

Practical Limitations of Break-Even Theory

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Abstract

A five-year expenditure profile of a company, 'Buni Bricks and Blocks Industry Nigeria Ltd.', was studied alongside its incomes for the same period. The objective is to determine the cost / revenue interactions on break-even charts. These charts were obtained for the five years studied. Among the practical realities discovered include: the sales revenue and total cost were not linear, two or more break-even points were found to exist, some costs fall under both fixed and variable costs, and beyond certain optimum production levels, sales revenue decreases sharply and total cost also increases.

Keywords: Break-even analysis, marginal costing, fixed cost, variable cost, semi variable cost, profitability, production level, profit margin.

Introduction

It has been stated that the break-even point (BEP) is the production volume at which a firm is neither making profit nor loss (Nwachukwu 2004). Any increase in production from this level results in profit making, while any decrease would result in losses. Industrial enterprises or firms therefore strive to exceed this point so that they can make profit. This point is normally illustrated in cost/revenue (C/R) vs. production level (Q) charts as the position where the total revenue (TR) line intersects the total cost (TC) line (Fig. 1). The production level at the break-even point is represented by Q_{BE} . Here

$$TC = vQ + F, \quad (1)$$

where Q is the quantity produced, v is the variable cost per unit sold and F is the fixed cost. Break-even analysis is often used as a measure to determine general guidelines for business decision making (Pollack 1995), to evaluate the company's desired profit levels, to conduct cost reduction impact analysis (Berryman and Nobe 1999), to evaluate the potential prices, the impact of price changes and fixed /variable costs on profitability (Powers 1987).

The concept of break-even analysis is dependant on the theory of marginal costing. Under this, the total cost of manufacturing or producing products or services can be segregated into two distinct parts: the fixed and the variable costs. Fixed costs are said to be remaining constant no matter the variation in the volume of products, while variable (marginal) costs vary directly with production volume. However, difficulties do arise in categorizing some costs as either fixed or variable. Sinclair and Talbot (1986) stated that most businesses have a combination of the two resulting in semi variable costs.

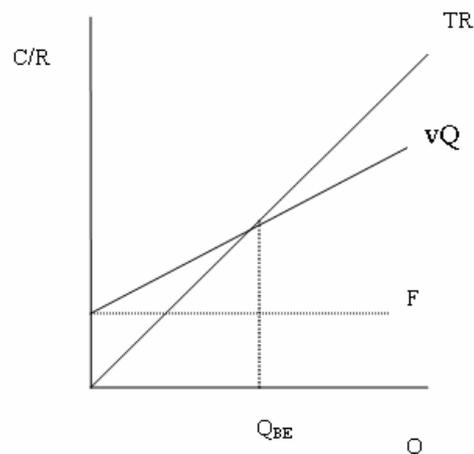


Fig. 1. One-product break-even analysis (BEA).

Other costs are even questionable and cannot be easily classified. Haslehurst (1980) gave an example of semi variable cost in press work, where a reinforced plastic forming tool used for short runs can experience increase in fixed cost. The continuous strengthening of the plastic former by glass fibre addition can incur addition cost. Thus, as the production volume increases, the cost of glass fibre increases. As such, fixed cost also increases by some factor.

While making the assumptions of the break-even theory, no consideration was made for semi variable costs. It is this shortcoming and some others that led to this investigation. In this write-up, the real characteristics of the behavior of an enterprise is examined. The cost behaviors and revenues accruing to the firm were studied and the results are reported in the following paragraphs.

Case Presentation and Methods

In this study, an industrial establishment, the ‘Buni Bricks and Blocks Industry Nigeria Ltd.’, Yobe State, Nigeria, was investigated. The company manufactures two types of products: the fired clay building bricks and cement blocks. Five years production activities and expenses were obtained for the study. The period covered the years 1999 to 2003. The items which constitute the expenditures of the company are summarized in Table 1.

Within each year, production volumes vary from one month to the other. The sales also vary from month to month. The various production levels attained over the months were obtained. The expenses incurred in achieving these levels of productions were computed. As usual, these costs were classified as fixed and variable costs. As can be seen from Table 1, some cost items come under both fixed and variable costs. These were arrived at by using “high / low” method of Powers (1987). Summing up both cost components (fixed and variable); the total monthly costs of productions were obtained.

The values of total costs obtained from these computations are plotted in the graphs shown in the various figures presented in the following paragraphs.

Table 1. Summary of cost items of Buni Co. Ltd.

Item	Cost Type
Materials -sharp sand -cement	variable variable
Labor -direct -indirect	Variable Variable & fixed
Plant Expenses -auto expenses -depreciation -electricity -miscellaneous expenses -telephone -property taxes	Variable & fixed variable Variable & fixed fixed Variable & fixed fixed
General & Administrative -Association dues -Commissions -Interest expenses -Accounting -Stationary & supply -Travel & expenses	fixed variable Variable & fixed Variable & fixed fixed fixed

Similarly, the sales recorded over the months for the production years were also obtained for analysis. The sales curves are also presented in the figures.

Observation, Interpretation and Discussion

Figs. 2 to 6 represent the break-even charts for five years production period of Buni Bricks and Blocks Industry Nigeria Ltd.

In Fig. 2, the chart presented is for two varieties of products. Cost accounting principle demand that each cost centre should have distinct income and expenditure account. Therefore the true picture of each of the bricks and the cement blocks were not revealed. Since both the sales revenue and costs are lumped together, the concept of break-even is of little meaning in this case, unless a break-even chart is prepared for each of the products separately.

This would be difficult because of costs allocation problems.

The company’s transactions for subsequent years as illustrated by Figs. 3 to 6 are for one product only – the cement blocks. In all the figures, the following general observations can be made:

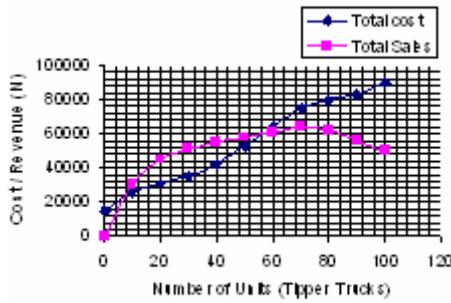


Fig. 2. Break-even chart for production and sales of brick and cement blocks in the year 1999.

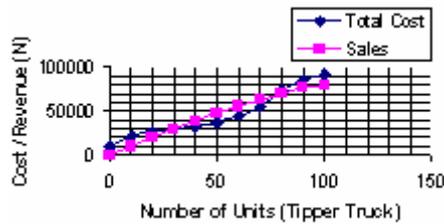


Fig. 3. Break-even chart for Buni transactions for the year 2000.

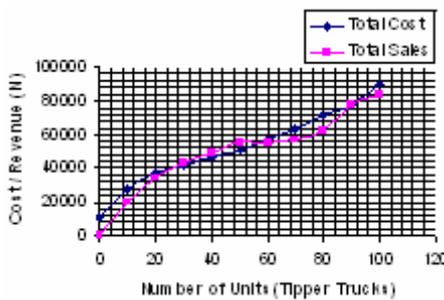


Fig. 4. Break-even chart for the year 2001 Buni transactions.

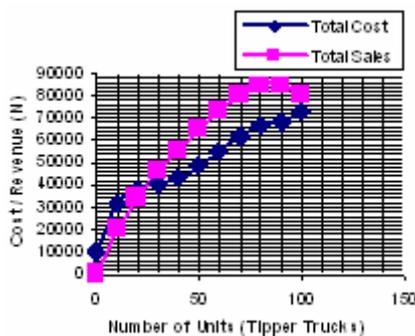


Fig. 5. Break-even chart for the year 2002 Buni transactions.

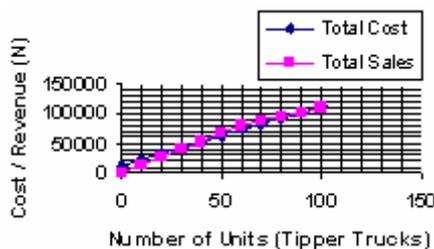


Fig. 6. Break-even chart for the year 2003 Buni transactions.

i. Multiple points of intersections (BEP) are found to exist except in Fig. 5.

ii both the total expenses and sales income lines are not straight.

iii the revenue lines in Figs. 2, 3 and 5 tend to curve inward towards the extreme levels of productions. This behavior is more pronounced in Fig. 2.

From these observations, it is clear that the “linearity” always assumed while formulating the break-even theory (Adediran 2001; Degtiareva 2001) may not exist in reality. This is because the demand for a product normally changes with any alteration in either selling price or even to the volume produced.

The existences of multiple points of intersections mean that it is possible to have more than one break-even point. Thus, the likelihood of more than one area of unprofitable operation exists. A Company might choose to produce at a point so as to maximize profit or to minimize loss.

In a simple break-even chart such as that of Fig.1, the profit margin continues to widen as the production level increases (Adediran 2001; Degtiareva 2001; Nwachukwu 2004). However, the curve lines in Figs. 2, 3 and 5 shows that the two lines (total cost line and revenue income line) do not diverge indefinitely. This is because, at higher production levels, there is tendency that the selling price would decrease as the market becomes saturated. This causes the sales income line to drop downward.

In Fig. 2, the highest profit margin of about ₦16,000 (US\$126.4) is obtained between production levels of 20 – 30 tipper trucks of the product. Therefore, the optimum production level should be between 20 and 40 tipper trucks of the products with equivalent sales income of between ₦30,000 (US\$237) and ₦54,000 (US\$426.6). It can be seen that further increase in production above 58 tipper trucks results in loss. This is because the total cost line rise sharply possibly due to increasing extra expenditures, and the total income line fall also sharply possibly due to the increasing price of products brought about by the extra costs.

Similar explanations can be given for the other years as illustrated by Figs. 3, 4 and 6. In all these years the profit margins are small as can be seen from those figures. However, in Fig. 5, the profit margin is about ₦16,000 in production range of 76 – 86 tipper trucks. The optimum production is about 82 tipper trucks. This is for only one product type – the cement blocks. The equivalent sales income of ₦86,000 is accruable to the company at that level. Production beyond this level results in income reduction. Further increase would ultimately result in losses.

Practically, the enterprise can not influence sales level. It is the variation of the sales level that determines the profit margin. This is why different sales margins were found for different years. This is one of the practical realities of markets.

This paper therefore tries to point out that enterprises should not have the impression that break-even theory easily gives a point where the company earns profit. They should also not go by impression that the higher the production, the more the profit. One of the best ways to determine the break-even point by a company is to accumulate historical costs and sales data for a number of accounting periods and plot on a set of axes for each period (Amrine *et al.* 1983). In this way an optimum production level can be obtained.

Conclusions

The study revealed the following practical realities associated with break – even theory.

i. Semi variable costs do exist amongst the cost components and must be considered for appropriate estimation (apportionment) into both fixed and variable costs.

ii. The sales revenue and total costs are not always linear in as normally assumed in the theory.

iii. Two or more break-even points may exist for a particular industry depending on a number of factors.

iv. Economic factors such as demand, supply and prices do affect the break-even point and profitability.

v. Actual sales determines the profit margin achieved by an enterprise

Acknowledgement

The authors wish to acknowledge the management of Buni Bricks and Blocks Industry Nigeria Ltd. for allowing them access to their books of account.

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