

## **A Microsoft *Excel*-based Aid for Learning Cost Estimation**

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Good decision making requires good information. To assist management in the decision process, accountants must provide accurate predictions of future costs and/or revenues. Instrumental in predicating costs and/or revenues is developing reliable prediction models. Cost estimation is the process of developing these prediction models. The prediction models, or cost functions, require a classification of costs by behavior, i.e., estimates of fixed and variable costs.

In managerial and cost accounting classes, discussion of cost estimation processes help in understanding how cost functions can be created for predicting future costs and revenues. A variety of techniques are available, depending upon availability of prior data and the costs/benefits associated with each situation. A few of the techniques typically covered are account classification, engineering study, scatter-graph, high-low, and least squares regression. The coverage varies dramatically among texts, often placing the burden of in-depth study on the individual instructors. This requires instructors to develop instructional materials.

This paper reports a web-based tool that provides materials requiring no financial costs and little or no time costs to accounting instructors who desire more enriched inquiries into cost estimation. This paper describes a Microsoft *Excel* template that facilitates such inquiry. The workbook and an accompanying primer are at <http://campbell.berry.edu/faculty/grobson/costest.html>.

**The workbook**

The workbook contains all components necessary to perform ordinary least squares (OLS) regression, calculating pertinent statistics, and creating appropriate graphs. It also implements a simple high-low method to create a cost function. This section describes the workbook design and presents results from OLS regression analysis and high-low analysis.

The workbook opens with a menu page that introduces various aspects of the remainder of the workbook. A specified set of cells contains information on various aspects of the workbook. A set of navigation buttons accompanies this informational material; these help the user move directly to the appropriate spreadsheet.

The first spreadsheet contains space for entering data. The next three spreadsheets contain templates for OLS regression. To gain the advantages of a prefabricated *Excel*-based regression package that places minimal burden on the user, separate spreadsheets are used for one, two, or three independent variables (In rare cases, where more independent variables are required, the user must make minimal adjustments to one of the spreadsheets.) The final spreadsheet implements the high-low alternative to OLS regression. The remainder of the paper discusses each spreadsheet in turn. (The discussion of OLS is limited to simple regression. Nothing of import changes when multiple regression is introduced.)

#### *Entering and representing data*

The data sheet contains space for four independent variables and one dependent variable. The user may observe scatter plots of the dependent variable against each of the independent variables (a recommended practice).

#### *Ordinary least squares regression analysis*

Each spreadsheet provides instructions regarding the setting up of the regression program, along with estimates and diagnostic information. *Excel* routinely returns much standard output: point estimates, standard errors, t-values, ANOVA information, etc. Along with this information, the spreadsheet reports the Durbin-Watson statistic and other summary statistics (minimum, maximum, and average values for each of the variables in the model). The

spreadsheet also routinely provides forecast information. Given a value of the independent variable(s), the forecast value of the dependent variable and a two-sigma forecast interval are reported.

Also, the user is provided graphs of the residuals. The residuals appear from two different views. First a time-series plot allows the user to examine the pattern (if any) of movement through time and to look for outliers. In addition, the residuals are plotted against the independent variable(s). This plot can provide evidence of possible influential observations, individual data points that can give a distorted view of the true relationship.

#### *High-low estimation*

High-low estimation is often used to get a quick look at the relationship between cost and a single cost driver. High-low analysis is often (and deservedly) criticized for putting so much weight on a few data points, but such criticism can be taken too far. OLS estimation places the same weight on every observation, often an improper procedure. Furthermore, high-low estimation does have the advantage of transparency. The user can often get to know the few data points to be used, determining whether they are likely to be wildly non-representative. In any event, the question need not be either-or. This software makes it a single matter to conduct both types of estimation.

Typically, estimates using the high-low technique do not yield an  $R^2$ , but we consider this a useful summary measure and include it. We also include a forecast for the dependent variable for a given value of the independent variable. High-low estimation does not allow for confidence interval construction. A final piece of information is a graph showing the actual and estimated values of the dependent variable as functions of the independent variable.

#### **Summary**

This paper reports the availability of a Microsoft *Excel*-based workbook and a related primer that can allow instructors to introduce statistic estimation of cost drivers into their cost accounting courses with minimal loss of time and continuity, even if the topic is not covered in-depth by the textbook. Students are typically familiar with

*Excel*, even though they may not have used its statistical functions. The workbook is self-contained, in that one could estimate cost drivers using both OLS and high-low methods with a purely *Acookbook@* approach. This is not recommended, however, so the primer (not addressed directly in this paper, but available at the indicated website) accompanies the workbook. The primer provides insights into the use of regression methods, including a discussion of some of the pitfalls of which the analyst must be aware.