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Using relative profits as an alternative to activity-based costing

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Abstract

Activity-based costing (ABC) tries to assign overhead costs to cost objects more accurately than traditional cost systems. However, due to its severe separability and proportionality assumptions using ABC for decision-making may lead to a considerable economic loss. To evaluate products on the basis of their activity-based costs, we therefore use a data envelopment analysis (DEA)-like approach which mainly separates the product portfolio into a set of potentially optimal and a set of non-potentially optimal products. In contrast to DEA, we do not need any ad hoc assumptions about the production possibility set or returns to scale. Furthermore, it will turn out that in contrast to conventional ABC, we will not have to determine the cost driver rates ex ante, reducing information cost.

Keywords: Relative profit; Activity-based costing; Data envelopment analysis; Product evaluation; Potential optimality

1. Introduction

Activity-based costing (ABC) is a well-known method to evaluate long-term decisions (e.g., Cooper and Kaplan, 1988). It is even considered as a strategic cost system that for instance allows to measure the cost of product design and development (Tornberg et al., 2002; Ben-Arieh and Qian, 2003). However, in assigning overhead cost, ABC implicitly uses severe proportionality and separability assumptions (Noreen, 1991; Christensen and Demski, 1995) which in practice are generally not fulfilled. A paper providing empirical evidence against proportionality is Noreen and Soderstrom (1994). They test for the proportionality of overhead costs to activity using hospital data and reject proportionality. This means that in practice ABC will violate the 'proportionality theorem' underlying many European costing systems (e.g., Alnestig and Segerstedt, 1996; Kloock and Schiller, 1997). Hence, using ABC for decision-making might result in sub-optimal decisions. Several papers suggest that at best ABC can be considered as an approximate method for decision-making (Balakrishnan and Sivaramakrishnan, 1996; Salafatinos, 1996; Balachandran et al., 1997; Schneeweiss, 1998; Homburg, 2004). In addition, in selecting cost drivers and determining cost driver rates one often must trade off accuracy against information cost (Cooper, 1989; Babad and Balachandran, 1993; Datar and Gupta, 1994; Homburg, 2001). To reduce the number of cost drivers one will pool non-homogenous activities, resulting in further approximations.

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In what follows, we will focus on (strategic) product evaluation. To evaluate a product's profit, ABC determines the product's cost driver usage which then is weighted with the corresponding cost driver rates. Thereby the same cost driver rates apply for all products. Revenue minus the product's activity-based cost yields the product's profit. This profit value is biased because of all the above-mentioned shortcomings of ABC. The idea of the paper is to accept that, in practice fulfilling the proportionality theorem might often not be feasible for strategic evaluations. However, if a cost driver rate is a non-proportional allocation base, then a sharp cost driver rate becomes obsolete. Therefore, the paper suggests to no longer try to obtain sharp but rather weak strategic signals from the costing system.

Another way of generating weak signals is data envelopment analysis (DEA) (Charnes et al., 1978) which has been suggested for management accounting (Callen, 1991). While conventional ABC generates absolute profits, DEA could be used to distinguish the product portfolio in a set of relatively efficient and a set of relatively inefficient products. When compared with conventional ABC, the main advantage of DEA is that to obtain this distinction, no cost driver rates must be specified ex ante. Rather, cost driver rates are determined by a simple optimization procedure. However, the dual formulation of the original DEA model reveals that DEA is based on severe convexity assumptions about the production possibility set which are often inappropriate. For instance, DEA assumes that convex combinations of observed input–output vectors (decision-making units or DMUs) are feasible. When applied to product evaluation, this means that convex combinations of the products' cost driver demands would have to yield the corresponding convex combinations of the products' revenues. This, however, seems to be an unrealistic assumption. For the same reason, the stochastic version of DEA (Banker et al., 1998) is inappropriate for product evaluation. Also, modifications of DEA relaxing the convexity assumptions (Petersen, 1990; Bogetoft, 1996) still need information about the underlying returns to scale which are most difficult to determine in the context of product evaluation.

To avoid the shortcomings of ABC and DEA—as a possible alternative to ABC—we therefore develop a different approach. On one hand, we aim to avoid the problems of ABC which are mainly caused by the fact that it is very difficult and often impossible to determine suitable (ex ante) cost driver rates for all products. On the other hand, in contrast to DEA, we aim to avoid any ad hoc assumptions about the underlying production technology or returns to scale. One way of avoiding these assumptions is to use the free disposal hull model of Deprins et al. (1984) dropping convexity assumptions for the production set. The way, however, which is followed in the paper is to use the concept of potential optimality known from multi-criteria decision-making. An alternative is considered potentially optimal when there are weights for the decision-maker's criteria which, firstly, are consistent with the available preference information and for which, secondly, the alternative maximizes the decision-maker's utility (Fishburn, 1964, Chapter 3; Hazen, 1986; Weber, 1987). While it can be shown that multi-objective decision-making and DEA are structurally very similar when the set of feasible alternatives is assumed convex (Joro et al., 1998), our approach differs considerably from a conventional DEA approach since it is based on a discrete (non-convex) set of alternatives. Nevertheless, it will turn out that there are major structural similarities as well.

Following the idea of potential optimality, one must analyze whether a product has got the potential to be the most profitable product of the portfolio. The concept of potential optimality thus focuses on *relative* rather than *absolute* profit. Therefore, the outcome of our approach will not be as sharp as that of conventional ABC and does not yield concrete advices. However, we believe that ABC suggests an accuracy which it cannot provide in real-world applications. We, therefore, argue that particularly for a strategic cost system, it might be sufficient to yield weak strategic signals, indicating for instance the relative standing of a product, rather than sharp cost numbers. Although interpreting such signals is not as easy as