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Teaching and educational notes

Service department cost allocations using the net services model and the MDTERM function in Excel[☆]



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ABSTRACT

A teaching note on the reformulation of service cost formulas is presented as a way to add value to the process of Reciprocal Costing by facilitating the tracing of cost between service departments, thereby increasing the accuracy of cost estimations for outsourcing decisions. Emphasis is placed on a solution method using the Excel MDTERM function and Cramer's rule that facilitates the tracing of costs between service departments.

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1. Introduction

This paper addresses the issue of how to allocate service department costs among user departments. There are three methods that can be used to accomplish this: direct, step and reciprocal. We focus on the last of these. Coverage of the reciprocal method of allocating service department costs¹ in managerial accounting and cost accounting textbooks varies greatly. A brief review of managerial and costs textbooks (Garrison, Noreen, & Brewer, 2015; Hartgraves & Morse, 2015; Mowen, Hansen, & Heitger, 2012) found that some mention and briefly describe the reciprocal method but delay a detailed discussion of the technique for other more advanced cost accounting texts. Other managerial and cost accounting textbooks present a basic two-department example and illustrate the method of solving simultaneous equations manually (Hansen & Mowen, 2015; Hilton, 2011; Zimmerman, 2014). One textbook did not cover the topic of service department allocations (Whitcotton, Libby, & Phillips, 2011).

Other texts, primarily cost accounting textbooks, illustrate methods using Excel spreadsheets. Three different techniques were identified: Repeated iterations (Horngren, Datar, & Rajan, 2015), MINVERSE

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¹ Some authors refer to this as the simultaneous equation approach to allocating service department costs.

(Lanen, Anderson, & Maher, 2011), and Solver (Blocher, Stout, Juras, & Cokins, 2013). Over the years journal articles have offered similar solutions to those presented in textbooks today with a recent emphasis on techniques that use Excel spreadsheets (Savage & Wilburn, 1997; Stinson, 2002; Togo, 2012). In each article and text the method used started with linear equations of the form:

$$X_a = BC_a + B_a(X_b)$$

$$X_b = BC_b + A_b(X_a)$$

where X_n = reallocated costs, department n

BC_n = original budgeted costs, department n

A = coefficient signifying the inward flow of cost allocated to department X_n .

In 1963, Manes introduced the idea of using a Net Services Model. In a follow up article Manes (1965) reintroduced this model to offer a resolution of the problem common to the standard or Gross model (Bentz, 1973), as presented earlier where the resulting sum of reciprocal costs is greater than the original budget costs i.e., $X_a + X_b > BC_a + BC_b$. In the Net Services Model, the equations include variables with coefficients measuring both inflows and outflows of costs between service departments. Livingstone (1968) corrected a problem with the Manes' version of the model and resolved the differences in final allocations between the Gross model and the Net Services model. Livingstone reasoned that for the net services model to be a true net services model it should include coefficients adjusted to account for the production department percentages not being considered. Therefore the coefficients for the following equations are divided by the percentage of the allocation base used in direct allocations for each service department. Therefore the net services model a la Livingstone would read:

$$X_a = BC_a + B_a(X_b) - A_b(X_a)$$

$$X_b = BC_b + A_b(X_a) - B_a(X_b)$$

where A_n and B_n equals the percentage of allocation base measured to service department n, divided by the sum of the percentages of allocation base devoted solely to profit centers.

The resulting reciprocal costs sum exactly to the original budgeted costs.

What follows is a teaching note on solving for Reciprocal Costs using Excel and a set of fully specified linear equations, i.e., Manes' *Net Services Model*. The resulting reallocated costs differ from those calculated using traditional Gross method formulas. In addition, the method of solution differs from the techniques listed earlier. The solution method presented solves for reciprocal costs using the MDETERM function in Excel to calculate matrix determinants and Cramer's rule to solve for reciprocal costs. The solution method can also be used to calculate the same results found in textbook examples when solving for traditional formulas.

The author believes that the combination of the Net Services Model with the new Excel solution method offers a simpler measurement of the reciprocal reallocation of service department costs for final allocation and useful information about the impact of service departments on one another. The benefits include the ability to trace cost flows between service departments, simplification of final allocations to revenue departments using the direct method, while retaining the ability to calculate the full costs of service departments for use in outsourcing decisions using proven methods.

2. Reciprocal costing using Cramer's rule, fully specified formulas and the MDETERM function

The formulation of fully specified sets of equations that reflect all interdepartmental transfers as both inflows and outflows was first suggested by Manes (1963, 1965) and elaborated by Livingstone (1968) and by Keller (2005). In the examples to follow first a two then a three-department example are considered. Two-department model is solved using Gross formulas but using Cramer's rule. The three-department example uses the Net services formulas.

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