**2. Excel Modeling (Third Week)**

**Introduction to Modeling**

**Modeling** refers to using certain inputs and using those inputs to predict how a business metric will perform. The time duration of your forecast will depend on the type of business and the business metric:

* Startups – usually forecast 6-12 months out
* Established companies – usually forecast out a few years
* Sales bookings – a few months out

Models are continuously updated on a frequent or periodic basis (monthly, quarterly, yearly), depending on the metric.

Most businesses forecast their sales bookings and financial statements (profit and loss, balance sheet, and cash flow statements). This lesson will focus on the profit and loss statement.

**Top-Down Approach**

Forecasting requires careful thinking about which approach you want to take to create the models. One approach to modeling is top-down, which takes a macro approach to forecasting.

* You start with the best estimate of the larger size of the market narrowing it down to identify the portion of the market that the company is serving
* Then estimate what it will take to capture that portion of the market.

Top-down is a macro approach, but it is less credible and typically adopted when there's limited historical data.

**Bottom-Up Approach**

A bottom-up approach takes a micro approach to forecasting.

* This approach starts by looking at historical data. The more data you have, the better. But often, even as little as six months to one year of data is used in this approach.
* The model forecasts are based on this data to make assumptions about how the key metrics will behave, and then we forecast out the revenue based on these assumptions.

Similar to a top-down approach, a bottom-up approach is based on assumptions. However, unlike a top-down approach, it is built on previously attained numbers. These numbers are specific to how the company has performed, and not generalizations that relate to the market as a whole.

**Components of a Forecast Model**

1. **Inputs or Drivers:**These are the inputs that drive the output of the model and can include a combination of **historical data,** **assumptions,** and scenario analysis.
2. **Outputs:**This is the metric being forecasted within the model.

## Assumptions

In modeling, assumptions are what you think will come true for the inputs or metrics in the model. It can also be assumptions about circumstances that affect the metrics in the model.

To build your assumptions, you start with information available to you based on historical data, such as continuing to gain market share at the same rate as we have for the last six months or seeing spikes in sales around holidays or on certain days of the week.

As you make assumptions, pay attention to your forecasts about metrics that you have less control over. Be careful about assumptions that you make, and check to see if those assumptions are reasonable and make sense.

**Historical Data**

Historical data is about what your performance metrics show for the past. For sales, for example, we look at prior sales data from the previous year or months. For financial modeling, we look at prior financial statements, as well as quarterly and monthly results. Above we are using prior year data (e.g., Revenue, COGS) to get our operating income, which we then use to calculate the historical operating margin.

**Formulas for Calculating Historical Financial Metrics**

Typically, the historical statistics or metrics used to forecast financial metrics in an Income Statement are:

1. Revenue Growth
2. Gross Margin
3. Operating Margin
4. Historical Tax Rate
5. Historical Interest Expense Rate

The following list provides more information about calculating the historical statistics.

1. **Revenue Growth (in %) = (Current Year's Revenue / Previous year's revenue) - 1**
2. **Gross Margin = 1 - (Current Year's Cost of COGS / Current Year's Total Revenue)**

Keep in mind the two terms COGS and Cost of Revenue can be used interchangeably.

1. **Operating Margin = Current Year's Operating Income / Current Year's Total Revenue**
2. **Historical Tax Rate** is the tax rate from the companies previous year's tax rate.
3. **Historical Interest Rate** is the interest rate coming from the previous year's Debt Schedule.

**Sales Forecasting**

You will go through examples of forecasting sales bookings using both a bottom-up and top-down approach. Although there are many ways to implement each of these approaches, the examples will provide a foundation for extending these practices to new examples.

Before you get started, let's revisit the sales funnel. Sales metrics track the conversions from prospects into sales bookings. The layers of the funnel are:

* Prospects
* Leads
* Qualified Leads
* Conversion/Bookings

When using a bottom-up approach, you will use the sales funnel historical data.

## Top-Down Sales Forecasting

For the top-down sales forecasting model discussed in the video above, the model is focused on bookings per salesperson and is divided into four sections:

### Key Seller Assumptions & KPIs

These are the assumptions about the dollar amount needed in bookings and the following questions tell us the average size of opportunity a salesperson would be expected to generate.

* How Productive will the new salesperson be?
* How many opportunities will be generated?
* How much revenue is generated per unit and per opportunity?

### Sales Hiring Schedule

This section tells us the time and effort needed to generate the expected bookings and opportunities. In this example, we project out when the salesperson will be hired

### Sales Productivity Schedule

Based on historical sales data, we create the assumption that a new sales member would take x number of months to learn the business and "ramp up", in order to generate the bookings and opportunities assumed in the first section.

**Scenario or Sensitivity Analysis**

Scenarios are commonly used for financial forecasting and rely on assumptions to provide some perspective on a company's future. These perspectives typically that the form of:

* **Best Case Scenario**
* **Base Case Scenario**
* **Weak Case Scenario**

The assumptions used in your model will dictate the scenario you are looking at and will directly impact forecasted income for the company.

**Transitioning to Spreadsheet Tools**

To build out the financial model, let’s first take a look at some Excel functions and tools specifically for Financial modeling. As we introduce you to each of these, we will work towards a financial model, so this will set you up nicely for your final project.

* **Data validation** is a spreadsheet tool that allows you to limit what values are accepted in a cell. You can create drop-down lists of items and restrict cell value to date ranges and numbers.
* **INDEX** is used when you want the cell to have a value chosen from a specified array and row number indicated within the INDEX function.
* **MATCH** is a LOOKUP function that can locate the position of the lookup value within an array only when it meets specific criteria defined in the MATCH function.
* **INDEX AND MATCH** together add a powerful feature for advanced formulas. Together they can give a value from an array (the purpose of the INDEX function) based on a numeric position (which is provided by the Match function).
* And finally... **OFFSET**. Here you can select a start point in the spreadsheet, and tell Excel to return a set of cells that are counted from the starting point.

## Data Validation

The purpose of data validation tools is to confirm that the values within the cell are validated against a criterion. In other words, the values within the cell are confined to specific requirements. There are several criteria, including a provided list of values, date range, range of whole numbers, or decimal values.

To access the Data Validation tool within MS Excel, you **use the Data tab** and choose **Data Validation**.

### How to Create a Data Validation Dropdown List

To create a dropdown list using data validation, first**create a pivot table**:

1. Highlight the rows of data you want in the dropdown
2. Go to Pivot Table under the Insert tab to create a pivot table in a new worksheet (just hit OK)
3. From the PivotTable Fields menu, select the name of the field/column you want
4. You should now have a list of unique values with all duplication eliminated
5. Copy and paste the list of unique values into a new cell and give that cell block a name, for example, company\_list.

now that we have a named list of unique values, the second step is to **create a data validation feature**:

1. In a new worksheet, go to Data Validation under the Data tab
2. Choose your validation criteria. In the video example, we used List
3. For source, reference back to your named list. In our example, it was company\_list
4. Hit OK and now you should have a dropdown menu with only the unique values from your original data source

**Pro Tip**– You can use the Name Manager feature under the Formula tab to see all of the named boxes available in a spreadsheet and you can delete boxes, confirm or edit the source or range the box references.

**Index**

**INDEX** takes a range of cells and returns a value from a cell in that range, based on the location of the cell holding that value. This location is provided in the INDEX function as either **row number** or **column number**.

The following is the generic syntax for INDEX:

* **INDEX(array, row number, column number)**
* array – the range of cells to look through
* row number and column number - give the location of the cell of the specific value wanted

|  | **A** | **B** | **C** |
| --- | --- | --- | --- |
| 1 | **Fruit** | **Color** | **Quantity** |
| 2 | Apple | Red | 25 |
| 3 | Banana | Yellow | 10 |
| 4 | Grapes | Green | 7 |

Using the simple chart above, for example, if we have an array named fruit\_ with the values (Apple, Banana, Grapes) then INDEX(fruit, 3) would return Banana.

Once you have entered your formula, instead of hitting enter, you need to press Ctrl+Shift+Enter. This places the curly braces around the formula. Missing this step can cause #NAME? error.

Note that for the INDEX function, the array could be a single column or the whole table. For example, if the entire table above was named *sample\_table*, then INDEX(sample\_table,3) would return the entire third row of the table:

|  |  |  |
| --- | --- | --- |
| Banana | Yellow | 10 |

INDEX(sample\_table,,3) would return the entire third column of the table, and INDEX(sample\_table,1,2) would return the value in the first row of the second column.

**Match with One Criterion**

The purpose of the **MATCH** function is to provide the**location**of a defined lookup value within a given lookup array, and not the value itself. Unlike the INDEX function where an array could be an entire table, the loopup\_array for the MATCH function can only be a single column.

The following is the generic syntax for MATCH:

* **MATCH(lookup\_value, lookup\_array, match\_type)**
* lookup\_value – the value you want to search for
* lookup\_array – the array in which to search for the look\_up value
* match\_type – this can vary from 0 (match is an exact match to look\_up value), 1 (match is less than or equal to lookup value), to -1 (match is greater than or equal to lookup value).

|  | **A** | **B** | **C** |
| --- | --- | --- | --- |
| 1 | **Fruit** | **Color** | **Quantity** |
| 2 | Apple | Red | 25 |
| 3 | Banana | Yellow | 10 |
| 4 | Grapes | Green | 7 |

Using the simple chart above, for example, imagine that all the data in the table is made up of three arrays, called *fruit\_*,*color\_,*and *quantity\_*.

* INDEX(fruit\_, 3) would return Banana.

However, what if we want to access the color or quantity of the Banana row? This is where we use the MATCH function. The MATCH function returns the position of the matched value within lookup\_array, not the value itself.

* MATCH(Banana, fruit\_, 0) returns 3, since the value, Banana, is in row 3 and MATCH gives us the location of a cell within an array.
* INDEX(color\_, MATCH(Banana, fruit\_, 0)) – returns Yellow, since it is in row 3 of the array *color\_.*
* INDEX(quantity\_, MATCH(Banana, fruit\_, 0)) – returns 10, since it is in row 3 of the array *quantity\_.*

**Index and Match with Multiple Criteria**

Thus far, you have learned to use INDEX and MATCH to find values based on a single criterion, say the name of a fruit. This works well when there is only one entry for that fruit. However, when there is more than one row with the same look\_up value, this formula logic does not work.

In the table below, for example, there are two entries for Apple. Searching just this word will not provide enough information for Excel to distinguish which row of data we need. We need to specify which row of Apple we want by adding more criteria.

To do this, Excel uses boolean logic to create the MATCH criteria. The following is the generic syntax for combining INDEX and MATCH when you need MATCH to meet multiple criteria:

* **INDEX(array, MATCH(1, (condition 1)\*(condition 2), [match\_type]))**

|  | **A** | **B** | **C** |
| --- | --- | --- | --- |
| 1 | **Fruit** | **Color** | **Quantity** |
| 2 | Apple | Red | 25 |
| 3 | Banana | Yellow | 10 |
| 4 | Grapes | Green | 7 |
| 5 | Apple | Green | 30 |

So let's say we want information based on the following criteria:

1. Fruit = Apple
2. Color = Green

Remember that the arrays in our set are *fruit\_*, *color\_*, and *quantity\_*. Since we are looking for two criteria now, the syntax will be:

* INDEX(quantity\_,MATCH(1, (Apple = fruit\_)\*(Green = color\_), 0))
* this returns 30 as the number of apples that are green.

Note that in the example shown in the video, instead of hard coding the name of the variable needed, we simply refer to the spreadsheet cells that contain the criteria.

* INDEX(costofrevenue, MATCH(1, (H1=ticker\_symbol)\*(H2=year),0))

# Financial Forecasting Process – Part I

Remember we want to create three forecasting scenarios based on our assumptions:

* Best Case Scenario
* Base Case Scenario
* Weak Case Scenario

To do this, we need to walk through the following four steps to create our financial forecasting model:

1. **Calculate operating statistics**
2. **Create the scenarios**
3. **Create assumptions** – this is where the **OFFSET** function will be used
4. **Develop the forecasted scenarios**

## Step 1 – Calculate operating statistics

Here we calculate operating statistics based on historical data from the income statement:

* **Gross margin** – 1- (Cost of good sold/Total revenue)
* **Operating margin** – Operating profit/Total revenue
* **Revenue growth** – (Current year revenue/Prior year revenue) -1

**Step 2 – Create the scenarios**

In this step, we create the three scenarios for each of our operating statistics because they will feed into the forecasting model. The numbers used in this step are based on:

* Historical data
* Business analyst's knowledge of the business
* Research
* Assumptions about the business itself

## Step 3 – Create assumptions

When running your models, you always want to avoid hardcoding in numbers. Rather, you want the spreadsheet to change dynamically based on the scenario you choose. This is where the **OFFSET**function can be used.

### Excel Syntax

The purpose of the OFFSET function is to return a range that is a specified number of rows and columns from a reference cell or range.

* **OFFSET(cell\_reference, number of rows to offset by, number of columns to offset by)**

In the other words, using OFFSET allows you to move around on a page to pull data. Look at the following table for example;

|  | **A** | **B** | **C** |
| --- | --- | --- | --- |
| 1 | **Fruit** | **Color** | **Quantity** |
| 2 | Apple | Red | 25 |
| 3 | Banana | Yellow | 10 |
| 4 | Grapes | Green | 7 |
| 5 | Input | **Grapes** |  |

If we are looking for data on the quantity of fruit based on the name input in cell B5 then:

1. **cell\_reference** – The Quantity column name in the cell C1 would be our
2. **Use MATCH**– to find the row of the word in cell B5 based on the words in the range A2:A4
3. **OFFSET Syntax** – OFFSET($C$1, MATCH($B$5, $A$2:$A$4,0),0), the 0 at the end tells Excel to stay in column C because we want the quantity value.
4. **Output** – 7

This syntax will produce a different quantity output based on the word in cell B5 of our table.

**Step 4 – Develop the forecasted scenarios**

This is the final step in the financial forecasting process. Here we pull all of our work of the previous steps together to project out a financial picture of our company, based on one of our three scenarios:

* Best Case Scenario
* Base Case Scenario
* Weak Case Scenario

**Formatting principles for Modeling**

Here is a guide to best practices for formatting financial models.

1. All inputs to the model should be colored BLUE. These include hard-coded values.
2. All formulas and calculations should be coded in BLACK.
3. Any links to other sheets within the workbook should be coded in GREEN.
4. Any links to other files should be coded in RED.