Week 06, Forecasting with Excel – Teaching Approach

The purpose of this document is to describe the teaching approach used to cover the content within Week 6, Forecasting with Excel.

# Background Information

Students within this course have previous experience using Excel for data and statistical analysis and may or may not have experience with Excel VBA macros. Therefore, this week focused on the use of Excel for forecasting without use of any macros.

# Section 1: Introducing Business Time Series Data

We started this section of the discussion by using time series data on temperature with all of the data provided in Excel spreadsheets. In this exercise, we had ten years of average monthly high and low temperatures for a city. This data was plotted to show how a common cyclical pattern existed, and then we averaged across the ten years to generate a “typical” temperature for each month in a year. This process allowed us to start discussing how we might forecast the temperatures for each month for the next year.

Next, we discussed businesses that are impacted by factors like temperature (such as energy companies). With this foundation, we then used temperature as input to further discussion on forecasting sales for utilities or solar panels, and the importance of forecasting economic and non-economic variables. We continued the discussion of the application of forecasting in business including budgets, inventory, process and quality control, bond yields, and stock market prices.

Working within this type of time series data supported students in connecting their current knowledge of cyclical temperature changes (something common in our location) with terminology about time series data (such as seasonality). In addition, they could connect temperature and other factors as time series data that can be valuable for businesses.

Content within this section supports the following learning outcomes:

* Identify and describe business decision making scenarios appropriate for financial modeling.
* Demonstrate data wrangling techniques required to prepare data for use in financial modeling.

# Section 2: Reviewing Forecasting

Section 2 began by taking students through a process where they started smoothing the monthly temperature data using three-month and twelve-month moving averaging to visualize how temperatures change. This naturally led us to conducting and graphing a simple linear regression on the data that shows the linear trend of the data and brings in discussions about businesses that might benefit from the trend. Interspersed with these discussions were creation of naïve forecasts (the temperature tomorrow will be the temperature today) as well as the role of other qualitative factors. As a final step, we expanded the discussion to multiple regression as we could ask about what other factors could be impacting the temperature trends that we were visualizing and discussing.

Throughout this section, students followed along by completing steps within Excel to create the forecast models of the next month’s temperatures.

Working through these models was an important review step for students. In addition, this section allowed us to show students the next step in forecasting. First, we could incorporate free data from the Federal Reserve Economic Data (FRED) data source into a model forecasting economic sales for a firm using their historical data. Second, we could use these tools to model a firm’s stock price using some of the price momentum (also known as technical analysis) concepts from finance.

Content within this section supports the following learning outcomes:

* Identify and describe business decision making scenarios appropriate for financial modeling.
* Demonstrate data wrangling techniques required to prepare data for use in financial modeling.
* Create and interpret appropriate financial models.

# Section 3: Using Forecasting Tools in Excel

In the final section for this week, we used Excel to take the aforementioned firm and FRED data and show students how they could use the various forecasting tools (e.g., LINEAR, SEASONALITY, CONFINT, etc.) that are already available for use in Excel. We conceptually discussed how these forecasts are necessary and important to allow the firm to forecast important financial statement such as free cash flow (FCF) statements and budgets that are necessary to make decisions today that will then allow the firm to move towards meeting their goal of maximizing the wealth of their owners. For example, if our modeling is forecasting a larger increase in product sales, then we might need to get lines of credit and inventory orders prepared in advance to achieve the desired level of production to make our sales forecast based on the external economic conditions. In Excel, we were then able to show students how we can forecast different financial outcomes in our FCF statement based on decisions of managers made on firm inputs.

Working through this discussion supported students delving into the forecasting support within Excel as well as their ability to communicate the findings of their models to decision makers.

Content within this section supports the following learning outcomes:

* Identify and describe business decision making scenarios appropriate for financial modeling.
* Create and interpret appropriate financial models.
* Professionally communicate the process and results of financial modeling to a variety of stakeholders.

# Homework

At the completion of the Week 6 discussions, we asked students to mirror the models described in class. Students completed forecasting and graphing homework for this week using the FRED data and the individual stock price data by applying this data to all of the different forecasting approaches, from naïve to multiple regression, used in the class.

The last component of their work was to develop the stock prices using the FCF model, but we also started introducing the idea of evaluating the strengths and weaknesses of models created by other people based on design and usability. The intention was to get students thinking about who might be using their models, especially if they are no longer available to explain them (such as if they leave a position or the firm). We explained to students the importance of this model design skill and stated that it would be included in their evaluation of the final projects for the course.

While this homework is graded and included in the student’s final grade for the course, this assessment is considered formative in nature.

# References

Free cash flow (FCF) information obtained from the Brigham-Daves text (student files).

Temperature materials obtained from Machine Learning Mastery GitHub directory, specifically <https://github.com/jbrownlee/Datasets/blob/master/daily-min-temperatures.csv>.

All other materials created by faculty teaching this course.