



How to Create Sensitivity Tables in Excel

Welcome to our next lesson in this Excel course. Now this is a very important lesson, and hence, I am going back to Spider-Man here and pulling out the most famous Spider-Man quote, "With great power comes great responsibility." This lesson is about how to create sensitivity tables in Excel. And I picked this quote because sensitivity tables are very powerful, but you have to be very responsible when you use them because it's very easy to set them up incorrectly, to calculate them incorrectly, and in general, to misuse them.

We are on the Walmart Model still, and specifically, we are on the DCF tab here. And if you scroll to the bottom of this DCF tab, you will see the Sensitivity Tables laid out right here. And essentially, these let us see what Walmart's Implied Share Price looks like under different conditions, under different scenarios, under different assumptions for the Discount Rate, and under different assumptions for the Terminal Value in this analysis.

Now I have some very detailed written notes on the right-hand side here. There's a lot to get through. You will also get an exercise at the end. But since there is so much to get through here, I think we should just get started, and I should say a few words about the basic setup and requirements first.

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So, this lesson is all about sensitivity tables. They let you see how the output of a model changes based on 1 or 2 changing inputs, but not 3, 4, 5, or 10 changing inputs. It is always limited to one or two assumptions.

Now the shortcuts and commands to create these tables are fairly easy in my opinion, but the hard part is the setup. A lot of people get the setup wrong, which means that their calculations and data tables are completely wrong. And so, it's really important to go through it step by step. This set of steps may seem ridiculous to you if you're looking at it for the first time. But I want to be very specific about how to do this because it will become more natural over time as you get more practice with these tables and as you see them used in more models and templates.

So, I am going to illustrate how this works by creating a sensitivity table for the Scenario versus the Discount Rate in this model for Walmart. And you'll see how its Implied Share Price changes as we vary those assumptions.

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The first step of this process is that the input variables and the output must be on the same spreadsheet, the one with the table. If they are not on the same spreadsheet, then you have to change the model around and make sure they are on the same spreadsheet.

So, here, for example, if you look at these tables, we have the Discount Rate, the Terminal EBITDA Multiple, the Terminal Free Cash Flow Growth Rate, and then the Operating Scenario. Now if you go up to the top, the Discount Rate is on this tab, so this is fine. It's directly here. And if you press the Ctrl +] key, you can see that it feeds directly into all the calculations in the DCF analysis. You can also press Shift + Ctrl + } and see that it is a very important part of all these calculations. So, this is fine. And similarly, the EBITDA Multiple and Terminal Free Cash Flow Growth Rate, these are both a very important part of this model, and again, you can press Shift + Ctrl + } and see exactly how they factor in. So, these are already here, and these are fine, and we don't need to do anything.

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The problem is that the Operating Scenario is not on this tab. It's not on the spreadsheet. And so we need to go over to the Walmart Model tab, and we need to take this Selected scenario right here, and we need to cut this with Ctrl + X or Command + X on the Mac, and then go over to the DCF spreadsheet, and then paste it somewhere here. You might wonder why we have to cut this instead of just copying it. And the answer is that this is a named cell called Scenario. And so, if we just copy this instead of cut it, it's not going to work. It's going to break the entire model because now the named cell will still be on the Walmart Model tab, and nothing will update in response to whatever we're doing on this DCF tab. So, we need to cut and paste this.

You might be thinking that that's it. But there's actually one extra step here, which is that if you are cutting and pasting in something like a scenario box or a dropdown box, you may need to re-link some of the assumptions here.

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So, let's go in and take a look at this. If I go over here and I press Alt, D, L, for the Source, it's still linking to the same set of cells that we were using on the Walmart Model tab, but here, they're completely blank, which is a problem. So, we need to re-link this to the correct set of scenarios. So, let's go in. I'm just going to delete what's there, and I'll link to Upside, Base, and Downside in Cells C47 through C49. It's very important to do this because if you don't, the dropdown is not going to work correctly, and the scenarios and the setup, in general, are probably not going to work correctly.



So, that is the first step. Now we've ensured that everything is actually on this spreadsheet.

Step two is to test your model. We've made some changes already, so we want to make sure that the output actually changes in response to changes in the assumptions, because a lot of people try to set up these tables, but their model doesn't actually work correctly, and so the tables don't work correctly. Let's take a look at this.

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So, we're in the Base Case. We're at about \$112 for the Implied Share Price. If I change it to the Upside Case, it goes up by quite a bit. If I change it to the Downside Case, it goes down by quite a bit. So, that appears to be working.

With the Discount Rate, if we make this say 10% instead, the valuation goes down by quite a bit, so that appears to be working. And then if we change the Terminal EBITDA Multiple to 15.0x, now the valuation goes up substantially. So, just based on that simple test, we can be pretty sure that our model is at least linked and set up properly. You could do the same thing for the Terminal Free Cash Flow Growth Rate, but I already know this works, so I'm going to skip it here.

Now step three is to pick the row and column inputs. The important point here is that you cannot link to or from anything that is directly in the model, so nothing directly in this DCF. You have to use either hard-coded numbers or simple plus or minus operators based on numbers that are just in this area, just this table area. So, let's go down and take a look at what I mean.

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For something like this table, with the Operating Scenarios, you would not want to go up and link it to the Upside, Base, and Downside Case here. Technically, you could, and it might actually work okay in this case, especially because these are text inputs, but it would not be good practice to do this. What you want to do instead is just reenter them as hard-coded values down here. Or you could link to them at first and then do a copy and paste as values or something like that. But you generally don't want to link these to anything directly in the model.

Now for the Discount Rate, you have a few different options. One thing you don't want to do is link directly to this cell no matter what else you do. So, our preferred approach here is to enter a 6.00% at the top. And then we could go down and we could just subtract 0.25% in each row until we get to 4.00% at the end. But there is one trick here that makes this a lot faster.



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Let's say that we want to span the Discount Rate from 4.00% to 6.00%. I could just enter these two numbers, and then I can use this Excel shortcut, Alt, E, I, S for filling in a series. And you can see it automatically picks up the Step Value, it detects the Type Linear, and it detects that the series is going to be in columns. And I can say OK, and now it fills in these values automatically. So, it looks at two values and then fills in everything in between. And that's a neat time-saving shortcut that you can use for these types of sensitivity tables.

So, I just have a note about that on the PowerPoint slide, Alt, E, I, S. Unfortunately, there is no Mac shortcut for this. So, on the Mac, you'll have to go to the Home part of the ribbon menu and then go to the Edit area. And then right under AutoSum, there will be something for fill right there. You can't see it because my screen is too small at the moment, but you can go to that menu, and you'll find it if you look to the right on the Home tab.

So, step four, now we have to enter a direct link to the output that we want in the top left corner of the table, and we can anchor this if we're going to reuse it. So, this part is pretty easy.

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We're just going to go to Cell D130 here, and we could link to the output from either one of the tables because we're not wedded to the Terminal Multiple or the Terminal Growth Rate here. But I'm just going to go up, and I will link to the one that is based on the Terminal Growth Rate. So, I'll link to the Implied Share Price right here, N39. We could anchor this, but we don't necessarily have to. I'll anchor it just because we might be copying and pasting this around to other tables in the future. If you go to Ctrl + 1, I've already set the font color here to light blue, so you don't see it. If we change it to white, then you would see it. So, that's the explanation of how this is not actually showing up there.

For the next step, you want to set the Workbook Calculations within the Options menu and Formulas to Partial or Automatic Except for Data Tables in older versions of Excel. So, if you go to Alt, T, O or Command + comma on the Mac, Formulas, make sure Workbook Calculations are set to Partial right here. You don't want to set it to Automatic because if you do that, then the tables are going to recalculate every time something in the workbook or the file changes, which can really slow things down. So, you generally want to keep this set to Partial, which it is right now.

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For step six, now you want to select the whole area and then use the Alt, D, T shortcut for data table to set this up. You'll enter something for the row input cell and then for the column input cell. Now on the Mac, the Alt, D, T shortcut does not work. So, what you'll have to do is go to Data in the ribbon menu, and then go to What-If Analysis, and then go to Data Table, and you can enter it from there. On the PC, you could also do this, and you could go through all the shortcuts to get there, but I just prefer the legacy Alt, D, T shortcut because I find it easier to remember D for data and T for table.

Now for the row input cell, we want to go up and link to the Scenario right here. And then for the column input cell, we want to link to whatever is in the column on the left, the Discount Rate, in this case. I'll say OK. And then we can see our data table, and nothing is there, which leads us into the next step.

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Now you have to press F9 or Shift + F9 or just save your file to get results in the table. So, let's do that. I just hit Save, and now we get results right here. And your data table should look something like this.

As expected, as the Discount Rate falls, the Implied Share Price goes up. And then across the Scenarios, we get the lowest prices in the Downside Case, the highest ones in the Upside Case, and the Base Case is somewhere in the middle.

So, that is how you set up a basic data table. Now I know that this is a lot of steps to go through and look at, but I wanted to be very, very specific about this because I've seen so many people not really understand the process and set this up incorrectly. So, I wanted to give too much detail here rather than too little detail here. And that's the explanation for this set of steps.

But now that we've been through this once, I want you to get some practice doing this on your own. So, if you refer to the exercise over here, I want you to create the first two sensitivity tables here, which should be easier because you already know the process and you don't have to change anything with the input boxes. So, for the Discount Rate, you can use that same range of 4.00% to 6.00%. The Terminal EBITDA Multiple can go from 6.9x to 10.9x. The Terminal Free Cash Flow Growth Rate can go from -0.75% to 0.50%.

[11:08]



So, pause the video right now, and then go over to these tables and follow the process that I just showed you and create them. When you're done, unpause this video, and then we will walk through this together.

Okay, good. Let's start with the basic table setup. Now I'm not going to go through the whole process of making sure that all the inputs and outputs are on this and that the model works. We already covered that the first time around, those steps one and two, when I set up the initial table down here for the Scenarios and Discount Rate. So, we don't need to do all that again. Everything here is already on this tab. We already checked for that. So, I'm just going to get started with the input assumptions here.

For the Discount Rate, we can say 6.00% and 4.00%, And same thing down here, 6.00% and 4.00%. And we could use that same trick. Select everything, Alt, E, I, S and we can let Excel create a series like that. Select this whole thing, Alt, E, I, S and Excel will create a series like that.

[12:09]

Now for the Terminal Free Cash Flow Growth Rate, they said it was supposed to go from -0.75% to 0.50%. And then for the Terminal EBITDA Multiple, they had said 6.9x to 10.9x. And let's do the same thing here. Select everything with Shift + Ctrl + right arrow key, Alt, E, I, S. We have that. And then do the same thing up here, Alt, E, I, S, and we create our series like that.

Now let's enter the input cells. So, for this one, with the Terminal Free Cash Flow Growth Rate, we want to get the output from the DCF calculations that are based on Terminal Value linked to the Perpetuity Growth Rate or Free Cash Flow Growth Rate. So, let's go up here and link to our number in this one, the Perpetuity Growth Rate Method. I will anchor this even though it's not really necessary here.

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And then for this one, we want to get the Implied Share Price from the Terminal Multiple-based DCF analysis. So, we'll link to this in Cell I39, and I'll anchor this. And we have that.

Now let's enter these tables. So, I'll select everything. I'll go to Alt, D, T, and then we'll get our Terminal EBITDA Multiple for the row input cell. We'll go up here and select this. And then for the column input cell, we'll get the Discount Rate right here. And I'm actually just using the mouse for this part. I think it's fine because you don't create data tables repeatedly. You sort of create them once, and then you may refresh them over time, but you're not constantly recreating these.



Let's do the same thing for this other table. For the Terminal Free Cash Flow Growth Rate, Alt, D, T. And then for the row input cell, we'll go up to our Baseline Terminal Free Cash Flow Growth Rate. And then for the column input cell, we'll go over here to our Discount Rate. We have that. Since our calculations are set to Partial, the tables are not refreshing, but you can press F9, Shift + F9, or Ctrl + S to see the file and refresh, and now you get everything right there. And there you have your data tables.

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Now there can be more to it than this, and sometimes you will run into more complicated problems that are trickier to solve. But these are the basics and the fundamentals of what you absolutely need to know about data tables to use them successfully in financial models.

So, with that all done, let's do a quick recap and summary. Sensitivity tables are very powerful because they let you see what the model output looks like under different conditions, under different growth rates, under different margin assumptions, under different scenarios, under different discount rates. However, they are also quite tricky to set up and require a lot of legwork. This is why I started with this comparison to Spider-Man, "With great power comes great responsibility." They're very powerful, but they're also tricky to use, and you have to get the setup steps exactly right.

We started here by making sure the input variables and output were on the same spreadsheet. In this case, the Scenario box was not, so we had to cut and paste it and then re-link the data validation.

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Then we tested the model to make sure that the output, the Implied Share Price responded properly. Then we put the row and column outputs. And with this, one very useful shortcut is to enter these and then use Alt, E, I, S to create a series in Excel going from one number to the other. For the Scenarios, we just entered the text as hard-coded values again. Then we entered a direct link in the top left corner of the table. So, we linked it to the Implied Share Price output from the model.

Then we set Workbook Calculations to Partial to make sure that our tables do not constantly refresh, which can really slow things down. Then we selected the whole area and used the Alt, D, T shortcut and entered the right row input cell and column input cell. We didn't get anything in the table at first, and so we had to press F9 or Shift + F9 or just save the file to get results and updated numbers in the table.



So, that's about it. The overall interpretation here is that Walmart seems about appropriately valued because its Current Share Price is right in the middle of the column for the base range, and it's pretty close to the middle of these other tables. But this is how you might set up something very useful that you will use all the time in financial models and valuations.

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That's it for this lesson. Coming up next, we'll cover Goal Seek and a bit about how the Solver functionality in Excel works, and you'll see some real-world applications of them.