# DCF Valuation Modeling

# Course Instructor

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**Creative. Methodical. Meticulous.**

Duncan is fascinated with pedagogy and loves course creation and design. He is an effective communicator with extensive experience teaching financial modeling, accounting, analysis & valuation. Prior to teaching, Duncan held senior equity research positions with top banks & brokerages. He has solid analytical skills with an Engineering degree, Master of Finance degree and a CFA Charter.

# Learning Objectives

**Explore** a framework and guidelines for effective financial modeling.

**Analyze** a company's operations and divide a financial model into schedules.

**Approach** each schedule with a consistent layout and structure.

**Calculate** key outputs within the model schedules.

**Finalize** and review the financial model, ensuring integrity.

**Create** and maintain a library of schedules or building blocks.

# Compact Model Theory

# Compact Discounted Cash Flow Model

We're going to jump straight into the model-building process.

We will start with a **compact** discounted cash flow (DCF) model.

It is useful to know how to construct a **simple** DCF model quickly for two reasons.

It helps us learn the main features of a **DCF model.**

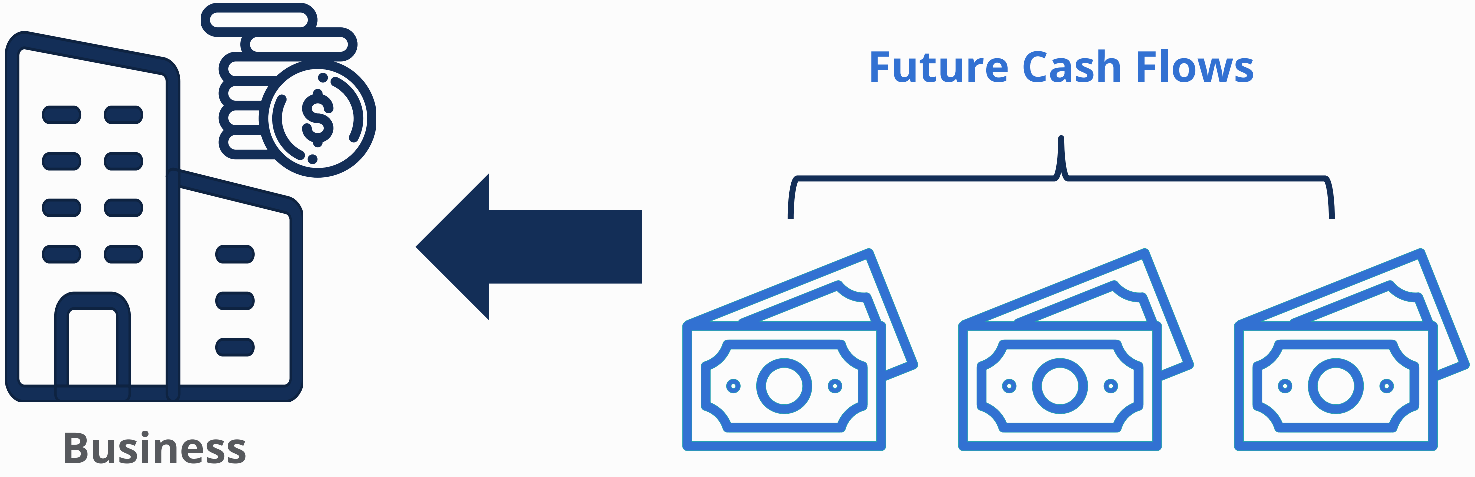
It can assist in situations that require a **quick analysis**.

We will build a **full DCF model** after completing this **compact** model.

# Future Cash Flows

We often use **DCF models** to value businesses.

The business value depends on the quantity and timing of the expected **future cash flows.**




We need to convert all future cash flows to their **present value,** which is the equivalent value today.

# Important Dates

There are **two critical dates** to always consider in DCF models.

### The Valuation Date

This is the date we set and use for the **valuation.**

All cash flow quantities will be **adjusted** to this date.

### The Cash Flow Timing

These are the dates **within each year** when cash flows occur.

We assume cash flows occur at the **end of each year** for now.

# Time Quantity of Money

Moving cash flows **forward** or **backward** is usually referred to as the Time Value of Money.

We prefer the **Time Quantity of Money** as it is the **quantity** that is changing.

| FORWARD | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| Growth Rate | | 10% | 10% | 10% | 10% |
| Cash Flow | 40,000 | 44,000 | 48,400 | 53,240 | 58,564 |

**To Move Forward**

$40,000 x (1 + 10%) = $44,000

This operation can continue forward to Year 5 to get a compounded amount of $58,564.

# Time Quantity of Money

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|---|---|---|---|---|---|
| Growth Rate | | 10% | 10% | 10% | 10% |
| Cash Flow | 40,000 | 44,000 | 48,400 | 53,240 | 58,564 |

This operation can continue backward to Year 1 to get a starting amount of $40,000.

We have **discounted** the amount of $58,564 back to $40,000 in Year 1.

**To Move Backward**

$$\frac{\$58{,}564}{(1 + 10\%)} = \$53{,}240$$

# Choosing Cash Flows and Discount Rates

Using the **wrong cash flows** or the **incorrect discount rates** is common.

Which cash flows and discount rates are correct?

$$\frac{\text{Cash Flow ?}}{\text{Discount Rate ?}} \Rightarrow \frac{\text{Unlevered Free Cash Flow}}{\text{Weighted Average Cost of Capital}} = \frac{\text{UFCF}}{\text{WACC}}$$

It is correct to pair up the **UFCF** with the **WACC.**

But **why** is this?

# Numerators and Denominators

A common theme across all types of valuation is **consistency.**

We need consistency here between the **numerator** and **denominator.**

$$\frac{\text{UFCF}}{\text{WACC}} \rightarrow \frac{\text{Cash flows available to } \textbf{all capital providers}}{\text{Cost of capital from } \textbf{all capital providers}} = \textbf{Enterprise Value}$$

Both the numerator and denominator represent **all capital providers.**

Discounting all UFCFs back at the WACC gives us the **enterprise value.**

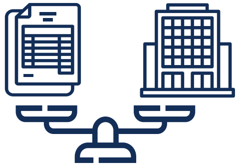
# How Long to Forecast for in a DCF

**A Common DCF Modeling Question:**

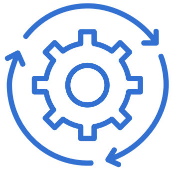
How long do you need to forecast for in a DCF model?



The correct answer is that you need to **forecast forever!**



We often assume that the business is a **going concern** when doing valuation analysis.



This in an accounting term that assumes the business will continue to operate **indefinitely.**

This means we need to forecast the cash flows **forever** into the future. How? Excel has 16,384 columns!

# Two Parts to a Typical DCF Forecast

First, we need to separate our cash flows into two parts.

## Part 1: Discrete Forecast

This shows the first few years when the company grows faster than the economy.

Growth for the company slows in later years as competitors enter the market.

Eventually, the company reaches a **steady state** when it grows in line with the economy.

## Part 2: Terminal Value

This part of the valuation covers the steady state period which continues indefinitely.

It is not practical to forecast cash flows forever in a financial model.

We use a **growing perpetuity formula** to value the perpetual growing cash flows.

# Part 1: Discrete Forecast

## Two Components to DCF Valuation

| Discrete Forecast | | | | | Term |
|---|---|---|---|---|---|
| Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |

| | |
|---|---|
| Terminal Growth | 2.0% |
| WACC | 13.5% |

**UNLEVERED FREE CASH FLOW**

| | | | | | |
|---|---|---|---|---|---|
| 12,500 | 13,900 | 15,000 | 16,000 | 16,800 | 17,200 |

**CASH FLOW PROFILES**

| | | | | | |
|---|---|---|---|---|---|
| Discrete Forecast | 12,500 | 13,900 | 15,000 | 16,000 | 16,800 |
| Terminal Value | – | – | – | – | 149,565 |
| Total Cash Flow | 12,500 | 13,900 | 15,000 | 16,000 | 166,365 |

| Discrete Forecast | Discounted In Years |
|---|---|
| 12,500 | 1 |
| 13,900 | 2 |
| 15,000 | 3 |
| 16,000 | 4 |
| 16,800 | 5 |

**ENTERPRISE VALUE**

| | | |
|---|---|---|
| PV of Discrete | 50,623 | *39%* |
| PV of Terminal | 79,406 | *61%* |
| Enterprise Value | 130,028 | *100%* |

=NPV( rate, value1, [value2],...)

# Part 2: Terminal Value

## Two Components to DCF Valuation

| Discrete Forecast | | | | | Term |
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**Perpetual Growth** ⟶ $PV_5 = \dfrac{CF_6}{(r - g)}$

**Where:**

- $PV_5$ = Present Value in Year 5
- $CF_6$ = Cash Flow in Year 6
- r = Discount Rate (WACC)
- g = Terminal Growth

$$PV_5 = \frac{17,200}{(13.5\% - 2.0\%)}$$

$$PV_5 = 149,565$$

# Part 2: Terminal Value

## Two Components to DCF Valuation

| Discrete Forecast | | | | | Term |
|---|---|---|---|---|---|
| Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |

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=NPV(rate, value1, [value2],...)

# Enterprise Value

Enterprise Value represents **our view** of the company's value.

**Total Debt – Cash = Net Debt**

**Enterprise Value – Net Debt = Equity Value**

**Net Debt** reflects cash being used to pay off debt.

## Enterprise Value & Equity Value

| | |
|---|---|
| Total Debt | 45,261 |
| Less: Cash | (11,246) |
| Net Debt | 34,015 |
| | |
| Enterprise Value | 130,028 |
| Less: Net Debt | (34,015) |
| Equity Value | 96,013 |
| | |
| Shares Outstanding | 25,613 |
| Equity Value per Share | 3.75 |
| | |
| Current Share Price | 3.14 |
| Premium / (Discount) | 19.4% |

# Equity Value

**Equity Value** is the value that equity holders are entitled to.

This represents **your own view** of the company's equity value. This can be compared to the stock market price.

$$\frac{\textbf{Equity Value}}{\textbf{Shares Outstanding}} = \textbf{Equity Value per Share}$$

**Enterprise Value & Equity Value**

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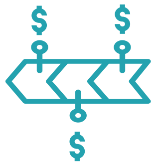
# Valuation Techniques

# Valuation Techniques

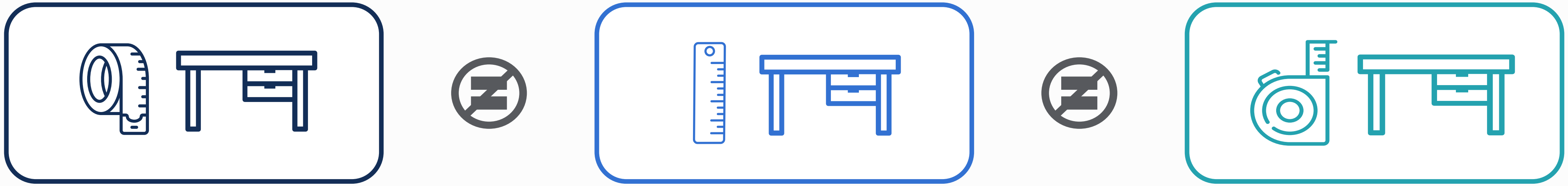
The three most common techniques used to value a company are:

**Comparable Trading Analysis**

**Precedent Transaction Analysis**



**Discounted Cash Flow (DCF) Analysis**



Why does each valuation technique usually give us such **different results?**

# Valuation Views

Let's explore why these three techniques yield different results.

**Comparable Trading Analysis**
Looks at the valuation for similar peer companies that are publicly traded.

This is a **relative valuation** technique.
Target company is valued relative to where its peers are trading in public markets.

**Precedent Transaction Analysis**
Looks at the acquisition prices for similar peer companies in recent transactions.

This is a **relative valuation** technique.
Target company is valued relative to where its peers have been acquired in past transactions.

**Discounted Cash Flow Analysis**
Builds a model of the company to get the present value of all future free cash flows.

This is an **absolute valuation** technique.
Often referred to as an intrinsic valuation technique.
The value of the peers is not considered in this process.

# Valuation Views

These techniques each provide us with insight into the views of different groups.

**Comparable Trading Analysis**
Looks at the valuation for similar peer companies that are publicly traded.

→ **Market View**

Market participants move the stock prices for peer companies, so this technique shows their view.

**Precedent Transaction Analysis**
Looks at the acquisition prices for similar peer companies in recent transactions.

→ **Buyer View**

Previous buyers set acquisition prices, so this technique shows their collective view.

**Discounted Cash Flow Analysis**
Builds a model of the company to get the present value of all future free cash flows.

→ **Your View**

You will build the DCF Model. If you also select the inputs, then this technique shows your view.

# Advantages and Disadvantages

There are distinct advantages and disadvantages to these valuation techniques.

### Comparable Trading Analysis

- ✓ Uses readily available and observable data.
- ✓ Pricing is efficient and updated constantly.
- ✗ No peer companies are exactly the same as the target company

### Precedent Transaction Analysis

- ✓ Uses readily available and observable data.
- ✓ Shows market for sale or purchase of company.
- ✗ Hard to find perfectly comparable and recent transactions.

### Discounted Cash Flow Analysis

- ✓ One of the soundest valuation techniques.
- ✓ Provides an opportunity to learn about the business.
- ✗ Requires a lot of inputs and the model is only as good as the inputs used.

# Importance of Model Design

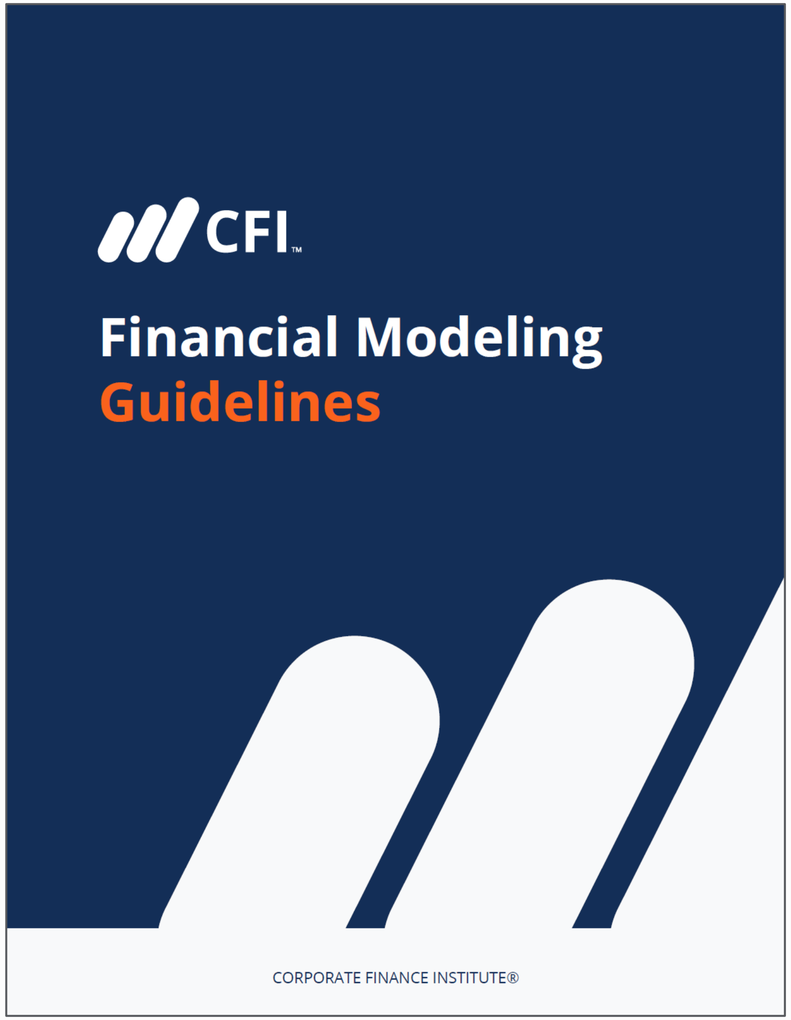
Many model builders **overlook the importance** of model design.

They often are excited or anxious to start the process and skip the design in order to **start building sooner.**

Upfront model design is **critically important** for two reasons.

- It will result in a **better financial model** in the end.
- It will **save large amounts of time** on the model build.

# Financial Modeling Guidelines

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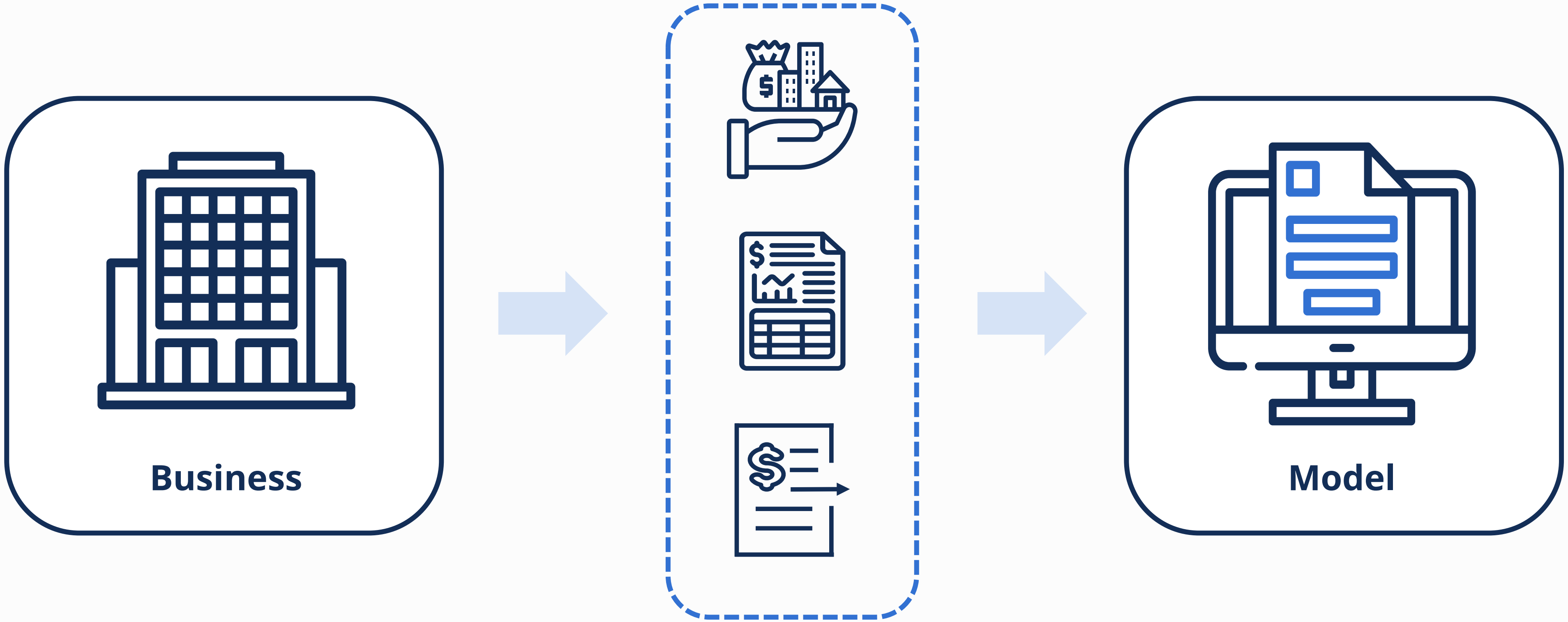
# DCF Model Design

# Why We Model Businesses

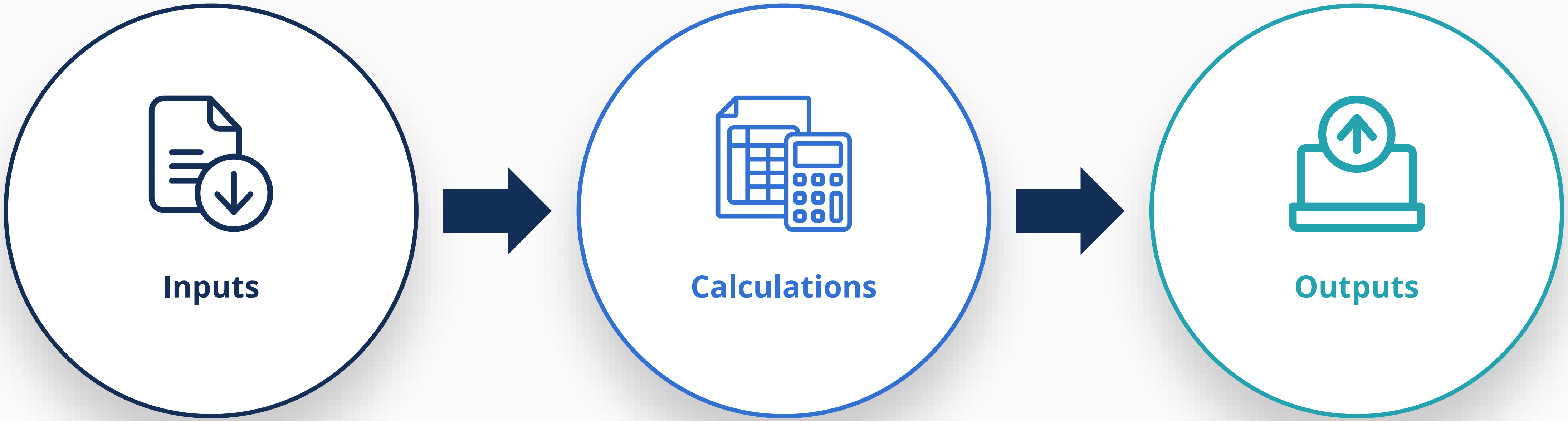
You don’t really have a deep understanding of a business until you’ve **modeled** it.




**Replicating the business** in an electronic format forces you to understand all the aspects of the business.

# Model Design

Let's consider one way that we could design our **financial model.**




Intuitively, this makes sense as it follows the **linear flow from inputs to outputs.**

# The Role of Financial Models

There are **two very important aspects** of financial models.

### Decision Making

Financial decisions can be very complex.

Financial models are **important tools** to assist us with decision making.

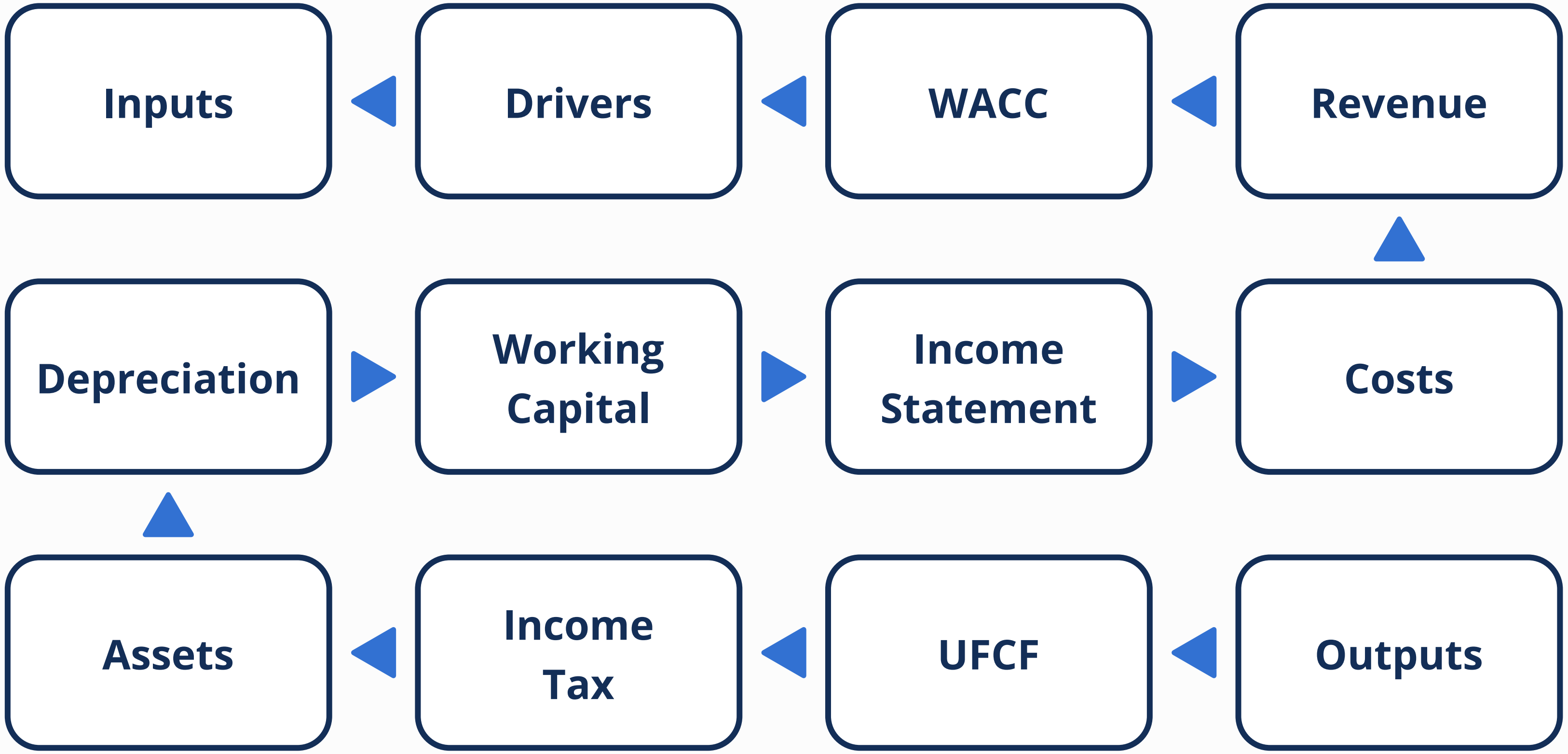
### Communication

Financial models must be **easy for others to understand.**

They should have dashboards so that figures can be clearly communicated.

# Preferred Model Design

We are trying to make an informed **decision** about the valuation of a company.



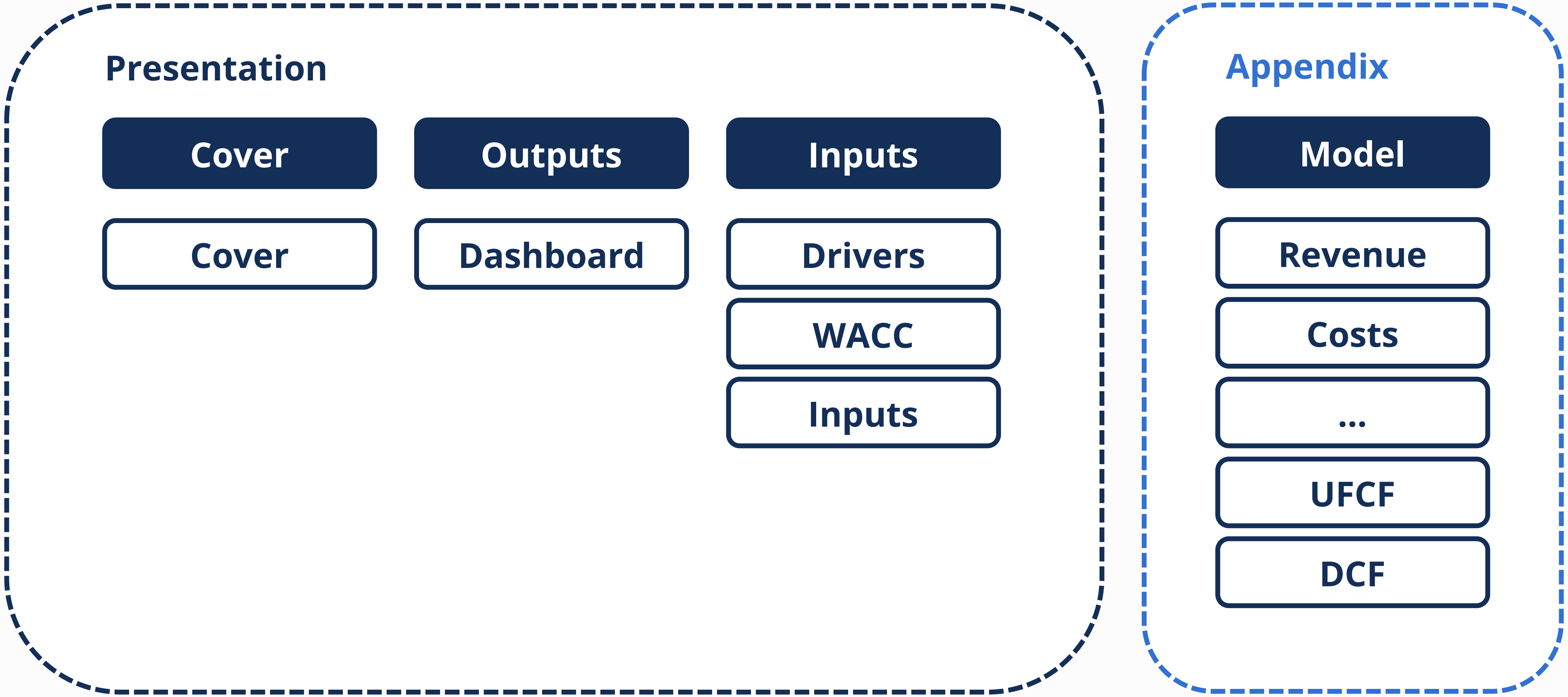

We prefer to design using the **opposite order.**

Designing backwards ensures that **all schedules support the outputs.**

This also ensures **the right level of detail** through the financial model.

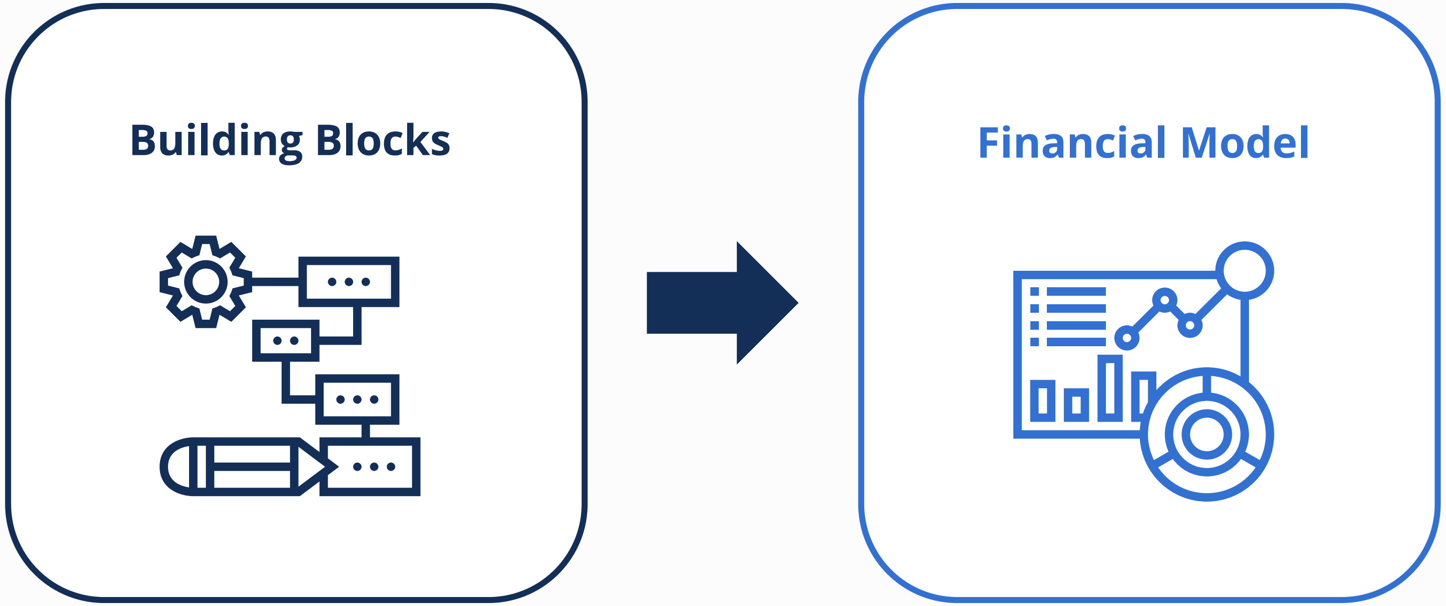
# Preferred Model Layout

Next, we prioritized the schedules from a **communication perspective.**



# Model Design

We always think about models in a modular fashion made up of **building blocks.**



# Library of Schedules

Those engaged in financial modeling typically have **portfolios** of schedules that facilitate model construction.

We often refer to these schedules as **building blocks.** They might include schedules for calculating revenue, costs, or taxes.

This allows us to approach financial modeling in a **modular** fashion made up of a collection of schedules.

Once a schedule has been built and reviewed, it can be stored away for **future use.**

# Model Drivers

# Model Drivers

| Cover | Outputs | Inputs | Model |
| --- | --- | --- | --- |
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | UFCF |
| | | | DCF |

Here is the design of our DCF Model.

One of the first things for us to discuss is the **Model Drivers.**

These are the most **important inputs** to the financial model.

We need to test how the model **reacts** when these drivers move.

# Model Drivers

We need to evaluate the relative importance of the model inputs.

We **isolate the drivers** so that we can test how the model reacts to them.

We need to **separate model drivers** from other less important inputs.

Model drivers are **volatile and have a significant impact** on model outputs.

Identifying the drivers requires **detailed knowledge of the business.**

# Model Drivers

Let's look at some examples of **model drivers** and how to test them.

**Sales volume** and **sales price** can be volatile and may have large impacts on the business.

Start by considering **minimum** and **maximum** levels for the drivers.

Only the **model drivers need to be tested** with switches in this way.

## Drivers

| *All figures in USD thousands unless stated* | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| **Driver Switch** Base Case | | | |
| **Sales Volume Growth** | **2.0%** | **1.0%** | **1.0%** |
| Best Case | 3.0% | 2.0% | 2.0% |
| Base Case | 2.0% | 1.0% | 1.0% |
| Worst Case | 1.0% | 1.0% | 0.5% |
| **Pricing Increases** | **3.0%** | **1.0%** | **1.0%** |
| Best Case | 3.5% | 2.0% | 2.0% |
| Base Case | 3.0% | 1.0% | 1.0% |
| Worst Case | 1.0% | 1.0% | 0.5% |

# Macabacus (Optional)

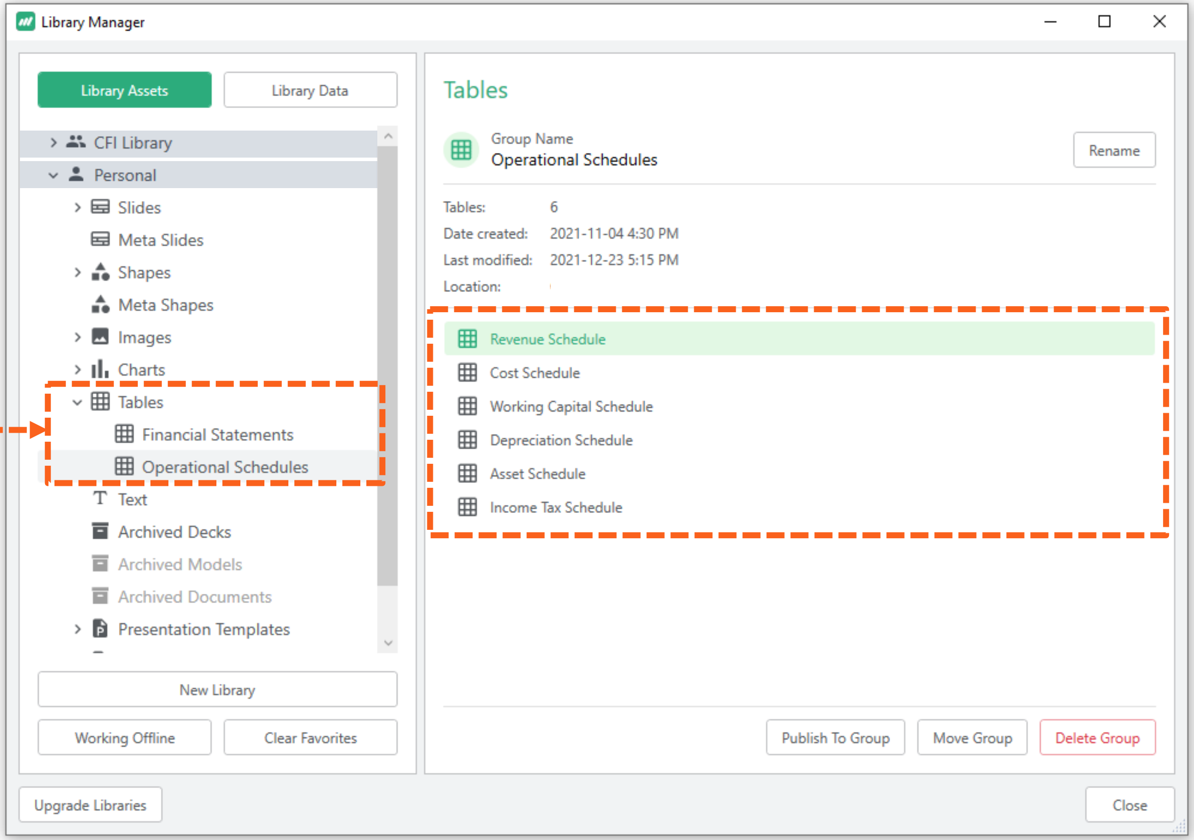
# Modular Design

Macabacus has some tools to facilitate creating a personal or shared library of model schedules.

https://macabacus.com/docs

**Revenue Schedule**

| *All figures in USD thousands unless stated*<br>*Model Running: Base Case Drivers* | | 2020A | 2021A | 2022A | 2023F | 2024F | 2025F |
|---|---|---|---|---|---|---|---|
| **OPERATIONS** | | | | | | | |
| Sales Volume Growth | | | 2.0% | 2.1% | 2.0% | 1.0% | 1.0% |
| Sales Volume | *(Units/Day)* | 1,374 | 1,401 | 1,430 | 1,459 | 1,473 | 1,488 |
| Plant Capacity | *(Units/Day)* | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 | 1,500 |
| Operational Efficiency | | 91.6% | 93.4% | 95.3% | 97.2% | 98.2% | 99.2% |
| **VOLUME** | | | | | | | |
| Days in Period | | 365 | 365 | 365 | 365 | 365 | 365 |
| Sales Volume | *(Units/Day)* | 1,374 | 1,401 | 1,430 | 1,459 | 1,473 | 1,488 |
| Sales Volume | *(Units)* | 501,510 | 511,365 | 521,950 | 532,389 | 537,713 | 543,090 |
| **PRICING** | | | | | | | |
| Pricing Increases | | | 1.7% | 2.1% | 3.0% | 1.0% | 1.0% |
| Unit Price | *(USD/Unit)* | 102.86 | 104.61 | 106.81 | 110.01 | 111.11 | 112.23 |
| **REVENUE** | | | | | | | |
| Sales Volume | *(Units)* | 501,510 | 511,365 | 521,950 | 532,389 | 537,713 | 543,090 |
| Sales Price | *(USD/Unit)* | 102.86 | 104.61 | 106.81 | 110.01 | 111.11 | 112.23 |
| Revenue | | 51,585 | 53,494 | 55,749 | 58,570 | 59,748 | 60,949 |
| Operational Capacity Exceeded? | | No | No | No | No | No | No |



# Operational Schedules

# Operational Modeling

Operational schedules are used to model the **operational movements** of a business.

**Revenue Schedule**

**Cost Schedule**

**Income Statement**

**Working Capital Schedule**

**Depreciation Schedule**

**Asset Schedule**

**Income Tax Schedule**

We cover these schedules in detail in our **Operational Modeling** course.

# Operational Schedules

| Cover | Outputs | Inputs | Model |
|---|---|---|---|
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | UFCF |
| | | | DCF |

Here is the design of our DCF Model.

We typically position the operational schedules in the **Model** tab.

We have a total of eight operational schedules in this model.

These schedules are important as they show us **critical aspects** of the business.

# Tax Schedules

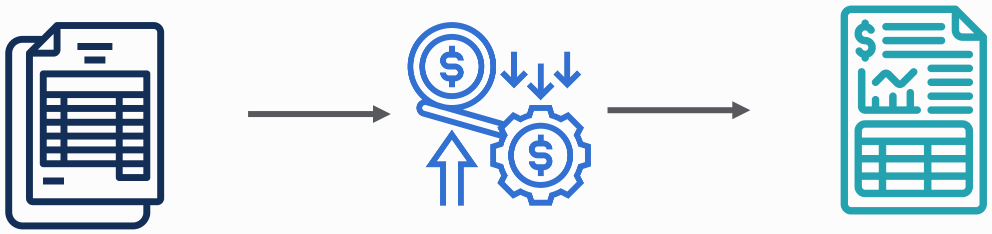
# Income Tax Terminology

Let's review some income tax terminology from our **Operational Modeling** course.

| | |
|---|---|
| **Current Taxes** | Current is an accounting term meaning 'within the current period'.<br>These amounts will be paid to the government as tax payments.<br>These represent **physical cash outflows** from the company. |
| **Deferred Taxes** | These are taxes that are being deferred into future periods.<br>Governments often allow these deferrals to encourage investment.<br>These are **non-cash taxes** for the company. |
| **Total Taxes** | This is simply the current taxes plus the deferred taxes.<br>Income Statements often only show **one line for Total Taxes.**<br>Remember that many companies have both Current and Deferred Taxes. |

# Need for the Levered Tax Schedule

We have looked through the layout of the income tax schedule in the model.



**Income Tax Schedule (Levered)**

**Income Statement**

But there are two **Income Tax Schedules** in the model. Let’s compare them.

# Comparison of Tax Schedules

Let's consider a **comparison the two tax schedules** in our model.

| | Levered Tax Schedule | Unlevered Tax Schedule |
|---|---|---|
| **What is the starting point?** | **Earnings Before Tax (EBT)** | **Earnings Before Interest and Taxes (EBIT)** |
| **What does it show us?** | Taxes **with** debt in capital structure. | Taxes **without** debt in capital structure. |
| **Why do we need it?** | For tax lines on the **income statement.** | To calculate the **tax shield.** |

# Tax Shield from Interest Expense

How do we calculate the **tax shield** from interest?

## Unlevered Free Cash Flow Schedule

| *All figures in USD thousands unless stated* | **Year 1** |
|---|---|
| **TAX SHIELD FROM INTEREST** | |
| Current Taxes (Unlevered) | 2,765 |
| Current Taxes (Levered) | 1,878 |
| **Total Tax Shield** | **887** |

We take the **difference** between the current taxes.

This shows us the **cash tax savings** from using debt.

The difference gives us the **total tax shield.**

# UFCF Schedule

# Unlevered Free Cash Flow

| Cover | Outputs | Inputs | Model |
|---|---|---|---|
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | **UFCF** |
| | | | DCF |

We've connected all the operational schedules now.

We need to discuss the unlevered free cash flow or the **UFCF** next.

These are the cash flows that will be discounted to get the **enterprise value.**

# Unlevered Free Cash Flow

Recall that we must use the correct cash flows together with the appropriate discount rate.

Remember the key to this is **consistency** between the **numerator** and **denominator.**

$$\frac{\textbf{UFCF}}{\textbf{WACC}} \Rightarrow \frac{\text{Cash flows available to } \textbf{all capital providers}}{\text{Cost of capital from } \textbf{all capital providers}} = \textbf{Enterprise Value}$$

Both the numerator and denominator represent **all capital providers.**

Discounting the UFCF back at the WACC gives us the **enterprise value.**

# Levered Free Cash Flow

There is another approach that you may encounter that is less common.

The key to this is still having **consistency** between the **numerator** and **denominator.**

$$\frac{\textbf{LFCF}}{\textbf{Re}} \rightarrow \frac{\text{Cash flows available to } \textbf{equity providers}}{\text{Cost of capital from } \textbf{equity providers}} = \textbf{Equity Value}$$

Both the numerator and denominator represent **equity providers.**

Discounting the LFCF back at the cost of equity gives us the **equity value.**

We will use the previous approach to get **enterprise value** since it is more common.

# Two Methods to Calculate UFCF

More common in **capital market** groups.

Shorter and uses EBITDA which is a **common** measure of profitability.

We use **both** the Net Income and the EBITDA methods in our courses.

It is good practice to learn both and to make sure they **reconcile.**

## Unlevered Free Cash Flow Schedule

| *All figures in USD thousands unless stated* | **Year 1** |
|---|---|
| **EBITDA METHOD** | |
| EBITDA | 19,628 |
| Current Taxes | (2,765) |
| Capital Expenditure | (4,850) |
| Change in Working Capital | (106) |
| **Unlevered Free Cash Flow** | **11,907** |
| | |
| **NET INCOME METHOD** | |
| Net Income | 9,969 |
| Depreciation | 4,647 |
| Deferred Tax | 614 |
| Interest Expense | 2,520 |
| Tax Shield From Interest | (887) |
| Capital Expenditure | (4,850) |
| Change in Working Capital | (106) |
| **Unlevered Free Cash Flow** | **11,907** |
| | |
| *Two UFCF Methods Different?* | No |

# Comparison of the Methods

**EBITDA Method**
This method is shorter since it starts with an **unlevered term** and ends with an **unlevered term.**

**Net Income Method**
This method is longer since it starts with a **levered term** and ends with an **unlevered term.**

## Unlevered Free Cash Flow Schedule

| | *All figures in USD thousands unless stated* | **Year 1** |
|---|---|---|
| | **EBITDA METHOD** | |
| Unlevered | EBITDA | 19,628 |
| | Current Taxes | (2,765) |
| | Capital Expenditure | (4,850) |
| | Change in Working Capital | (106) |
| Unlevered | **Unlevered Free Cash Flow** | **11,907** |
| | **NET INCOME METHOD** | |
| Levered | Net Income | 9,969 |
| | Depreciation | 4,647 |
| | Deferred Tax | 614 |
| | Interest Expense | 2,520 |
| | Tax Shield From Interest | (887) |
| | Capital Expenditure | (4,850) |
| | Change in Working Capital | (106) |
| Unlevered | **Unlevered Free Cash Flow** | **11,907** |
| | *Two UFCF Methods Different?* | No |

# Understanding the Net Income Method

The **tax shield** is the amount of cash taxes saved by having debt in the capital structure.

We **unlever** net income by adding the interest expense and subtracting the tax shield.

## Unlevered Free Cash Flow Schedule

| *All figures in USD thousands unless stated* | Year 1 |
|---|---|
| **TAX SHIELD FROM INTEREST** | |
| Current Taxes (Unlevered) | 2,765 |
| Current Taxes (Levered) | 1,878 |
| **Total Tax Shield** | **887** |

| | | |
|---|---|---|
| | **NET INCOME METHOD** | |
| Levered | Net Income | 9,969 |
| | Depreciation | 4,647 |
| | Deferred Tax | 614 |
| Adjustment | Interest Expense | 2,520 |
| | Tax Shield From Interest | (887) |
| | Capital Expenditure | (4,850) |
| | Change in Working Capital | (106) |
| Unlevered | **Unlevered Free Cash Flow** | **11,907** |

# WACC Schedule

# Time Quantity of Money

A DCF Modeling course would not be complete without discussing the impact of **time on money.**

We refer to this as the **Time Quantity of Money.**

### Changing Quantity

We prefer this title since it is the **quantity** of money that is changing.

### Inflation Rate

The **value** of money can also change depending on the inflation rate.

### Inflation and Erosion

We will discuss how **inflation** impacts the value of money separately.

Next, we will review how the **quantity** of money can change over time.

# Forward Moving Time Quantity of Money

Time Quantity of Money is really **compound growth.**

| GROWTH FORWARD | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| Growth Rate | | 10% | 10% | 10% | 10% |
| Money | 60,000 | 66,000 | 72,600 | 79,860 | 87,846 |

**To Move Forward**

60,000 x (1 + 10%) = 66,000

This process could continue with similar calculations each year to arrive at a population of **87,846 for Year 5.**

# Backward Moving Time Quantity of Money

Now we can **reverse the process** to go backward.

| GROWTH BACKWARD | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| Growth Rate | | 10% | 10% | 10% | 10% |
| Money | 60,000 | 66,000 | 72,600 | 79,860 | 87,846 |

We use this process in our model to **discount back** to a value of 60,000 in Year 1.

**To Move Backward**

$$\frac{87{,}846}{(1 + 10\%)} = 79{,}860$$

# Weighted Average Cost of Capital

| Cover | Outputs | Inputs | Model |
|---|---|---|---|
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | UFCF |
| | | | DCF |

We need to use the **WACC** to discount the unlevered free cash flows.

There are **several formulas** which are needed to calculate the WACC.

We have included a **separate schedule** to work through these calculations.

# Weighted Average Cost of Capital

We've just discussed the Time Quantity of Money and discounting cash flows.

We must use the correct cash flows discounted by an appropriate discount rate.

$$\frac{\text{UFCF}}{\text{WACC}} \Rightarrow \frac{\text{Cash flows available to } \textbf{all capital providers}}{\text{Cost of capital from } \textbf{all capital providers}} = \text{Enterprise Value}$$

The WACC represents the cost of capital from **all capital providers.**

# Calculating the WACC

The WACC needs to include the cost of capital from **all debt providers** and **all equity providers.**

**Formula:**

$$WACC = (W_d * R_d) + (W_e * R_e)$$

**Where:**

$W_d$ = Weight of Debt

$W_e$ = Weight of Equity

$R_d$ = Cost of Debt

$R_e$ = Cost of Equity

**Example:**

$$WACC = (0.25 * 0.050) + (0.75 * 0.108)$$
$$= 0.094$$
$$= 9.4\%$$

**Where:**

$W_d$ = 25%

$W_e$ = 75%

$R_d$ = 5.0%

$R_e$ = 10.8%

It is normal for the cost of debt to be **lower** than the cost of equity.

The equity carries a heavier weight and **skews the WACC** up to 10.8%.

# Calculating the Cost of Debt

Let's walk through an example of how to calculate the **after-tax cost of debt.**

**Formula:**

$R_d = R_p\ (1 - T)$

**Where:**

$\mathbf{R_d}$ = Cost of Debt (After-Tax)

$\mathbf{R_p}$ = Cost of Debt (Pre-Tax)

**T** = Tax Rate

**Example:**

$R_d = 0.0625\ (1 - 0.20)$

$= 0.050$

$= 5.0\%$

**Where:**

$\mathbf{R_d}$ = Cost of Debt (After-Tax) ?

$\mathbf{R_p}$ = 6.25%

**T** = 20%

# Calculating the Cost of Equity

Let's walk through an example of how to calculate the **cost of equity.**

**Formula:**

$R_e = R_f + R_c + (R_m \times B_L)$

**Where:**

$\mathbf{R_e}$ = Cost of Equity
$\mathbf{R_f}$ = Risk Free Rate
$\mathbf{R_c}$ = Country Risk Premium
$\mathbf{R_m}$ = Market Risk Premium
$\mathbf{B_L}$ = Levered Beta

**Example:**

$R_e = 2.4\% + 3.6\% + (4.7\% \times 1.03)$
$= 10.8\%$

**Where:**

$\mathbf{R_e}$ = Cost of Equity?
$\mathbf{R_f}$ = 2.4%
$\mathbf{R_c}$ = 3.6%
$\mathbf{R_m}$ = 4.7%
$\mathbf{B_L}$ = 1.03

# Calculating the Levered Beta

Let's walk through an example of how to calculate the **levered beta.**

**Formula:**

$B_L = B_U \times (1 + (1 - T) \times (D/E))$

**Where:**

**$B_L$** = Levered Beta

**$B_U$** = Unlevered Beta

**T** = Tax Rate

**D/E** = Debt-to-Equity Ratio

**Example:**

$B_L = 0.91 \times (1 + (1 – 0.3) \times (0.176))$

$= 1.03$

**Where:**

**$B_L$** = Levered Beta

**$B_U$** = 0.91

**T** = 30%

**D/E** = 17.6%

# Calculating the Unlevered Beta

We could rearrange the formula to calculate the **unlevered beta.**

**Formula:**

$B_U = B_L / (1 + (1 - T) \times (D/E))$

**Where:**

**$B_U$** = Unlevered Beta
**$B_L$** = Levered Beta
**T** = Tax Rate
**D/E** = Debt-to-Equity Ratio

**Example:**

$B_U = 1.03 / (1 + (1 – 0.3) \times (0.176))$
$= 0.91$

**Where:**

**$B_U$** = Unlevered Beta
**$B_L$** = 1.03
**T** = 30%
**D/E** = 17.6%

# DCF Schedule

# Model Design

| Cover | Outputs | Inputs | Model |
|---|---|---|---|
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | UFCF |
| | | | DCF |

We've worked our way down to the **bottom** of the Model tab now.

We are now able to correctly calculate the **enterprise value** for the company.

We will also be determining the equity value as well as the **equity value per share.**

# Two Components to Forecast Forever

Recall that we need to forecast forever in our DCF model.

We will do this in two distinct components.

**Discrete Forecast** | **Terminal Value**

*All figures in USD thousands*

| | Valuation | Discrete Forecast | | | Term |
|---|---|---|---|---|---|
| | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) |
| **Fiscal Year End** | 23-01-01 | 23-10-01 | 24-10-01 | 25-10-01 | 26-10-01 |
| **Cash Flow Timing** | 23-01-01 | 23-04-01 | 24-04-01 | 25-04-01 | 26-04-01 |
| Unlevered Free Cash Flow | – | 14,500 | 15,700 | 16,500 | 17,000 |

This company will reach steady-state **after 3 years.**

Then we use the **terminal cash flow** forecast.

It's very important to be accurate with the terminal cash flow since it **repeats and grows forever.**

# Timing is Everything

We need to understand and set the timing for **two events** in our DCF model.

We must determine the **timing of cash flows** and where we will set the **valuation date.**

| Year 0 | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| **Valuation Date** | **Cash Flow** | **Cash Flow** | **Cash Flow** |
| We discount cash flows back to this date. | Timing of the cash flow within this year. | Timing of the cash flow within this year. | Timing of the cash flow within this year. |

# Three Important Dates to Consider

### 1) Fiscal Year End

This is the date of the fiscal year-end for the company.
This date can be easily found on the financial statements.
It is common to see the same month and day every year.

### 2) Cash Flow Timing

This is the date we expect the cash flows to occur.
Could be closer to fiscal year end if Q4 is seasonally strong.
Between the two fiscal year dates for no seasonality.

*All figures in USD thousands*

| | Valuation | Discrete Forecast | | | Term |
|---|---|---|---|---|---|
| | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) | (YY-MM-DD) |
| **Fiscal Year End** | 23-01-01 | 23-10-01 | 24-10-01 | 25-10-01 | 26-10-01 |
| **Cash Flow Timing** | 23-01-01 | 23-04-01 | 24-04-01 | 25-04-01 | 26-04-01 |
| Unlevered Free Cash Flow | – | 14,500 | 15,700 | 16,500 | 17,000 |

### 3) Valuation Date

We will discount all cash flows back to this date.
This date is set by the model building team.
The present value of the business will be as of this date.

We will be taking the cash flows from the **cash flow timing** dates back to the **valuation date.**

# First Important Finance Equation

$$PV = \frac{FV}{(1 + r)^{n}}$$

**Time Quantity of Money**

Used to discount future cash flows back to a present value.

Can be used on distant cash flows back any number of periods.

**Where:**

PV = Present Value

FV = Future Value

r = Discount Rate

n = Number of Periods

# Second Important Finance Equation

$$PV_0 = \frac{FV_1}{(r - g)}$$

**Growing Perpetuity**

Used to calculate the present value of a perpetuity that grows forever. Input future value to get present value in previous period.

**Where:**

$PV_0$ = Present Value in Period 0

$FV_1$ = Future Value in Period 1

r = Discount Rate

g = Terminal Growth Rate

# Dashboard

# Model Design

| Cover | Outputs | Inputs | Model |
|---|---|---|---|
| Cover | Dashboard | Drivers | Revenue |
| | | WACC | Costs |
| | | Inputs | ... |
| | | | UFCF |
| | | | DCF |

We can now progress over to the **Outputs** tab and work on the dashboards.

The model outputs are **critically important** for the stakeholders in making decisions.

We need a thoughtful dashboard showing the **most relevant** model information.

# The Importance of Dashboards

Our model design typically starts with a **dashboard.**

The dashboard is the most important part of the presentation.

Model drivers are **critical inputs** that must be shown.

We often **provide a toggle** to change these drivers here.

We need to show **enterprise value** and **equity value.**

Toggle gives us a **range** for enterprise value and equity value.

**Model Drivers**

| | |
|---|---|
| Model Drivers Set To | Base Case |

**Main Outputs**

| | Enterprise Value | Equity Value | Equity Per Share |
|---|---|---|---|
| Best Case | 124,843 | 106,201 | 3.11 |
| Base Case | 92,363 | 73,721 | 2.16 |
| Worst Case | 74,416 | 55,774 | 1.63 |

**Selected Inputs**

| | | |
|---|---|---|
| Terminal Growth Rate | | 2.0% |
| WACC | | 13.3% |
| Net Debt | *(End of 2022)* | 18,642 |
| Shares Outstanding | *(FD 000)* | 34,200 |
| Current Stock Price | *(US$/sh)* | 1.83 |

*All figures in USD thousands unless stated*

# Showing Sensitivity to Inputs

It is normal to present a **range of valuations** in a dashboard.

Views may differ for the WACC and Terminal Growth Rate.

Presenting a range shows the **sensitivity** to these inputs.

Data Tables are a very useful and **powerful tool** in Excel.

Care must be taken to ensure they are **setup properly.**

**Enterprise Value**

| | | Terminal Growth Rate | | | | |
|---|---|---|---|---|---|---|
| | | *1.0%* | *1.5%* | *2.0%* | *2.5%* | *3.0%* |
| WACC | *11.3%* | 102,904 | 105,878 | 109,172 | 112,840 | 116,949 |
| | *12.3%* | 94,995 | 97,364 | 99,962 | 102,826 | 105,997 |
| | *13.3%* | 88,357 | 90,275 | **92,363** | 94,644 | 97,146 |
| | *14.3%* | 82,703 | 84,278 | 85,982 | 87,830 | 89,841 |
| | *15.3%* | 77,827 | 79,137 | 80,546 | 82,064 | 83,706 |

**Equity Value**

| | | Terminal Growth Rate | | | | |
|---|---|---|---|---|---|---|
| | | *1.0%* | *1.5%* | *2.0%* | *2.5%* | *3.0%* |
| WACC | *11.3%* | 84,262 | 87,236 | 90,530 | 94,198 | 98,307 |
| | *12.3%* | 76,353 | 78,722 | 81,320 | 84,184 | 87,355 |
| | *13.3%* | 69,715 | 71,633 | **73,721** | 76,002 | 78,504 |
| | *14.3%* | 64,061 | 65,636 | 67,340 | 69,188 | 71,199 |
| | *15.3%* | 59,185 | 60,495 | 61,904 | 63,422 | 65,064 |