Financial Modelling in Excel (Intermediate)

Online Course Notes
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“Financial Modelling Techniques”
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MODULE FOUR: Financial Modelling Techniques

Module 4 consists of 6 videos:

1. Skills Needed for Financial Modelling
2. What Makes a Good FM?
3. Building Error Checks
4. What-if Analysis with Goal Seek
5. Calculating the WACC
6. Calculating NPV & IRR

Log into your online course and download the Excel templates on each video page. Follow along with the video demonstration, and save your model. Note that the Excel models in Module Two are not required uploads for this course, however, you are welcome to submit them if you’d like us to check that you’re on the right track.
Video 4.1: Skills Needed for Financial Modelling

Recommended Reading:

See the section on “Skills Needed for Financial Modelling” in Chapter 1, page 17 of Using Excel for Business and Financial Modelling.

See this article for a list of Financial Modelling & Excel Resource Links as mentioned in the video.

When you decide your financial models are not as good as they should be, should you immediately take an advanced Excel course? Whilst this is helpful, **there's a great deal more to financial modelling than being good at Excel!**

When considering the skills that make up a good financial modeller, we need to differentiate between conceptual modelling, which is to have an understanding of the transaction, business, or product being modelled, and spreadsheet engineering, which is the representation of that conceptual model in a spreadsheet. Spreadsheet skills are reasonably easy to find, but a modeller who can understand the concept of the purpose of the model and translate it into a clear, concise, and well-structured model is much rarer.

People who need to build a financial model sometimes think they need to become either an Excel super-user or an accounting pro who knows every in and out of accounting rules. I’d argue you need a blend of both, as well as a number of other skills, including some business common sense!
Skills Needed for Financial Modelling

1. Spreadsheeting / Technical Excel Skills
2. Industry Knowledge
3. Accounting Knowledge
4. Business Knowledge
5. Design skills
6. Communication / language skills
7. Numeracy skills
8. Ability to think logically

Spreadsheet and Technical Excel Skills

It's very easy for financial modellers to get bogged down in the technical Excel aspects of their model, get carried away with complex formulas, and not focus on key high-level, best-practice procedures, such as error-checking strategies and model stress-testing.

Excel is an incredibly powerful tool, and almost no single Excel user will have the need or desire to utilise most of the functionality this program offers. As with most software, the 80/20 rule applies: 80 percent of users use only 20 percent of the features—although some would argue that 95 percent of Excel users use only 5 percent of the features! Still, there are those select few who understand every in and out of Excel, every single function, and work out how to do practically anything in Excel. Do you need to have this level of Excel skill to become a good financial modeller? Unfortunately, having great software skills doesn’t always help when it comes to applying them to a specific area of business. Realise that Excel is used in several capacities, so being an Excel super-user doesn’t automatically mean you’ll be a super financial modeller. The best financial models are clear, well structured, flexible, and dynamic; they are not always the biggest and most complicated models that use the most advanced tools and functions! Many of the best financial models use only Excel’s core functionality.

Having said that, to be a good financial modeller, you do need to know Excel exceptionally well. Those people who maintain that you don’t need good Excel skills to be a financial modeller are usually those
with weak Excel skills. You should be building a superb model using simple and straightforward tools because you've chosen to make your model clear and easy to follow, not because that's all you know how to do! You don't have to be a super-user—the 99th percentile in Excel knowledge—but you must certainly be above average. A complex financial model might use features in Excel that the everyday user doesn't know. The best financial model will always use the solution that is the simplest tool to complete the task (as simple as possible and as complex as necessary, right?), so the more familiar you are with the tools available in Excel, the easier it will be. An array formula or a macro might be the only way to achieve what you need to achieve, but a simpler solution may well be—and often is—superior. You might also need to take apart someone else’s model, which uses complex tools, and it's very difficult to manipulate an array formula or a macro if you've never seen one before! So, if you are considering a career as a financial modeller (as I assume you are) improving your Excel knowledge is an excellent place to start.

Industry Knowledge

One of the fantastic things about financial modelling is that it is applicable across so many different industries. Good financial modelling skills will always stand you in good stead, no matter which industry or country you are working in! Financial modelling consultants or generalists will probably work in many different industries during their careers and be able to build models for different products and services. They will probably not be experts in the intricacies of each industry, however, and that's why it's important for a financial modelling generalist to consult carefully with the subject matter expert for the inputs, assumptions, and logic of the financial model. Don't be afraid to ask lots and lots of questions if the details are not absolutely clear. It’s quite likely that the person who has commissioned the model hasn’t actually thought through the steps, inputs, assumptions, and even what the outputs should look like, until you ask the right question.

Accounting Knowledge

Elements such as financial statements, cash flow, and tax calculations can be an important aspect of many financial models. Professional accountants know every single accounting rule and law there are, but this does not necessarily make them good financial modellers. If a highly skilled accountant built a financial model, you would guess that the layout and structure of the financial statements will be 100 percent correct, but will they be linked properly? If you change some of the inputs, does the balance sheet still balance? Sometimes not! A good accountant, or even someone qualified with a master of applied finance for example, might not be familiar with all of the modelling technical tools, even if they are a competent Excel user. As with the other modelling skills, you don't need a top level of accounting knowledge to build a financial model. In fact, financial models are often relatively straightforward from an accounting standpoint. You certainly do not need to be a qualified accountant to become a financial modeller, although a good understanding of accounting and knowledge of finance certainly helps.
Business Knowledge

A modeller with wide-ranging business experience is well-equipped to probe for the facts and assumptions that are critical for building a financial model. This is probably the most difficult skill to teach, as it's most easily picked up by working in a management role.

Business acumen is particularly important when commissioning, designing, and interpreting a financial model. When creating the model, the modeller needs to consider the purpose of the model. What does the model need to tell us? Knowing the desired outcome will assist with the model's build, design, and inputs. If, for example, we are building a pricing model, we need to consider the desired outcome; normally, the price we need to charge in order to achieve a certain profit margin. What is an acceptable margin? What costs should we include? What cost will the market bear? Modellers should also have an understanding of economic concepts, such as efficient costs and how these are calculated, an expected return on an asset base, operating costs and working capital, or long-run versus short-run marginal costs.

Of course the answers to these questions can be obtained from other people, but a modeller with good business sense will have an innate sense of how a model should be built, and what is the most logical design and layout to achieve the necessary results.

Aesthetic Design Skills

This is an area that many modellers and analysts struggle with, as aesthetics simply do not come naturally to left-brain thinkers like us. We are mostly so concerned with accuracy and functionality that we fail to realise that the model looks—and I'm not going to mince words here—ugly! Although it's just a simple matter of taking our time when formatting, most of us could not be bothered with such trivial details as making models pretty, and consequently most models I see use the standard gridlines, font, and black-and-white colouring that are Excel defaults. I'm certainly not suggesting that you embellish your models with garish colours, but you should take some pride in your model. See the section on “Bulletproofing Your Model” in Chapter 7 for some ideas on how to remove gridlines and change some of the standard settings so that your model looks less like a clunky spreadsheet and more like a reliable, well-crafted model you've taken your time over. Research shows that users place greater faith on models with aesthetic formatting than those without, so one of the fastest and easiest ways to give your model credibility is to simply spend a few minutes on the colours, font, layout, and design.

Communication and Language Skills

This is also an area that we left-brain thinkers are not always good at. Some analysts like to lock themselves away, working on spreadsheets without communicating with other people. If this is your tendency, then you might need to consider whether financial modelling is a good career choice for you, because there is a surprising amount of human interaction required for most financial modellers. This can be in the form of:
• Assumptions Validation
• Data Gathering
• Presentation Skills
• Client Skills

In all of these interactions with other people, financial modellers must show confidence in their model. Build the model to the best of your ability. Use best practices, check for errors, and follow a good and logical thought process, so that when you present or discuss your model, you can do so in a way that exudes absolute confidence. Doing so reduces questions about the accuracy, usefulness, and validity of your model. Be honest about the fallibility of your model and its known shortcomings (let's face it, no model is perfect), but be confident that you have built it to best-practice standards within the limitations of time, data, or scope. This will serve to increase your model's credibility, building your reputation within your company, and, of course, enhancing your career!

**Numeracy Skills**

Financial models, of course, have a significant mathematical component, and people with good numeracy skills are best suited to it. Solid math skills can be particularly useful in error-checking and sense-checking. The ability to make rough estimates quickly means they will be able to spot errors more easily. If we sell 450 units at $800 each, will our sales revenue be $3.6 m, or $360,000? If we've made a calculation error, the numerate modeller will pick up the mistake much more quickly.

The numerate modeller will also have a gut feel for differentiating between critical assumptions that need further verification, and input that is insignificant or immaterial to the model. The less-numerate modeller will have to test it manually, and will probably end up with the same result, but it will simply take longer.

General numeracy is a skill that is difficult to teach, and one that can be easily tested for in the recruitment process. Experience working with models over time can drastically improve these skills as the modeller who is less numerate will learn ways to compensate through error-testing, and these techniques will become acquired, innate habits.

**Ability to Think Logically**

Modelling is often like programming, and complex logic needs to be interpreted into the language of Excel so that the program can understand and create the modeller's expected results. Logic is also critical for model layout, design, and the use of assumptions in calculations. Logic is one of those analytical skills that is very difficult to teach, but modellers who have made a logic error learn quickly from their mistakes and are quite careful to use clear, well-documented logic for others to follow and check.
Video 4.2: What Makes a Good Financial Model?

**Recommended Reading:**

A well-built model will have the following user-friendly features and structural attributes:

### What Makes a Good Model?

**User Friendly Features**
- Well documented assumptions
- Explains the functionality
- Flows logically (left to right and top to bottom)
- Inputs and outputs, workings and results are clear and easy to find
- Contains in-built error checks
- Easy to navigate and find desired information
- Should contain instructions
- Printable – outputs are summarised and fit onto printable pages

### What Makes a Good Model?

**Structural Features**
- The only hard-coding should be the inputs and source data. All other information is linked.
- Duplication is minimised
- Names, formulas and formats should follow a consistent convention
- Is modular and scalable
- The most efficient function is used
Video 4.3: Building Error Checks

Recommended Reading:
See the section on “Building Error Checks” in Chapter 4, Page 81 of Using Excel for Business and Financial Modelling.
See the section on “Build in Error Checks” in Chapter 4, Page 59 of Financial Modeling in Excel for Dummies
See the webinar recording: Building Error Checks in Financial Models

Basic reconciliations can be built within a model, and a well-built financial model should have error checks included where possible so that the user or modeller can see at a glance if the formulas are calculating correctly. For example, when creating management reports, check that the sum of each individual department’s report adds to the company-wide total. This can be done by inserting a simple IF function, or several other methods, as shown in the next section.

Note that error checks are not a substitute for good practice such as checking and auditing your formulas. Error checks are most appropriate for capturing errors a subsequent user has made; they are less likely to highlight a model building error.

Background: Let’s say, for example, that you have the following cars in stock in a showroom. You want to know how many of each type of transmission you have in stock, so you have created a SUMIF formula to summarise how many of each type are in stock. See below:

If someone is updating this model and accidentally types Automatic in cell B3 instead of Automatic, your totals at the bottom will be wrong.
In cell C18, we can create an error-checking formula that will alert us if something like this happens. There are several different formulas we could put in cell C18 that will alert us if the model is not balancing properly:

- \( =C17=C13 \) will return the value TRUE if they are the same, or FALSE if not. However, this is also subject to a false error, as shown in the following section.
- \( =C17-C13 \) is the easiest formula to build that would serve as an error check, as it would return a value in the case of an error. Although this would not necessarily alert the user immediately that an error had been made, it is certainly quick and easy to follow and for this reason, a fairly common error check favoured by many modellers. It’s a good idea to format it using the Comma Style (found on the Home tab in the Numbers group) and then removing the decimal place and formatting it to red font. This will mean that the zero will not show if there is no error, and a red number will show if there is an error.

**Allowing Tolerance for Error**

\( =IF(C17<>C13,"error",0) \) is a superior error check, but on a small number of occasions, there can be an issue with this.

This formula usually works, but it can occasionally return a false error result, even though the values are the same. This is a bug caused by the fact that Excel carries calculations to 14 decimal places. After that, it truncates the value, and can cause a minute discrepancy, which will report an error when it's only 0.00000000000001 off.

Therefore, to avoid this potential issue, you could use an absolute value formula, which would allow a tolerance for error. \( =IF(ABS(C17-C13)>0.1,"error",0) \) will allow the values to be off by 0.1 before it reports an error. If you use the ABS function in Excel, this will take the absolute value of the result, such that it does not matter if it is a positive or negative number.

The image below, if the sum of each individual item does not equal the grand total, the cell will return the word error; otherwise it will show a zero. There are many variations of this formula, and I'm sure you can come up with many of them. Many modellers prefer to show the word OK if the numbers are right, and Check if they are not.
Error-Check Example

To make the error check even more prominent to the user, use conditional formatting to add a rule that makes the entire cell turn red if the error check has been triggered. See the section on “Conditional Formatting” for how to do this.

Error-Check Alerts

Consider adding in an error-checking page at the very back of your model that links through to all the error checks in the entire model. This page can be hidden, as the user does not need to see it, and the modeller can unhide it if necessary.

Create a summary cell that will identify, in a single cell, whether or not there are any errors in the entire model. This can be achieved with a COUNTIF formula like this:

=COUNTIF($A$3:$A$21,"error")

The COUNTIF function returns a 1 if there are errors. Now nest this with an IF statement, which will show the text Errors exist within this model if any of the error checks have been triggered.

=IF(COUNTIF($A$3:$A$21,"error")>0,"Errors exist within this model",0)

Now copy this formula (see the image below) to somewhere prominent at the top of each page (such as within the header) to create a global error check indicator, which will alert users to any error as soon as it is triggered.
Global error check alerts are particularly useful for a modeller who has users working with the model regularly. The error check will alert the user that something has gone wrong in the model—usually the user has simply entered some incorrect data—and hopefully the user will be able to correct the input, ensuring the continuing integrity of the model.
**Video 4.4: What-if Analysis with Goal Seek**

**Recommended Reading:**
See the section on “Goal Seeking” in Chapter 8, page 240 of *Using Excel for Business and Financial Modelling*.

See the section on “Goal Seeking” in Chapter 6, Page 117 of *Financial Modeling in Excel for Dummies*.

Also see the webinar recording on *Performing Break-Even Analysis in Excel*.

Goal seek is a very handy and commonly used tool in financial modelling and analysis. Goal seek is used to adjust the value in a specified cell until a formula dependent on that cell reaches the result you specify. In other words, it will change the inputs such that the output is set to the exact amount you want it to be.

In order to run a goal seek, you must have:

- A formula
- A hard-coded cell that drives that formula

The formula and its input cell do not need to be on the same sheet or even in the same model. As long as there is a direct link between the two (no matter how many calculations are in-between) the goal seek will work. However, it’s important to remember that the input cell must be hard-coded. An input cell that contains a formula will not work.

**Solve for Interest Rate Input Using Goal Seek**

**Background:** Let's say you borrow one million dollars at an interest rate of 6.5 percent.

1. Go to the “Goal Seek” file and select the “Goal Seek” sheet as shown
2. Use the PMT function to calculate the monthly repayments over 15 years
3. If you use the PMT formula wizard, your input should look like this:

   *See the section on “Goal Seek” in Chapter 8, page 247 of *Using Excel for Business Analysis*.***
4. The result will be -$8,711. Put a minus sign in front of it to make it a positive number.
5. Your formula should be =-PMT(B2/12,B3*12,B1).

Let's say that we can afford for our repayments to go up to, say, $10,000 per month. How much of an increase in interest payments can we afford? Maybe we should fix our rate.

6. On the Data tab, in the Data Tools group, click on What-if Analysis and select Goal Seek from the drop-down list. In Excel for Mac 2011, go to the Data tab. Then, in the Analysis group, click on What-if Analysis and select Goal Seek from the drop-down list.
7. In the Set Cell box, enter the reference for the cell containing the formula that produces the desired end result (B4, in this case).
8. In the To Value box, enter the result you would like to achieve in the Set Cell (type in 10000).
9. In the By Changing Cell, enter the reference for the cell that Excel is to change (B2, the interest rate).
10. This will bring up the Goal Seek Status dialog box containing the result of your seek as shown below.
11. Click OK to accept the new values, or Cancel to go back to the original values.

See “Loan Calculations” in Chapter 6 on page 180 of “Using Excel for Business Analysis” for more detail on how to use PMT and other loan calculation functions.
The answer to this problem is that we can afford for interest rates to increase to 8.75 percent. If the bank were to offer us a fixed interest rate of 8 percent, then we should take it! While this calculation could have been done by trial and error, it's much quicker to use a goal seek. Goal seek will work in huge models and run through a large number of calculations, giving the result you need to achieve your desired outcome.

**Break-Even Analysis Using Goal Seek**

A common use of goal seek is in break-even analysis. We normally want to know how many units we need to produce to break-even (i.e., how many units we need to produce in order to recover our costs). In this instance, we'd change the number of units in the model until the profit amount is set to zero.

Another way to perform a break-even analysis is to use the goal seek tool.

Go to the Break Even Sheet and we need to set up the sheet as a simple P&L calculation, as shown in the image below.

The number of cages produced is the unknown variable, and we have entered a value of 2,500 into cell C11 as a placeholder in the meantime (which we can see generates a loss). This is the variable that will change when we perform the goal seek. Remember that to perform a goal seek we need a formula, and a hard-coded number that drives that formula. The formula will be the profit/loss amount in cell C16, and the hard-coded number is the number of cages in cell C11. Make sure that all of the formulas in cells C13 to C16 contain formulas; otherwise the goal seek won't work.

So to perform the break-even analysis, we need to set the net profit/loss value to zero by changing the number of cages produced. See the image below.

When you click OK, Excel calculated the exact breakeven point and edits the cell value accordingly, as shown below.
We can see that we end up with a value of 2944.41176470588. You might like to round it to the nearest unit, which will show a small profit or loss, which might be confusing. Alternatively, change the formatting so that the decimal places don't show.

Using Goal Seek to Calculate Break-Even Point

If you have the power to manipulate the unit pricing, then you can change the price points to reach break even at the sale of fixed number of units, and even set profit targets using the goal-seek function. Let's say you don't think you can sell more than 2,500. What would you need to set your price at in order to make a profit of $50,000 if the maximum you will sell is 2,500? Because of the way we have set up this model, this is relatively easy to calculate. See the image below.

If we want to make a profit of $50,000, we'd need to sell 2,500 cages at $160 each.
Whilst the goal-seek method takes a little longer to run and set up, it’s a great way to run different scenarios and test changes in inputs when performing breakeven analysis.

![Break-Even Goal Seek with Changed Inputs](image-url)
Video 4.5: Calculating the WACC

Recommended Reading:

See the section on “Weighted Average Cost of Capital (WACC)” in Chapter 9, Page 278 of Using Excel for Business and Financial Modelling.

What is the Weighted Average Cost of Capital (WACC)?

Before investing in a project or new venture, we need to evaluate whether the expected returns justify the risks. Many financial models are built for the purpose of new project evaluation, and the most commonly used tools that we use for evaluating the expected returns are NPV (net present value), IRR (internal rate of return), and payback period. How to calculate these measures is discussed in detail in “Financial Project Evaluation Functions” in Chapter 6.

However, in order to calculate the NPV, we need to know our cost of capital or our required rate of return for the project. You may also hear the cost of capital referred to as the discount rate or hurdle rate. The cost of capital is basically the opportunity cost of the funds invested, or, in other words, the rate of return that investors would expect to receive if they invested the money somewhere else, rather than in this particular project. In effect, by investing in the business, the investor is willing to forego the returns from other avenues. Therefore, cost of capital is the minimum required return for a project—the returns need to be greater than the cost of capital for the project to be accepted.

The importance of WACC is that it becomes a baseline to determine suitable investments for success of the business. WACC is typically represented as a percent, so any investment decisions taken by the company must aim to deliver returns greater than the WACC to make them worthwhile. For example, if the WACC of a company is 15 percent, then most of the investments that the company makes must be with the goal of generating returns greater than 15 percent. WACC is not just calculated to the entire company or business. It can also be calculated for individual projects to determine if it is worthwhile for the company to pursue the project.

Company capital is sourced from many avenues and is targeted for various areas of business growth and sustenance. Typically, the two major sources of capital are debt and equity. Both these tools are distinctly different, have different costs, and hence need to be considered differently in our calculations. As a result, not all capital carries the same weight, which is why we sometimes need to calculate the weighted average cost of capital (WACC) in order to work out how much our capital is worth. Sometimes when calculating the NPV of a project, a modeller may simply use a nominated cost of cost capital (we used a rate of 12 percent in the section “NPV (Net Present Value)” in Chapter 6), but to evaluate a project more accurately, we can calculate which WACC will give us the exact cost of capital for that company. Note that the WACC will be completely different for each company, depending on their individual mix of equity and debt.
Theory of How to Calculate the WACC

The WACC is the average return on capital weighted proportionally based on category. Typically, a company sources its capital from stocks (common and preferred), bonds, and long-term debts. Each category of capital is invested in different avenues to help the business sustain and grow. WACC represents the average cost of capital with proportional contributions from the various sources.

WACC can be calculated using the given formula:

\[
WACC = \left( \frac{Debt}{Debt + Equity} \times \text{Cost of Debt} \right) \times (1 - \text{Tax Rate}) + \left( \frac{Equity}{Debt + Equity} \times \text{Cost of Equity} \right)
\]

Where:

- **Debt** equals total capital raised from debts.
- **Equity** equals total capital raised from equity. Note that if the company has common and preferred shares, then the two need to be weighted and factored accordingly.
- **Cost of Debt** equals the cost of raising the debt. If taken as bank loans, then it is the interest that needs to be paid to the banks.
- **Cost of Equity** equals the return that the shareholders or investors expect from their holding in the company. Common ways of calculating this are the capital asset pricing model (CAPM) or Gordon’s growth model.
- **Tax Rate** equals the prevalent corporate tax rates.

Calculating the WACC in Excel

While the formula looks very complex, once the concepts are clear, WACC can be calculated relatively easily in Excel. Let's do an exercise where we need to manually calculate the WACC.

Let's say you have the following inputs:

- Debt is $6,023,000, for which you are paying 8.5 percent.
- Equity is $4,421,000, for which you expect a return of 15 percent.
- Tax is 30 percent.

1. Open up the WACC file provided as shown in the image below
2. In row 4, calculate the cost of debt and equity before tax.
4. In row 6, remove the tax from the debt amount.
5. Your formula in cell B6 should be \(=B4*(1-B5)\). Copy it across to cell C6. Although there is no tax applicable to the equity amount, we’ll still copy the formula across to maintain consistency of formulas (hence following best practice).

6. Add together the value of debt and equity in cell D2, and cost after tax in cell D6.

7. Now calculate the WACC, which will be the cost after tax of debt and equity as a proportion of the total.

8. Your formula in cell D7 should be \(=D6/D2\), and your worksheet should look something like this:

   ![WACC Calculation Layout](image)

   **WACC Calculation Layout**

   - **Value**
     - Debt: $6,023,000
     - Equity: $4,421,000
   - **Cost %**
     - Debt: 8.50%
     - Equity: 15.0%
   - **Cost before tax**
     - Debt: $511,955
     - Equity: $663,150
   - **Tax Rate**
     - 30.00%
   - **Cost after tax**
     - Debt: $358,369
     - Equity: $663,150
   - **WACC**
     - 9.78%

   **WACC Completed Calculation**

   Hence the weighted average cost of capital for this company is 9.78 percent. This means that when this company is evaluating new opportunities, the minimum required rate of return would be 9.78 percent, as this is what its capital is currently costing it. When calculating the NPV for a new project, this would be the input for the discount rate in the NPV function. Theoretically, the NPV at this discount rate must be greater than zero, and the IRR of a series of cash flows needs to be higher than this amount in order for a project to be accepted.
Video 4.6 Calculating NPV & IRR

Recommended Reading:
See the section on “Financial Project Evaluation Functions” in Chapter 6, Page 171 of Using Excel for Business and Financial Modelling.

How do we Use Net Present Value (NPV) in Financial Models?

NPV is the value of the expected future cash flows from an investment, expressed in today's dollars. The investor specifies a target rate of return (the cost of capital) for investing capital; it is an opportunity cost concept. Investors have the choice of investing in a project, or putting their funds elsewhere, so they determine the hurdle rate, or the amount they want to get back from the project.

The general rule (and the one you would have studied in your university finance textbooks) for considering the investment is: If the NPV is greater than zero, the investment should be accepted; if the NPV is negative, it should be rejected. A positive NPV means the investor can expect to earn a rate of return greater than the required return rate for such an investment. However, from a financial modelling perspective, the decision-making process is much more complicated than a deal-or-no-deal situation. It really depends on the scenario and sensitivity analysis from the financial model to test whether or not the project should go ahead. Large companies often have policies regarding the standard cost of capital or how long the payback period can be before it is rejected.

What Cost of Capital Should We Use? How much time is spent calculating the cost of capital really depends on how detailed your modelling is. Many models will simply use a nominated amount and document this as an assumption. This nominated cost of capital could be anything between, say, 6 and 15 percent (although sometimes higher), and it can fluctuate depending on the perceived risk of the project. We may decide to use very high required rate of return for a risky project to compensate for the risk taken.

However, instead of simply nominating a cost of capital amount as we will do in the example in Figure 6.47, you may decide to calculate the weighted average cost of capital (WACC). This calculation takes into account the mixture and rates of debt and equity in the company, and is therefore a much more accurate way of evaluating the expected rate of return for a project. For more detail on how to calculate the WACC, see the previous section on “Weighted Average Cost of Capital (WACC)”.

What Is Wrong with the NPV Function? Note that a key assumption of the NPV function is that the cash flows occur at the end of the period, whereas in reality they will probably occur unevenly throughout the year, with a large portion of costs spent closer to the beginning of the period. In the example shown below, we have included the initial investment in the first year. If, however, we know that a large initial investment will be made prior to the start of the project, then this should be included in Year 0, and added to the NPV calculation like this: =NPV(B4,B2:F2)+Y0_investment.

HOW TO CALCULATE THE NPV

With a series of cash flows as shown in the image below, the NPV is calculated as follows.
1. Select NPV function. At the Rate prompt, link it to the cost of capital, which we will assume is 12 percent.
2. At the Value1 prompt, link the formula to the cells that contain the expected return (i.e., as we are calculating the five-year NPV, it will be the profit or loss for 2017 to 2021). The formula should be =NPV(B4,B2:F2).
3. The result of your formula should be $127,568.

Using the NPV Function

In this case, the NPV is greater than zero, meaning that the return is greater than the required rate of return of 12 percent stated by the company. This means that, theoretically, the project should be accepted. However, scenario and sensitivity analysis will help determine how sensitive the model is to changes in inputs and gain a better perspective on whether or not this project should be accepted.

IRR (Internal Rate of Return)

IRR equates the present value of the cash inflows and the present value of the cash outflows. The decision rule in this case is: If the IRR is greater than or equal to the investor's required rate of return, the investment should be accepted; otherwise it should be rejected.

Comparing IRR with the Risk Factor Knowing about the IRR is of little use unless you can make decisions using it. To do that, you must compare the IRR with the risk factor.

There are two possible outcomes when you compare IRR with the risk.

1. The projected returns from the investment are greater than the risk. In other words, the returns from the investment are high enough to justify the risk of the investment. This is a positive recommendation to invest.
2. The projected returns from the investment are less than the risk. In other words, the returns from the investment are not high enough to justify the risk of the investment. This is a negative recommendation, cautioning against investment.

Like NPV, IRR uses all three criteria—returns, risk, and time—in its evaluation, and for this reason, many managers find it an easy, accurate, and dependable tool to use.
Using NPV and IRR to Make Decisions

Just because the NPV is positive, and our IRR is greater than our required rate of return, does not necessarily mean that we should go ahead with the project! Blindly accepting the output of a model is a dangerous business. As we know, a model is only as good as the assumptions that go into it, and if we have included aggressively optimistic assumptions in our model, of course the NPV will look good—but this does not mean the project will do well!

All financial models should be subjected to, at minimum, a base case, best case, and worst case scenario, which are used to evaluate the sensitivity of outputs to changes in inputs. The NPV, IRR, and payback period, which are calculated by the model, should be used as decision-making factors and not the ultimate deciding factors of the fate of the project.

HOW TO CALCULATE THE IRR

Using the same investment assumptions as in the previous example, the rate of return on the initial investment can be calculated as follows:

1. Select the IRR function
2. At the Values prompt, select or specify the cells that contain the requested information.
3. Leave the Guess prompt blank at this stage. (See the section on “The Problem with IRR” for more detail on when and why you need to include a guess.) In this instance all the cash flows are positive, so we don’t need to enter a guess.
4. Click on the OK button and the yield (IRR) is displayed. The formula should be: =IRR(B2:F2).

The result of your formula should be 13.3 percent and look something like this:

Using the IRR Function

In this case, the IRR is higher than the required rate of return of 12 percent, as stated by the company. This means that, theoretically, the project should be accepted.