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Operational Cost and Accounting Profit: An Heterogeneous Causality based on Wavelet Multiresolution Approach

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Abstract: *In this paper, we investigate the bi-directional causality between operating cost and accounting profit for a sample of Nigerian manufacturing companies over the period 2007 to 2018. We employ maximum overlapping discrete wavelet transform (MODWT) with Dimetriscu-Hurlin Granger no causality method for this investigation. The results show that bidirectional influences exist between operational cost and accounting profit at different timescales. However, much of this influence runs from operational cost to accounting profit in the anticipated short run dynamics. Therefore, we recommend that manager should hedge factor prices.*
Keyword: MRS, MODWT, DH-Granger, Bidirectional Influence

1. Introduction

Over the years, even until now it is difficult to understand the misery in the nexus between operational costs of a company and its profit. Costs are generally loathed, but seemingly inevitable. They must be incurred in order to increase the quality and quantity of a product to be sold, which can consequently lead to a rise in profit margin. However, a suboptimal level could be detrimental to the financial health of a company. The question is what is the optimal level or trade-off between cost and profit? Previous studies have investigated this trade-off or relationship using different approaches. For instance, Rai, Patnayakuni, and Patnayakuni (1997) emphasized that reduction in labor cost is associated with improved performance. Equally, Schuh, Raudabaugh, Kromoser, Strohmer, and Triplat (2008) confirmed that cost reduction is a necessary impetus for increasing value and firm performance. This is in tandem with the phrase "the companies that are effective in reducing costs will have better performance" (see Dyer & Chu, 2003). Performance in this regard may be synonymous to profit or its close proxy return on asset. All of these studies are in support of inverse relationship between cost and performance; either in term of profit or return on asset.

In the light of the study by Oloko, Anene, Kiara, Kathambi and Mutulu (2014), a contradictory evidence was established. The authors stressed that marketing expenses could increase overall cost but it has positive relationship with profit. Ayanda and Tubosun (2012) provided useful evidence in support of Oloko et al (2014). Essentially, the persuasion of this stance was found in the study of Nsour (2013). Therefore, there is a sharp quandary on this ongoing phenomenon- operational cost and profit relationship-that needs fresh investigation probably by using different methods to forestall the inaccuracy of some of the existing studies.

It is pertinent to express a dissatisfaction in the studies by Addae and Nyarko-Baasi (2013), Sharma and Husain (2015), Tomic, Tesic, Kuzmanovic and Tomic (2018), whose investigations are based on one way causation from cost to profit. Since some of these studies were based on pooled and fixed effects regression methods, they were not able to deal with nuisance parameters appropriately. Therefore, the presence of endogeneity could have affected the efficiency and unbiasness of their estimators. So also, the recent technique of evaluating a relationship between variables at different frequencies or scales was employed by any of these studies. Therefore, without equivocation our motivations for this study, are consideration for bidirectional causations and possibility of dealing with heterogenous effects using Dumitrescu and Hurlin (2012) technique, and lastly, consideration for multiscale investigation to confirm the certainty of parameters using the maximum overlapping discrete wavelet transform (MODWT) method. All of these are the driving forces behind this study. In this context, our study is similar to the approach of Gourene and Mendy (2017). The only possible difference is that we use a larger scale. The rest of the paper is organized as follows, literature review, data and method, results and conclusive remarks.

2. Literature Review

Literature reviews on cost-profit relationship are still very scanty. However, we present brief empirical reviews on this relationship and other similar relationships. Berman, Wicks, Kotha, and Jones (1999) conducted a study based on the impact of company–customer relationship on the company's performance indicators. They documented that cost reduction influences performance significantly. Reider (2004) confirmed that cost reduction is an integral part of a company's programmes designed to gain competitive advantage over others. Schuh et, al (2008) provided evidence in support of the preposition of inverse relationship between cost and firm value and performance. Oloko, Anene, Kiara, Kathambi and Mutulu (2014) found that expenditure in marketing enhances market share, opens up new markets and retains them, which promotes the ability to make profits in a company.

In 1988, Morbey documented that above a certain threshold level, cost of R&D has a strong relationship with the growth rate of sales, but weakly associate with profit. While, Branch (1974) suggested that historical profit drives R&D expenditures, on the other hand cost of R & D granger causes expected profit. Ben-Zion (1978) confirmed a positive relationship between profit and R&D expenditures. Karacaer et al. (2009) established a positive and significant relationship among R&D expenses, share earnings and asset profit in the study. Yoon (2004) explained that there is positive connectivity between R&D expenditures and price-cost range. The studies by Lee, Lee and Zahra (1994), Yucel, and Kurt (2003) were among the foremost studies on the cost of R&D- profit relationship. They confirm that the cost of R&D in a company does not have any significant effect on the company's profit. Several other studies such as Ayaydın and Karaaslan (2014), Capon, Farley and Hoenig (1990), Kocamis and Gungor (2014) maintained that a positive relationship exists between cost of R&D and profit.

Wang (2009) provided evidence in support of s-curve relationship between R& D expense and profit. Similarly, Yang, Chiao and Kuo. (2014) demonstrated s-curve relationship exists between expense on R&D and firm's profit. Yeh, Chua, Sherc and Chiua. (2010) documented that positive relationship between the cost of R&D and firm performance continues to a certain threshold, and thereafter the relationship turned out to be negative in the long run. Ciftci and Cready (2011) confirmed that a firm grows simultaneously with positive relationship between R&D expense and expected income, and thereafter, fluctuations set in. Sahar and Yalali (2014) claimed that there is positive effect of R&D expenditures on a firm's profit.

Eljely (2004) using correlation and regression methods confirmed a negative relationship between current ratio and profit. Abor (2004) affirmed that there is a negative significant relationship between profit and inventory and account receivable, analogously, the author documented that non-significant relationship between profit and number of day's accounts payable. Lazaridis and Tryfonidis (2006) found a negative relationship between profit and cash conversion cycle, likewise, the studies by Garcia-Teruel and Martinez-Solano (2007) indicate that negative relationship exists between profit and cash conversion cycle for small and medium sized firms. Roth and Jackson (1995) said that when a company becomes lean with respect to low labor input, has the hidden cost of reduced service quality of such company. In view of this ongoing debate on the issue of cost-profit relationship, we hypothesize that there is bidirectional causations or influences between the two variables. This hypothesis is tested in different scales of frequencies as discussed later in section 3.2 under MODWT.

2. 1 Theoretical Model

Cost-Volume-Profit (CVP) analysis is a managerial accounting technique which looks at the impact of sales volume and product costs on operating profit of a business. It presents how operating profit is affected by changes in variable costs, fixed costs, selling price per unit and the sales mix of two or more products. It need to be stated that the cost-volume-profit analysis makes several assumptions, including that the sales price, fixed costs, and variable cost per unit are constant. Running this analysis involves using several equations for price, cost and other variables.

CVP analysis is concerned with identification of a company's fixed costs, its variable cost per unit, the price of its product and using this data to calculate such measures as Contribution margin, Contribution margin per unit, Contribution margin ratio, Break-even point, target income sales and Margin of safety. Contribution margin is the difference between a company's total revenue and total variable costs. It represents the amount that sales contribute towards fixed costs and profit. Contribution margin per unit is the difference between sales price and variable cost per unit. Contribution margin ratio is the ratio of contribution margin to total revenue. The Break-even point is the sales volume (in units and Naira) at which the company is neither making a loss nor earning any profit. Target income sales is the sales level necessary to achieve a target income. Margin of safety is the percentage (or Naira) by which a company's sales volume exceeds its break-even point. However, the most critical input in CVP analysis is the relationship between different costs and volume that is the categorization of costs into fixed and variable categories.

3.1 Data

Data were collected on two variables (operational cost and accounting profit) from the annual statement of accounts published by 30 randomly selected Nigerian manufacturing companies continuously quoted on NSE over the period 2008 to 2016. Operational cost is a composite cost comprising costs involved in producing the goods sold, market and advertising expenses, and other miscellaneous expenses, while, accounting profit is computed as gross earnings minus explicit costs, therefore accounting profit is actually earning after tax expenses.

3.2 Methodology

Two methodological approaches are adopted in this study. In the first approach, we conduct multiresolution analysis (MRA) using MODWT to decompose the variables of interest individually. This is a multiscale time series analysis that is employed to reduce the noise in time series at different time scales without uttering the original data. In the second approach, we apply the heterogeneous panel granger causality test by DH on each of the time scales after the decomposition experiment. We use a larger scale than Gourene and Mendy (2017) so that to meet up with the number of observation required by DH method.

3.2.1 MODWT

The multiresolution analysis of a discrete time series say Y_t based on MODWT can be expressed as.

$$Y_t = \sum_{j=1}^{J} D_{j,k} + A_{J,k} \ ; j = 1 \ldots J \qquad 1$$

Where Y_t is the time series of interest, $D_{j,k}$ is the short run movements often referred to detailed wavelet coefficient, which represent local fluctuations in the time series at different scale, $A_{J,k}$ is the long run movements or smooth wavelet coefficient that capture the overall pattern of the original series. The two coefficients can be expressed as follows.

$$D_{j,k} = \int Y_t \gamma_{J,K}(t)dt \qquad 2$$

$$A_{J,k} = \int Y_t \phi_{j,k}(t)dt \qquad 3$$

Where γ is the father wavelet coefficient and ϕ is the mother wavelet coefficient. The scaling and translation $\gamma_{J,K}$ and $\phi_{j,k}$ are defined as.

$$\gamma_{J,K}(t) = \gamma\left(\frac{t-2^{jk}}{2^{j/2}2^{j}}\right) \qquad 4$$

$$\phi_{j,k}(t) = \phi\left(\frac{t-2^{jk}}{2^{j/2}2^{j}}\right) \qquad 5$$

We had applied Daubechies' (1992) least asymmetric (LA) wavelet filter of length 8 for the decomposition before utilizing the DH method.

3.2.1 DH MODEL SPECIFICATION.

To iterate we employ Dimitrescu and Hurlin (2012) heterogeneous panel granger causality method to achieve the objective of this study. The DH model is an extension of the time series model of Granger (1969) to panel setting. By definition, the model is expressed as.

$$y_{it} = \alpha_{i1}y_{i,t-1} + \ldots + \alpha_{ik}y_{i,t-k} + \theta_{i1}x_{i,t-1} + \ldots + \theta_{ik}x_{i,t-k} + w_{it} \qquad 6$$

$$x_{it} = \eta_{i1}x_{i,t-1} + \ldots + \eta_{ik}x_{i,t-k} + \rho_{i1}y_{i,t-1} + \ldots + \rho_{ik}y_{i,t-k} + z_{it} \qquad 7$$

$$w_{it} = u_{i1} + v_{it1} \qquad 8$$

$$z_{it} = u_{i2} + v_{it2} \qquad 9$$

Where y is the operational cost and x is the accounting profit, u_{i1} and u_{i2} are specific effects, v_{it1} and v_{it2} are the common errors.

4. RESULTS

In this section, we employ spike graph to examine the distribution pattern of the mean values of operational cost and accounting profit of the selected companies. We subject the decomposed series to unit root test and then conduct DH granger causality test in each case. The spike is reported in figure 1.

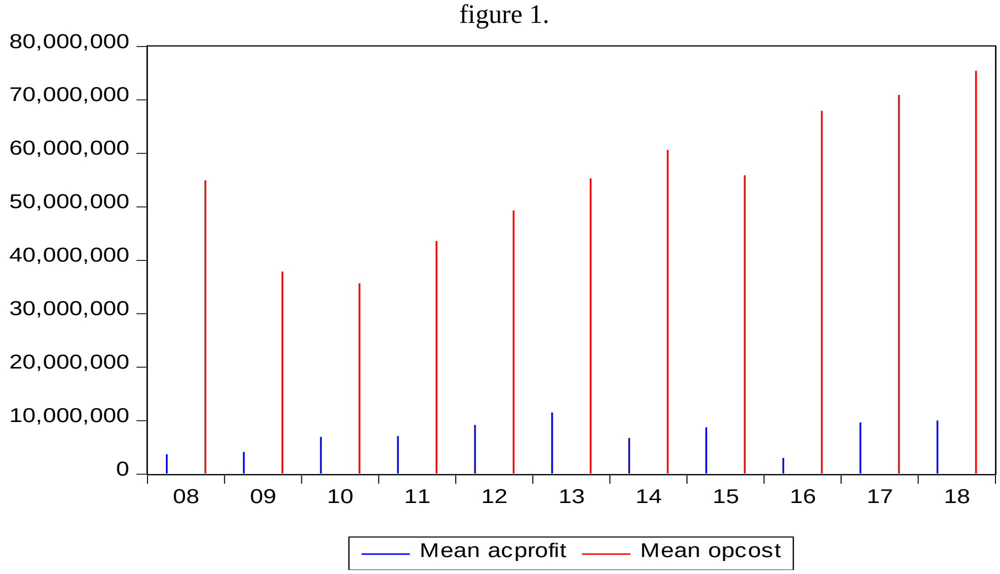

Figure 1

Spike showing the Distribution of the Average Values of Operational Cost and Accounting Profit

The lines marked blue are the average values of accounting profit, while the lines marked red are the average values of operational cost. The average operational costs in this sample appear too bogus. This is a signal that the cost of production is very high across each unit and overtime. Contrarily average accounting profit in this sector is generally low.

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Table 4
Unit Root Test

Variable	LLC	HT	IPS
Scale 1 (D1)			
Acprofit	-3-32(0.00)*	4.17(1.00)	-3.96(1.00)*
Opcost	-4.83(0.00)*	-6.85(0.00)*	-4.56(0.00)*
Scale 2 (D2)			
Acprofit	-1.99(0.02)**	-8.40(0.00)*	-7.78(0.00)*
Opcost	-9.93(0.00)*	-10.55(0.00)*	-7.83(0.00)*
Scale 3 (D3)			
Acprofit	-28.89(0.00)*	-18.28(0.00)*	-5.36(0.00)*
Opcost	-9.71(0.00)*	-16.37(0.00)*	-7.04(0.00)*

The values in brackets are the p-values
Maximum number of decomposition is log2(T)
D1(2-4years), D2(4-8years) and D3(8-16years)
*implies significant @ 1%
**implies significant @ 5%

The unit root test results by LLC, HT and IPS provide evidence of no unit root in the series of accounting profit and operational cost at different time scale and across the panels. Nevertheless, HT test does not reject the no hypothesis of no unit root for the series of accounting profit at scale one. This means by the transformation of these data, they have been de-noised, to be stationary at 1 percent or at least 5 percent. This supports the DH Granger-no-causality method, which is conducted at different time ranges as shown in table 2 to reflect policy implementation in a company at different timescales or decompositions by the management team.

Table 2
DH Granger no Causality Test Results

Scale1 (2-4 years)	W-bar	Z-bar	Z-bar Tilde
Opcost does not Granger-cause acprofit	3.13	8.26(0.00)*	3.39(0.00)*
Acprofit does not Granger-cause opcost	3.73	10.59(0.00)*	4.56(0.00)*
Scale2 (4-8 years)	W-bar	Z-bar	Z-bar Tilde
Opcost does not Granger-cause acprofit	5.82	18.66(0.00)*	8.64(0.00)*
Acprofit does not Granger-cause opcost	2.75	6.76(0.00)*	2.63(0.00)**
Scale 3 (8-16 years)	W-bar	Z-bar	Z-bar Tilde
Opcost does not Granger-cause acprofit	2.82	7.24(0.00)*	2.88(0.00)*
Acprofit does not Granger-cause opcost	2.59	6.19(0.00)*	2.34(0.02)**

The values in brackets are the p-values
Maximum number of decomposition is log2(T)
*implies significant @ 1%
**implies significant @ 5%

The maximum number of decomposition that can be achieved in this study is 3 because the time dimension is 10, and the optimum lag for DH Granger-no-causality method is 1 since T>5+3K. As shown by the statistics of both Zbar and Zbar tilde, there is evidence of bidirectional causations between operational cost and accounting profit for all the three scales or decomposition. However, further information provided by these statistics reveals that accounting profit Granger causes or influences operational cost more than how it is influenced by operational cost for scale 1(2-4 years). For the remaining scale 4 to 8 years and 8 to 16 years, operational cost influences accounting profit more than how it is being influenced by accounting profit. This implies that for the longer period within the short run dynamics much more influence run from operational cost to accounting profit than the influence from accounting profit to operational cost. This is logical in the business world because at the initial start of a business profit drives cost more than how cost drives profit, in the process of time cost drives profit much more.

5. Conclusion

In this study, we provide an empirical investigation on the relationship between operational cost and accounting profit for a sample of manufacturing companies in Nigeria. We have 3 decompositions from the original data because that is maximum number of decomposition we could have given the time dimension for this study. By applying the DH test, our findings show that bidirectional causations exist between operational cost and accounting profit in Nigerian manufacturing companies. We also confirm that in the nearest period operational cost is influenced by accounting profit more than, how it influences accounting profit. To the contrary, in the anticipated period operational cost commands much more influence on accounting profit. Thus, our findings are in close tandem with the study by Branch (1974). We recommend that managers should implement optimal cost reduction policy that is capable of minimizing operational cost at any level of profit both at the close or anticipated period. Such optimal cost reduction policy could assist in the decision to hedge factor prices in the factor markets.

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