ACTIVITY-BASED OPERATING LEVERAGE MODEL

Hamdi Bilici, California State University, Long Beach, 1250 Bellflower Blvd.,Long Beach, CA 90840, 562-598-3980, hbilici@csulb.edu.
Ilhan Dalci,Business Department, Eastern Mediterranean University,Gazimagusa, KKTC, Mersin 10, Turkey, ilhan.dalci@emu.edu.tr.

ABSTRACT

In traditional calculations of the operating leverage factor only volume based cost drivers are taken into consideration. The aim of this paper is to show how use of the traditional approach to calculating operating leverage factor could lead managers to make irrational or incorrect decisions. In addition, this paper aims to explain how the theoretical assumptions of activity-based costing can be combined with traditional ones to create a new model for calculating operating leverage factor and how the new model can be used as an alternative to the traditional model.

INTRODUCTION

Operating leverage factor is used to measure the firm's operating leverage at a particular sales volume [14] [15] [17]. Under traditional costing systems, the output level is the only cost driver [17] [19] [8]. Therefore, traditionally, total costs are separated into a fixed component which does not change with the output level and a variable component which varies with respect to the output level [13] [17][15]. This approach is consistent with the traditional costing systems which were designed for production systems with low levels of technology and overheads [5].

A great deal of overhead costs are composed of costs of those activities that can be represented by non-volume-related cost drivers in new automated production environments [7]**.** Resources consumed by batch and product-level activities do not change at unit level. Whereas batch-level and product-level costs are accepted as fixed costs in traditional costing systems, they are accepted as variable costs in activity-based costing systems [8]. Nevertheless, the traditional approach to the calculation of operating leverage factor treats setup, inspection, material handling, engineering and similar batch and product-level activity costs as fixed because these are fixed costs with respect to the number of units produced. Since the traditional leverage model takes only volume-based cost drivers into account, the operating leverage factor is assumed not to change at different levels of sales volume within the relevant range of fixed costs. However, changes in batch and product-level cost-driver activity levels result in changes in the batch and product-level costs. Therefore, a modified model taking into account multiple cost drivers of activity-based costing (ABC) can be a better model than the traditional one used to calculate operating leverage factor.

ACTIVITY-BASED COSTING

Traditional costing systems employing volume-based cost drivers in allocating overhead costs have lost relevance in the automated production environments which have experienced a significant increase in overhead costs and subsequent decline in direct labor costs [11]. ABC was promoted by Cooper and Kaplan in the mid-1980s, based on their experiences with some production companies in the USA.

Subsequent studies dealt with the deficiencies of traditional costing systems in the automated production environments [22] [18] [2] [21]. The activity-based approach to overhead costs is the extension of the traditional volume-based costing that treats manufacturing overhead as a complex set of costs with multiple cost-drivers [9]. ABC focuses on individual activities as the cost objects [16].

The basic premise of ABC is that products consume activities, activities consume resources and resources consume costs [7] [3] [1] [10]. One of the developments in the theory of ABC in the 1990s was the hierarchical classification of the activities performed at different levels such as unit, batch, product, and facility [13] [20] [6] [4]. The resources are consumed by the activities performed within an organization [8] [23].

Costs, like activities, may be classified as one of the many types depending on the kind of decision to use resources: unit, batch, product, and facility-level costs [9] [12]. Classification of activities in this manner shows the ability of ABC to recognize the causal relationship between the resources and activities. This, in turn, leads to an understanding that volume-based cost drivers are not the sole cost-drivers. In other words, some costs which are accepted as fixed with respect to the volume-based cost drivers under traditional costing systems are, in fact, variable with respect to some other cost drivers such as number of batches of products and number of design specifications [13]. As a result, operating leverage analysis with the multiple cost drivers of ABC is likely to provide managers with a much more complete picture of the behavior of the costs.

ACTIVITY-BASED OPERATING LEVERAGE

The traditional approach to measuring operating leverage is based on the assumption that only volume-based cost drivers determine how costs behave. Therefore, facility, product, and batch-level costs are assumed not to change at a specific level of sales within the relevant range. However, batch-level and product-level costs may vary, at different levels of sales volume, with respect to factors such as number of production runs and number of design specifications rather than the number of units of product produced within the relevant range. Since the traditional model ignores that reality, it may fall short of providing a complete planning tool. That is why predicting total costs in the analysis of operating leverage will require multiple cost drivers such as the number of setups, number of output units, and the number of design specifications. Under the activity-based approach, therefore, budgeted costs can be the expression as follows:

$$\text{Total Budgeted Costs} = [(\text{Number of Units} \times \text{Unit-Level Cost Per Unit}) + (\text{Batch Cost} \times \text{Batch CDA}) + (\text{Product Cost} \times \text{Product CDA}) + (\text{Facility-Level Costs})] \quad (1)$$

Where,

CDA= Cost driver activity (e.g., number of batches, number of design Specifications)

Consideration of multiple cost drivers within the context of ABC, as shown in the above equation, will have a significant impact to the model used to calculate the operating leverage factor. The modified model with multiple cost drivers of ABC will be called “Activity-Based Operating Leverage Model”. If we include the activity based costs by introducing unit level costs, batch level costs and product level costs into traditional operating leverage equation Activity Based Operating Leverage equation will emerge as follows:

$$ActivityBasedOLF = \frac{[(P \times Q) - (ULC \times Q)]}{[[(P \times Q) - [(ULC \times Q) + (BC \times BCDA) + (PC \times PCDA) + FLC]]} \quad (2)$$

Where;
P = *Selling price per unit*
Q = *Number of units produced and sold*
ULC = *Unit-level costs per unit*
BC = *Batch cost*
BCDA = *Number of batch-level cost driver activity*
PC = *Product costs*
PCDA = *Number of product-level cost driver activity*
FLC = *Facility-level costs*

As can be seen in the above activity-based model, change in batch or product cost driver activity (CDA) levels is expected to result in change in batch-level or product-level costs. Facility-level costs, however, are not expected to change with changes in the level of sales within the relevant range. In this case, expected changes in the number of product-level or batch-level CDA will result in fluctuations in the operating leverage factor. Since these changes are not taken into consideration by the traditional model, it's likely to give different results than activity-based models.

CONCLUSIONS

Operating leverage factor is used to measure the firm's operating leverage at a particular sales volume. However, the traditional approach that employs only volume-based cost-drivers has become obsolete in the automated production environments. Therefore, the use of a model which takes multiple cost-drivers into consideration will result in more rational decisions than the traditional model in the automated production environments where non-volume related costs incur.

REFERENCES

[1] Aderoba, A., 1997. A generalized cost-estimation model for job shops, *International Journal of Production Economics*, 53, 257-263.

[2] Baird, K. M.; Harrison, G. C.; Reeve, R. C., 2004. Adoption of activity management practices: A note on the extent of adoption and the influence of organizational and cultural factors, *Management Accounting Research*, 15 (4), 383-399.

[3] Baxendale, S. J., 2001. Activity-based costing for the small business, *Business Horizons*, 44 (1), 61-68.

[4] Ben-Arieh, D.; Qian, L., 2003. Activity-based cost management design and development stage, *International Journal of Production Economics*, 83, 169-183.

[5] Chen, F., 1996. Activity-based approach to justification of advanced factory management systems, *Industrial Management & Data Systems*, 96/2, 17-24.

[6] Colwyn, J. T.; Dugdale, D., 2002. The ABC bandwagon and juggernaut of modernity, *Accounting, Organizations and Society*, .27 (1-2), 121-163.

[7] Cooper, R.; Kaplan, R. S., 1988. How cost accounting distorts product costs, *Management Accounting*, April, 20-27.

[8] Cooper, R.; Kaplan, R. S., 1991. Profit priorities from activity-based costing, *Harward Business Review*, May-June, 130-135.

[9] Drake, A.; Haka, Susan, F.; Ravenscroft, S. P., 2001. An ABC simulation focusing on incentives and innovation, *Issues in Accounting Education***,** 16 (3), 443-445.
[10] Gosselin, M., 1997. The effect of strategy and organizational structure on the adoption and implementation of activity-based costing, *Accounting, Organizations and Society*, 22 (2), 105-122.
[11] Gunasekaran, A.; Marri, H.B.; Yusuf, Y.Y., 1999. Application of activity-based costing system: Some case experiences, *Managerial Auditing Journal*, 14 (6), 286-293.
[12] Gunasekaran, A.; Sarhadi, M., 1998. Implementation of activity-based costing in manufacturing , *International Journal of Production Economics*, 56-57, 231-242.
[13] Hilton, W. R., 1999. *Managerial Accounting*, McGraw-Hill, 4th Ed.
[14] Hilton, W. R., 2005. *Managerial Accounting*, McGraw-Hill, 6th Ed.
[15] Hilton, W. R.; Maher, M. W.; Selto, F. H., 2000. *Cost Management,* McGraw-Hill, International edition.
[16] Hicks, D. T., 1999. Yes, ABC is or small business, *Journal of Accountancy***,** August, 41-45.
[17] Horngren, C. T.; Foster, G.; Datar, S. M., 2003. *Cost Accounting*, Prentice Hall, 11th edition.
[18] Innes, John, 1999. The use of activity-based information: A managerial perspective, *Management Accounting*, 77 (11), Dec., 81-83.
[19] Johnson, T. H., 1990. Activity management: Reviewing the past and future of cost management, *Journal of Cost Managment,* 4, 4-7.
[20] Lere, J. C., 2002. Selling activity-based costing, *The CPA Journal*, 72 (3), 54-55.
[21] Özbayrak, M.; Akgün, M.; Türker, A. K., 2004. Activity-based cost estimation in a push/pull advanced manufacturing system, *International Journal of Production Economics*, 87, 49-65.
[22] Russell, D.; Patel, A.; Wilkinson, G., 2000. *Cost Accounting*: Prentice Hall.
[23] Schniederjans, M. J.; Garvin, T., 1997. Using analytic hierarchy process and multi-objective programming for the selection of cost drivers in activity-based costing, *European Journal of Operations Research*, 100, 72-80.