 DDum_{i,t} * log\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) * \Delta EMPINT_{i,t} + \beta_4 DDum_{i,t} * log\left(\frac{SRev_{i,t}}{SRev_{i,t-1}}\right) * \Delta FCF_{i,t} + \varepsilon_{i,t} \quad (2)$$

*Where: $OC_{i,t}$= operating costs of firm i at time t.SRev = net sales revenue, DDum= takes the value of 1 when sales revenue decreases, otherwise 0.ΔASINT = change in asset intensity, ΔEMPINT = change in*

*employee intensity, $\Delta FCF$ = change in free cash flow, $\Delta SALES$= change in sale (a control variable) and $\varepsilon$ = error termCoefficient $\beta_1$measures the percentage increase in operating costs as a result of a 1% increase in sales. $\beta_2$ measures the percentage change in OC cost when sales decreases.$\beta_1 + \beta_2 < \beta_1$ = the degree of asymmetry in cost behaviour.*

## 4. ESTIMATION RESULTS AND DISCUSSION OF FINDINGS

Table 1 presents result of the descriptiveanalysis. The data included are:operating cost (OC), sales revenue (SRev), property, plant and equipment (PPE), employee headcount (EMP) and free cash flow (FCF).

**Table1: Summary of Descriptive Statistic**

| Variable | Obs | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| OC | 1089 | 14.607 | 1.897 | 9.82 | 19.44 |
| SRev | 1089 | 15.973 | 1.954 | 8.74 | 20.51 |
| PPE | 1089 | 16.702 | 2.102 | 11.73 | 22.45 |
| FCF | 1089 | 3.775 | 13.819 | -22.43 | 20.04 |
| EMP | 1089 | 5.943 | 1.484 | 1.61 | 9.86 |

**Source: Researchers' Computation 2019**

SRevis about 21.7% of the total assets used in generating revenue. The mean value of sales revenue is 15.97 with a minimum value of 8.73 and maximum value of 20.51. The standard deviation of 1.95 indicated that most of sales revenues were closely clustered around their mean. OC is about 29.52% of sales revenue, and the mean value is 14.61 with the minimum and maximum value of 9.82 and 19.44, respectively. The standard deviation value of 1.90, which is lower than the mean means that most of the values for OC are clustered around the mean. The mean value of PPE is 16.70, with the a minimum value of 11.73 and a maximum value of 22.45. The standard deviation of 2.10 indicated that the values of PPE are not dispersed from the mean. FCF of the sampled observation is -58.16% of sales revenue, and the mean value is 3.78 with a standard deviation of 13.82 which is larger than the mean indicated that most of the FCF value greatly dispersed from the mean. The minimum value of -22.43 and maximum of 20.04 revealed that most the firms had larger negative FCF. The sales revenue to employee ratio is ₦37,314.04 per employee, while the mean value is 5.94, with the minimum and maximum value of 1.61 and 9.86, respectively. The standard deviation value of 1.48, which is below the mean indicated that numbers of employees are fairly clustered around the mean.

**Table 2: Matrix of correlations**

| Variables | OC | SRev | PPE | FCF | EMP |
|---|---|---|---|---|---|
| OC | 1.000 | | | | |
| SRev | 0.899 | 1.000 | | | |
| PPE | 0.927 | 0.872 | 1.000 | | |
| FCF | -0.010 | 0.026 | -0.073 | 1.000 | |
| EMP | 0.819 | 0.769 | 0.771 | 0.037 | 1.000 |

**Source: Researchers' Computation, 2019**

Table 2 above presented the direction of the association between the variables used for this study. The result in table 2 show that there exist a positive and strong association between OC and SRev (OC/SRev = 0.899), TA (OC/TA=0.927) and EMP (OC/EMP=0.819). There exist a negative and very weak association between OC and FCF (OC/FCF= -0.010). A look at the correlation matrix, it suggests that there is a linear association between the dependent and independent variables.

In table 3 below, we observed from the OLS pooled regression that the adjusted R-squared value of 0.787 showed that about 78.7% of the variation in OCs was explained by changes in sales. The F-statistic of 1334.201 and the P-value of 0.000 showed that the model is valid and fit for statistical inference at a 1% level of significance.

In order to ensure that the resultis free from error and misstatement, the classical regression assumption tests consisting of normality test, multicollinearity test and heteroscedasticity test was conducted. The results revealed (see tables in the appendix) that the joint probability of skewness and kurtosis for the residual is normally distributed at a 1% level of significance. This, therefore, the OLS normality assumptions holds, and data are free from the presenceof unequal variance. The VIF test revealed the absence of multicollinearity owing to the mean value of 3.870, which was less than the benchmarks value of 10. Also, the result has no heteroskedasticity problem owing to low chi-square value and insignificant P-value of 0.42(0.5176).

The results of estimating model 1 are presented in Table 3. The coefficient value of $\beta_1$= 0.124(t = 3.83) indicated the operating costs significantly increased 12.4% per 1% increase in sales revenue. The $\beta_2$ = -0.965(t= -17.19) is significantly less than zero, demonstrating asymmetric cost behaviour. Following the cost stickiness hypothesis, the combined value of $\beta_1 + \beta_2$ = 0.841 revealed that OC decreased by only 84.1% as a response to a 1% decrease in sales revenue.

**Table 3: Pooled OLS Regression Result for Model I**

| OC | Coef. | St. Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|---|---|---|---|---|---|---|---|
| $\beta_1$ | 0.124 | 0.032 | 3.83 | 0.000 | 0.061 | 0.188 | *** |
| $\beta_2$ | -0.965 | 0.056 | -17.19 | 0.000 | -1.075 | -0.855 | *** |
| $\beta_3$ | 1.106 | 0.038 | 29.23 | 0.000 | 1.032 | 1.181 | *** |
| Constant | 1.033 | 0.046 | 22.59 | 0.000 | 0.943 | 1.122 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 1.188 | SD dependent var | 1.104 |
| R-squared | 0.787 | Number of obs | 1089.000 |
| F-test | 1334.201 | Prob > F | 0.000 |
| Akaike crit. (AIC) | 1630.015 | Bayesian crit. (BIC) | 1649.987 |

**** p<0.01, ** p<0.05, * p<0.1*

**Source: Researchers' Computation 2019**

Therefore, it is interpreted that there isa significant difference between the increase in OC when sales revenue increases and decrease in OC when sales revenue decreases.The result showed that cost stickiness is prevalent in the data of the Nigerian listed companies. This result agrees with previous empirical studies (Anderson et al. 2003; He et al., 2010;Armantoet al., 2014;Subramaniam& Watson, 2016; and Ibrahim &Ezat, 2017)that operating cost is sticky in response to decrease in activity levels. This indicated that Nigerian managers are pessimistic and reluctant to adjust their excess operating capacity.

Table 4 presents the evidence on how other factors considered by this study as cost drivers increased or decreased the degree of operating cost stickiness. The post-regression diagnostic test (tables 5 to 8 in appendix) revealed that the result for model II has no normality and multicollinearity problem owing to the returned P-value of 0.000 and the mean VIF 1.76 respectively. However, there was an observed problem of heteroskedasticity owing to the large chi-square value and significant P-value of 1216.09(0.000). Therefore, the robust pooled OLS regression was conducted to correct the problem. The summary presented in table 4 is extracted from table 4 and table 9 in the appendix.

**Table 4: Pooled OLS Regression Result for Model II**

| **Varianles** | Pooled OLS | Robust Pooled OLS |
|---|---|---|
| C | 0.543(0.000)*** | 0.670(0.000) |
| $\beta_1$ | 0.502(0.000)*** | 0.380(0.000) |
| $\beta_2$ | 0.004(0.201) | -0.001(0.601) |
| $\beta_3$ | 0.025(0.000)*** | -0.001(0.730) |
| $\beta_4$ | -0.037(0.000)*** | -0.002(0.088)* |
| *R-squared* | 0.719 | 0.343 |
| *F-test and Prob>F* | 694.726(0.000) | 141.180(0.000) |

**** p<0.01, ** p<0.05, * p<0.1*

**Source: Researchers' Computation 2019**

In table 4 above, we observed that R-squared value of 0.343 for robust pooled OLS regression showed that about 34.3% systematic variation in OC is jointly explained by the change in sales, asset intensity, employee intensity and free cash flow. The f-statistic value of 141.180 with its associated P-value of 0.000shows that the Pooled OLS regression modelis statistically significant at <1% level of significance. This means that the regression model is valid andcan be used for statistical inference.

The $\beta_1$(0.543; P=0.000) coefficient of lagged changes in sales indicated that a 1% change in sales revenue explained about 54.3% variation in operating costs. This means that the systematic effect of change in activity levels on OC increased by 41.9% (0.543 – 0.124) when ASINT, EMPINT and FCF are fitted into the cost stickiness model. This is a good indication that adding the three variables to the one variable Anderson, et al. (2003) model significantly explains variation in operating expenses.

In testing the second hypothesis of the study, the $\beta_2$coefficient for ASINT was interpreted. The robust OLS regression result for ASINT in table 4 appears to have a negative and insignificant influence on operating cost, even at a 10% level of significance. Since the result is insignificant, the cost stickiness hypothesis failed to hold. Therefore, we conclude that ASINT does not significantly reduce the degree of operating cost stickiness. The result did not agree with prior empirical studies such as Karar, Han, and Donata (2018), that found evidence that asset intensity is significantly related to asymmetric cost behaviour. In Nigeria, this implies that managers do not consider their level of assets to sales ratio as a factor that determines their behaviour towards adjusting operating cost when activity falls.

The third hypothesis estimated whether employee intensity does not significantly reduce the degree of operating cost stickiness. The $\beta_3$ coefficient for employee intensity revealed a negative -0.001 (0.1%) power of determination as expected but was not statistically significant even at 10% level of significance. Applying the asymmetric cost behaviour test of the hypothesis($\beta_1 + \beta_3 < \beta_1$) indicated that employee intensity does not significantly reduce the degree of asymmetric cost behaviour. This result is contradictory to other prior studies like Bradbury and Scott (2018), Anderson, et al. (2016), Dierynck, et al. (2012) and Anderson, et al. (2003) who found corroborating evidence that stickiness increases with increase in employee intensity. This implies that managers do not consider a reduction in the numbers of employees as a significant adjustment cost factor when activities fall. This cannot be farfetched from the fact that there is no general statutory provision for severance pay or redundancy pay, although pursuant to sec. 20(2) of the Labour Act (LA) 1990 as amended, the minister may make regulations in particular and peculiar cases for the compulsory payment for redundancy. Managers can still easily let go of employees without incurring a significant labour adjustment cost.

The fourth and the last hypothesis of this study estimated whether the nature of a firm's FCF does not reduce the degree of OC asymmetry. Nature of FCF here refers to whether the FCF is positive or negative. The $\beta_4$ coefficient for FCF was -0.002 (P=0.088) and significant at 10% level of significance. Applying the asymmetric cost behaviour test of the hypothesis ($\beta_1 + \beta_4 < \beta_1$), indicatedFCF was significantly related to 0.378 (0.380 – 0.002) asymmetry in operating cost behaviour. This means that OC decreased 37.8% of the 100% decrease expected as a result ofa 1% decrease in FCF. This result corroborated ~~with~~ the result of Zhang (2016) and Chen, et al. (2012) that cost asymmetry increases with an increase in FCF. The interpretation is that managers are likely to invest more in operating cost according to the availability of free cash. It also means that cost symmetry is likely to be weak with negative FCF as managers would quickly adjust slack resources to save cost and improve earnings.

## 5. CONCLUSION AND RECOMMENDATION

This study investigated asymmetric cost behaviour in data collected from companies quoted in NSE. We expanded the Anderson, et al. (2003) single cost driver model to a multiple cost drivers model to include asset intensity, employee intensity and free cash flow. We assumed that overtime, these variables drive cost behaviour because of

managerial intervention in their adjustment when activity changes. The result shows that the cost data from Nigerian firms was sticky. Further, the results confirmed that FCF was significantly related to asymmetric cost behaviour. A positive increase in FCF increases the degree of asymmetric cost behaviour. However, the study found that asset intensity and employee intensity were not found to reduce asymmetric cost behaviour significantly.

As posited by Weiss (2010), the implications of cost behaviour are of primary interest to managers, management accountants, investors, analysts and researchers, among others.The results of the study confirmed the arguments of the asymmetric cost behaviour theory that deliberate managerial decisions and resource adjustment cost theory playa significant role in the determination of cost behaviour. Another implication is that analysts should take into consideration that cost behaviour is not always linear as predicted by the traditional cost model. Therefore, earnings forecast and budget preparation should provide for the asymmetry in the cost behaviour since traditionally, these managerial and analysts activities were built on traditional and always linear cost function assumption. Stakeholders should recognise that free cash flow is significantly related to the degree of asymmetric cost behaviour. Managers with higher free cash flow are likely to engage in empire building through investment in operating cost that benefits them rather than the shareholders, thereby resulting in asymmetric cost behaviour when activities decrease.

Future research may examine asymmetric cost behaviour across sectors or industries as well as decomposing the operating cost into the cost of goods sold and operating expenses. Moreso, future studies in Nigeria may measure employee intensity with labour cost instead of the employee's headcount. It would be useful to investigate the implication of asymmetric cost behaviour on earnings management in Nigerian data since reporting choices to influence the measurement of costs.

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## APPENDIX

**Table 1: Multicollinearity test result**

| VIF | VIF | 1/VIF |
|---|---|---|
| | 4.830 | 0.207 |
| 3.910 | 3.910 | 0.256 |
| 2.860 | 2.860 | 0.350 |
| 3.870 | 3.870 | |

**Table 2: Test of normality**

| Variable | Obs | Pr(Skewness | Pr(Kurtosis) | ----------joint---------- | |
|---|---|---|---|---|---|
| | | | | Chi2 (2) | Prob>chi2 |
| b1 | 1089 | 0.0000 | 0.0000 | 702.28 | 0.0000 |

**Table 3: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity**

Ho: Constant variance

Variables: fitted values of oc

chi2(1) = 0.42

Prob > chi2 = 0.5176

**TEST OF HYPOTHESES TWO TO FOUR**

**Table 4: Pooled Regression Result for Hypotheses two to four**

| oc | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|---|---|---|---|---|---|---|---|
| b1 | 0.502 | 0.029 | 17.03 | 0.000 | 0.444 | 0.560 | *** |
| b3 | 0.004 | 0.003 | 1.28 | 0.201 | -0.002 | 0.010 | |
| b4 | 0.025 | 0.004 | 6.26 | 0.000 | 0.017 | 0.033 | *** |
| b5 | -0.037 | 0.002 | -19.27 | 0.000 | -0.040 | -0.033 | *** |
| Constant | 0.543 | 0.043 | 12.51 | 0.000 | 0.458 | 0.628 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 1.188 | SD dependent var | 1.104 |
| R-squared | 0.719 | Number of obs | 1089.000 |
| F-test | 694.726 | Prob > F | 0.000 |
| Akaike crit. (AIC) | 1930.908 | Bayesian crit. (BIC) | 1955.874 |

**** p<0.01, ** p<0.05, * p<0.1*

**Table 5: Test of Residual Normality**

| Variable | Obs | Pr(Skewness | Pr(Kurtosis) | ----------joint---------- | |
|---|---|---|---|---|---|
| | | | | Chi2 (2) | Prob>chi2 |
| RESD2 | 1089 | 0.0000 | 0.0000 | 702.28 | 0.0000 |

**Table 6: Skewness/Kurtosis test for normality**

| Variable | Obs | Pr(Skewness | Pr(Kurtosis) | ----------joint---------- | |
|---|---|---|---|---|---|
| | | | | Chi2 (2) | Prob>chi2 |
| b1 | 1089 | 0.0000 | 0.0000 | 2478.96 | 0.0000 |
| b3 | 1089 | 0.0000 | 0.0000 | 2541.43 | 0.0000 |
| b4 | 1089 | 0.0000 | 0.0000 | 549.65 | 0.0000 |
| b5 | 1089 | 0.0000 | 0.0000 | 2645.85 | 0.0000 |
| ddum | 1089 | 0.0000 | - | - | - |

**Table 7: Multicollinearity test**

| Variable | VIF | 1/VIF |
|---|---|---|
| b1 | 2.45 | 0.407793 |
| b5 | 2.40 | 0.416119 |
| b4 | 1.10 | 0.908747 |
| b3 | 1.07 | 0.931110 |
| Maen VIF | 1.76 | |

**Table 8: Test of Heteroskedasticity**

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of oc

chi2(1) = 1216.09

Prob > chi2 = 0.0000

**Table 9: Robust regression**

| oc | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|---|---|---|---|---|---|---|---|
| b1 | 0.380 | 0.019 | 20.38 | 0.000 | 0.343 | 0.417 | *** |
| b2 | -0.001 | 0.002 | -0.52 | 0.601 | -0.006 | 0.003 | |
| b3 | -0.001 | 0.002 | -0.34 | 0.730 | -0.004 | 0.003 | |
| b4 | -0.002 | 0.001 | -1.71 | 0.088 | -0.004 | 0.000 | * |
| Constant | 0.670 | 0.025 | 26.78 | 0.000 | 0.621 | 0.719 | *** |
| Mean dependent var | | 1.157 | SD dependent var | | | 0.507 | |
| R-squared | | 0.343 | Number of obs | | | 1086.000 | |
| F-test | | 141.180 | Prob > F | | | 0.000 | |

**** p<0.01, ** p<0.05, * p<0.1*

**Table 10: Variable Definition**

| S/N | Variable name | Variable type | Measures | Appriori |
|---|---|---|---|---|
| 1 | ***Operating Costs (OC)*** | Dependent | Cost of Goods Sold + Operating Expenses | |
| 2 | ***Sales Revenue (SRev)*** | Independent | total sales less sales returns. It is used as a proxy for activity levels. | + |
| 3 | ***Sales Decrease Dummy (SDecr_Dum)*** | Independent | Takes the value of 1 if sales revenue in year t is less than sales revenue in year t-1, otherwise 0. | - |
| 4 | ***Assets Intensity (ASINT)*** | Independent | total assets divided by sales | + |
| 5 | ***Free Cas Flow (FCF)*** | Independent | | + |