Setting Expense Standards: Service Industry Applications

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Abstract

Regression analysis is a low cost way of setting expense standards in service firms with multiple branches. The resultant standards can be used for evaluating efficiency, performance, and personnel. The purposes, applications, techniques, and limitations of regression analysis are explained. The article is based on the author's experience at a large bank.

Introduction

Managers need criteria by which to measure performance within the organization. These criteria are needed to judge whether resources have been used efficiently. For these criteria to be accepted within the organization, they need to be perceived as fair and objective. Management accountants measure expense efficiency by setting expense standards.

Expense standards are not in widespread use in service firms, although they are commonly used in manufacturing firms. Setting standards in service firms has proven difficult because of the differences between service firms and manufacturing firms. Manufacturing firms produce products and there is usually a direct relationship between the products produced and the inputs necessary to produce those products. Service firms sell services and/or products and there is usually an indirect relationship between the services and products sold and the effort that goes into selling them.

Manufacturing firms use standards to determine the operational efficiency of sub-units of the firm. In service firms there are no commonly used measures of efficiency because of the difficulty in forming standards. Even in a service firm with multiple branches which perform similar activities, it can be difficult to compare the efficiency of the various branches. Each of the branches is a different size and adapts to its market area, thus, each has a different mix of products and services. What should the expense of each branch be? What level of expense would connote efficient operation?

Standard setting is useful for decision making and performance evaluation besides the obvious advantage of measuring efficiency. Standards can affect decisions on personnel, product development, and profitability. How well a manager controls expenses under their supervision is often a criterion for advancement and bonus.

This article discusses using regression analysis to set expense standards for efficiency in service firms with similar multiple branches(1). The types of service firms with similar multiple branches include stock brokerages, insurance companies, department stores, airlines, grocery stores, fast food outlets, franchises, accounting firms, banks, and community colleges, among others. These firms are very different in what they do and how they do it, but they are similar in how their expense structure can be analyzed. This article is based on the author's experience as a Scholar-in-Residence at a large Savings and Loan bank in the Pacific Northwest (hereafter called PN Bank) which had 53 branches at the time of the study.

Methods of Creating Expense Standards

Cost accounting text books detail how to create expense standards(2). However, they deal almost exclusively with manufacturing companies. The ways they prescribe, longitudinal analysis or engineering estimates, might not be appropriate in

service organizations.

Longitudinal analysis gathers data over time and uses that data to predict the future. It can be used with service organizations, but it would take multiple observations and those observations would have to be corrected for inflation, seasonalities, and changes in managerial policies.

Engineering estimates analyze each employee action, set time standards for those actions, and then prescribe a monetary standard for each function. Engineering estimates have been used by manufacturing firms and some large service firms, but they are extremely costly. Also setting standards in this fashion might not be possible in some service environments, where there are not similar repeated actions, as there are in manufacturing.

Standards in service firms, where there are multiple branches which are similar, can be formed cross sectionally across branches. This method is easier to apply than longitudinal analysis and far less costly than engineering estimates. Standards are formed by measuring all branches at one point in time.

The primary advantage of analysis across branches is that problems with the data due to changes over time (technological changes, price level changes, changes in managerial policies, and seasonalities) vanish. Thus, data wouldn't have to be altered to reflect changes over time.

One problem that could surface in this approach would be if the branches were not structurally similar. Branches would not be structurally similar if policy applied differently to different branches or if some branches provided substantially different services or if some branches were experimental. If branches were too different they would show up as outliers in the analysis. Then they could be removed from the analysis and analyzed separately across time.

A statistical technique which can be used to create standards cross sectionally is regression analysis. In order to use regression analysis: 1) data must be collected, 2) a regression must be run, and 3) the regression results must be interpreted. The remainder of this article details how to accomplish these tasks in a service firm with multiple branches.

Collecting The Data

Since data collection can be the most time consuming part of the process, it is necessary to organize the data collection process. Data must be collected for the expenses which are to be controlled (the dependent variable in regression analysis) and the activity variables which are expected to affect those expenses (the independent variables).

Only the expenses the manager can control should be collected as the dependent variable. If the manager can't control the expense, they can't change it, and they shouldn't be held accountable for it.

The expenses the manager can control are likely to include salary and benefit expenses, travel expenses, training expenses, other employee related expenses, and discretionary branch expenses. Expenses the manager can't control would include any expenses allocated from headquarters. If each branch is responsible for its own purchasing, then the expense of the product would be controllable.

The independent variables are those which are thought to cause the dependent variable (controllable expense) to change. As the independent variables increase or decrease the dependent variable increases or decreases. The purpose of the regression is to determine which independent variables are most strongly related to the dependent variable and to show the amount of that increase or decrease. The independent variables are likely to include the hours worked by employees and the quantities or average balances of products and services performed by the firm. Composite variables, variables created from other independent variables, can also be used.

At PN Bank the dependent variable (controllable branch expense) included the salary and benefits of branch employees (90 to 95 percent of controllable branch expense), employee training, business development, public/customer relations, publications, and dues. The independent variables were the number and balance of total and new asset and liability accounts, the number of transactions, and various composite variables which could be con-

Table 1
List of Independent Variables

Installment Loan Average Balance
Average Number of Installment Loans
Number of New Installment Loans
Mortgage Loan Average Balance
Total Liability Account Average Balance
Average Number of Total Liability Accounts
Number of New Liability Accounts
Average Number of Transaction Liability Accounts
Average Number of Money Market Liability Accounts
Average Number of Other Liability Accounts
Average Number of Total Liability Accounts plus Average Number of Installment Loans
Number of Over the Counter Transactions (Deposits and Withdrawals)
Rank (Weighted composite variable composed of liability balance, mortgage loan balance, consumer loan balance, and transactions as a percentage of the bank total)

structed from the other independent variables. Table 1 lists the independent variables.

Data can be retrieved electronically from the financial accounting system. Financial accounting data are accrual data, which means they are uniform across time periods and typically what the firm uses to judge its performance.

For this project data were gathered for three quarters from the 3rd quarter of 1985 through the 1st quarter of 1986. Quarters were chosen because they were long enough for inter-branch differences to even out and short enough so that multiple observations could be made.

The Regression Procedure

The purpose of regression is to make a linear approximation of the data using the least squares criterion. In multiple regression (regression with more than one independent variable) the resultant equation can be expressed as:

$$Y = a + b_1x_1 + b_2x_2 + ... + b_nx_n + e$$

The regression procedure will determine:

1. which independent variables are related to the dependent variable;
2. the significance of the relationship;
3. the value of the constant and the values of the independent variables' coefficients;
4. an expense standard for each branch; and
5. the difference (the residual) for each branch between the actual expense and the standard expense, which is a measure of the efficiency of that branch.

Since the regression procedure will make a linear approximation of any data, it is necessary that the assumptions that underlie regression procedure are met. If assumptions are not verified, the results of the regression may not be usable to predict efficiency. The key assumptions that underlie regression analysis are:

1. there is a significant linear relationship between the dependent and independent variable,
2. the dependent and independent variables are normally distributed, and
3. the error terms (residuals) are normally distributed with constant variance.

The dependent and independent variables should be linearly related to each other. A measure of linearity is the coefficient of determination (r^2), the correlation coefficient squared. The closer r^2 is to 1, the more likely a linear relationship exists. A test of the significance of the linear relationship is the t test. In general if the t value is above 2 the relationship is significant. This means it would occur randomly less than five times in a hundred.

The analysis of the data at PN Bank revealed

high r^2, the r^2 for each of the three quarters was over .886, and high t values for the three quarters. This established linearity and assured the dependent and independent variables were significantly related. Visual observation of scattergraphs of the data confirmed this.

The dependent and independent variables should be normally distributed. A visual inspection of a normal plot revealed the variables were normally distributed.

The error terms represent deviations from a purely linear relationship. The error terms are expected to be normal with constant variance, meaning they follow a normal curve and vary around the mean randomly. The residuals were plotted on a normal probability plot and they followed normality. Also they were plotted against the dependent and independent variable and were found to vary randomly around the mean. Another typical problem for the error terms, correlation over time, was not a problem in this analysis, since the regression was done across branches and not across time.

A problem in using regression analysis encountered at PN Bank was multicolinearity. Multicolinearity occurs in multiple regression when the independent variables are highly correlated with each other. Most of the independent variables were correlated at values over .800. Multicolinearity does not affect prediction accuracy, but does affect which variables enter the equation and the magnitude of those variables' coefficients.

When forming expense standards the variables and coefficients should be stable over time. The manager should believe they can control the underlying causes of the expenses. Thus, multicolinearity could pose a motivational problem, if the variables or coefficients changed from period to period. The manager might feel they had limited control over the expenses for which they were being held accountable.

Composite variables (variables that combine other variables into one variable) can be used to deal with multicolinearity. In creating a composite variable there will be only one independent variable, and multicolinearity can't occur. At PN Bank a composite variable called Rank was used to classify branches by size. Rank was a composite variable composed of transactions, liability balance, installment loan balance, and mortgage loan balance. These were weighted, added together and a resulting Rank was assigned by what percent each branch had of the total. Rank was added to the analysis when instability of variables and coefficients was found. The addition of this variable produced stable results as discussed in the next section.

Analyzing The Data

Regression analysis was first used on 4th quarter, 1985 data. Rank was the best predictor of controllable branch expense. The resulting regression equation was:

Controllable Branch Expense = 18018 + (17022 * Rank).

This means one would expect the controllable branch expense of a branch to be equal to 18018 plus (17022 multiplied by its Rank). This equation had an adjusted r^2 of .913 (clearly linear) and a t statistic of 23.38 and 10.84 for the coefficient and constant respectively (both clearly significant).

The next step was to see if the variable (Rank), the Rank coefficient, and the constant were stable

Table 2
Regression Equations for Controllable Branch Expense by Quarter

3rd Quarter, 1985
Controllable Branch Expense = 17,113 + (17,066 * Rank)

4th Quarter, 1985
Controllable Branch Expense = 18,018 + (17,022 * Rank)

1st Quarter, 1986
Controllable Branch Expense = 20,321 + (16,777 *Rank)

across other quarters. This was necessary to test if the standards would be stable in the future. The model was tested for three quarters and the variable (Rank), the coefficient of Rank, and the constant proved to be remarkably stable as can be seen in Table 2.

Rank entered the equation and is the only variable in the equation for each quarter. Also the constant and the Rank coefficient were remarkably stable. This was particularly important since without Rank in the equation, the variables and coefficients changed dramatically.

Often an equation will "over predict" the data. This means it is gathered from specific data and used to predict that data. A hold out sample can gauge how accurate the equation will be in the future. The holdout sample uses an equation formed from one half of the data (the selected data) to predict the other half of the data (the unselected data). The r^2 from the unselected data is regarded as the r^2 one could generate in future periods. For the fourth quarter of 1985 using Rank, the r^2 for the selected branches was .960 and the unselected .867. When the sample was formed by reversing which data was selected and unselected, the selected r^2 was .887 and the unselected .942 (it was actually higher!). These equations were used to predict other quarters with similarly high r^2. Thus, predictions from the model were deemed to be reliable.

A cautionary word must be added for the results of regression analysis. The data used were actual expenses. If branch operations were inefficient in the time periods under analysis, then the standards produced by the regression would continue the inefficiency. Thus, the resultant standards might be too loose. Even if this is true, the more inefficient branches in the current system might be forced to improve, since they would have unfavorable variances. Statistics can't solve this problem. However, if management feels the standards are too loose, they can tighten them by an arbitrary amount.

Applications

Standard setting is intended as a tool to help managers measure their own and their subordinates' performance. Any change in a performance evaluation system, such as the introduction of standards, will have behavioral consequences. Using regression to form the standards will help make the change acceptable. As long as the concepts of regression are applied reliably, as discussed above, the system will be seen as fair, objective, and stable.

Measuring efficiency is the prime application of setting standards. Efficiency is usually measured by how well a manager controls the expenses under their control. The regression method forms an expense standard and the deviation from the standard (the residual) gives a way of measuring the relative efficiency of the individual branches. The residuals are computed by subtracting the actual expense from the predicted (standard) expense.

It is often necessary to investigate the causes of large positive residuals, which usually indicate inefficient operation, to be sure the actual cause is branch inefficiency. Even large negative residuals, which usually indicate efficiency, can cause problems if service levels aren't being maintained.

At PN Bank there was a large variation in efficiency. Upon investigation, many of the branches with large positive residuals were inefficient, but some of those branches were different structurally or experimental. A branch which is different structurally or experimental might have a justifiable reason for different expenses. The branch which was most efficient (the one with the largest negative residual) had long customer lines indicating poor service.

Another application of standard setting would be as a performance evaluation tool. Using standard expenses as a plan or budget, managers would have to justify significant unfavorable variances or be held accountable for them. These standards and compliance with them could effect their bonus compensation.

Another use of the system would be to evaluate branch personnel decisions and the effect of those decisions on branch profitability and service levels. Using the regression results could show a manager when they had enough volume to hire another staff person or when service levels were too low. It could also show when the branch had too many

employees for its volume level. If hiring were centrally decided, then it could show when staff should be added or deleted from each branch.

If used correctly regression analysis can be a relatively inexpensive and objective way to measure expense efficiency in a service firm with similar multiple branches. The resulting standards can be used for controlling expenses, evaluating performance, making decisions regarding adding or deleting staff, and as part of the calculation of a manager's bonus. Given the low cost and many uses of regression analysis, it seems like an idea whose time has come.

Footnotes

1 Two other studies which apply regression analysis to service firms, specifically banks, are Longbrake[2] and Rose and Wolken[3]. These studies analyze product costs and profitability across a large number of banks, rather than analyze controllable branch costs within a single bank, as this study does.

2 Virtually every managerial or cost accounting textbook has a description of regression analysis for individual firms across time which vary between one page (sometimes as an appendix) and one chapter (usually in the back of the book as an "additional" topic). One textbook with an unusually thorough explanation of regression analysis (covering two chapters) is Kaplan and Atkinson(1).

References

1 Kaplan, Robert S. and Anthony A. Atkinson, *Advanced Management Accounting*, 2nd edition, Prentice-Hall, 1989.

2 Longbrake, William, "Statistical Cost Analysis", *Financial Management*, Spring, 1983, pp. 48 - 55.

3 Rose, John and John Wolken, "Statistical Cost Accounting Models in Banking: A Reexamination and an Application", Board of Governors of the Federal Reserve System, Staff Study 150, May, 1986.