



DCF Valuation Modeling

Course Instructor



Duncan McKeen

Executive Vice President

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**.



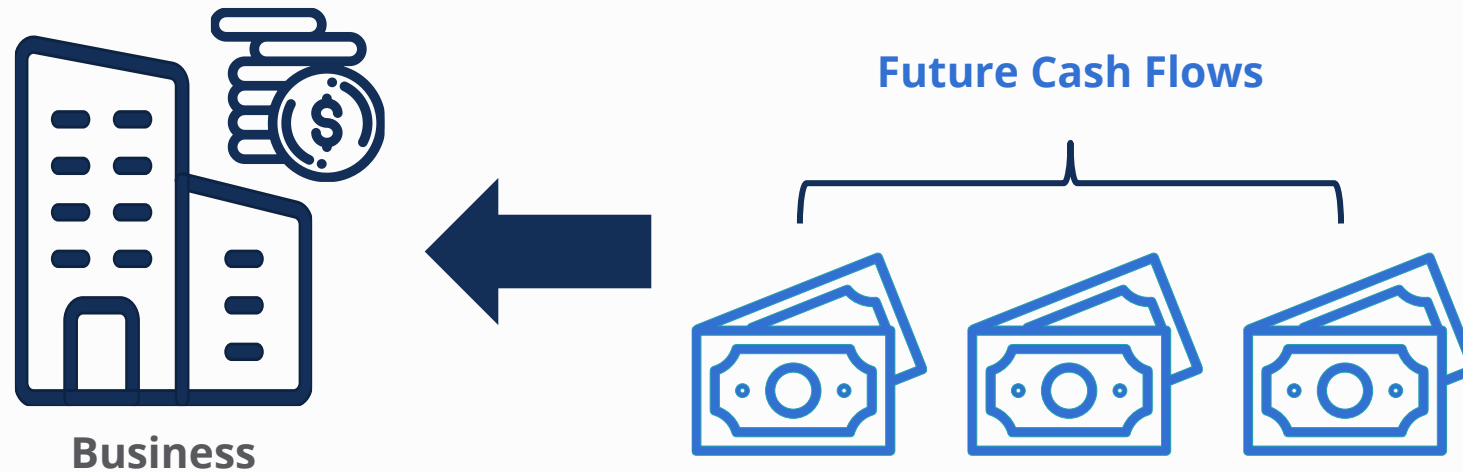
It can assist in situations that require a **quick analysis**.

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

Growth Rate
Cash Flow

Year 1	Year 2	Year 3	Year 4	Year 5
40,000	44,000	48,400	53,240	58,564

To Move Forward

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



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

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.

BACKWARD

Growth Rate
Cash Flow

Year 1	Year 2	Year 3	Year 4	Year 5
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?



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**.

The diagram illustrates the calculation of Enterprise Value. It starts with a box containing the formula $\frac{\text{UFCF}}{\text{WACC}}$. A thick blue arrow points from this box to a larger box. This larger box contains the expanded formula: $\frac{\text{Cash flows available to all capital providers}}{\text{Cost of capital from all capital providers}}$. To the right of this box is an equals sign, followed by a box containing the text "Enterprise Value".

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

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:

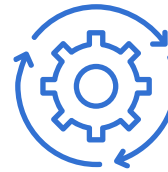
How long do you need to forecast for in a DCF model?



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 is 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
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

ENTERPRISE VALUE

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

Perpetual Growth \longrightarrow $PV_5 = \frac{CF_6}{(r - g)}$

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

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

ENTERPRISE VALUE

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


----- =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.

Equity Value

Shares Outstanding

= Equity Value per Share

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%

Valuation Techniques

Valuation Techniques

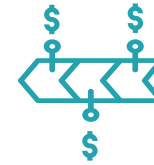
The three most common techniques used to value a company are:



**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.



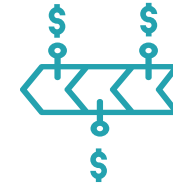
Comparable Trading Analysis

- ✓ 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

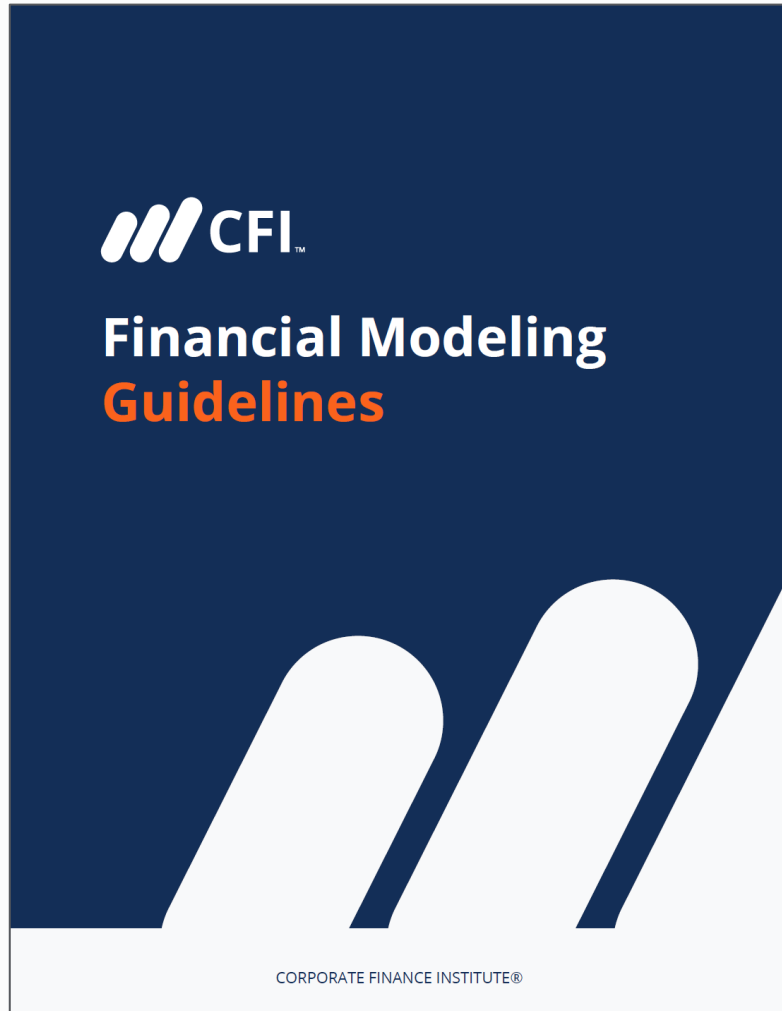


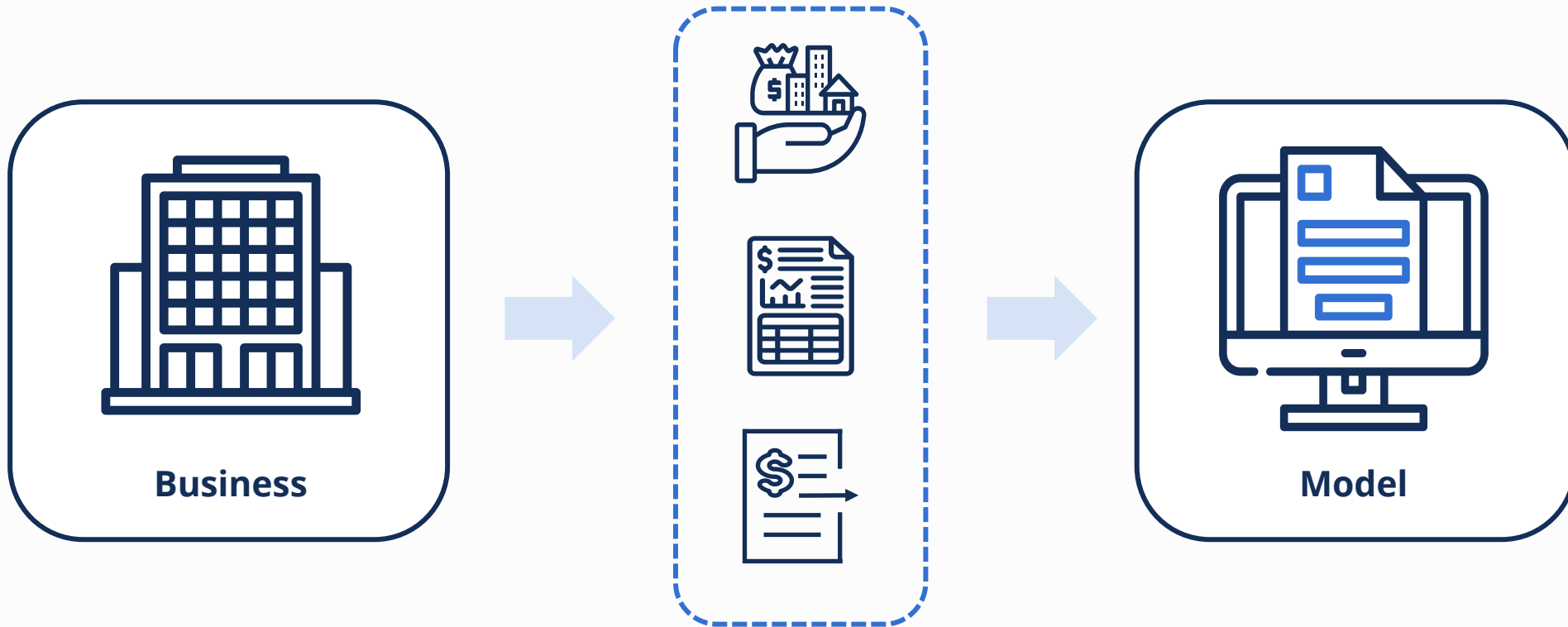
Table of Contents

Introduction	03	Consistent Labeling	53
Design: Common Approach	08	Capitalization	54
Design: Preferred Approach	09	Transparency	58
Building Blocks	10	Positioning Precedents	59
Level of Detail	11	Corkscrews	62
Model Drivers	11	Waterfalls	65
Model Inputs	14	Debt & Equity Schedules	67
Layout & Printing	16	Financial Statements	68
Stacking Schedules	30	Circularity	70
Aligning Columns	31	Formatting	73
Freezing Panes	33	Font Types	75
Column & Row Consistency	34	Custom Number Formats	76
Periodicity	37	Font Colors	81
Modularity & Schedules	41	Marking Units	84
Navigational Columns	43	Naming	85
Row Grouping	46	Macros	88
Custom Views	48	Protection	88
Adding Indents	50	Resources	94

DCF Model Design

Why We Model Businesses

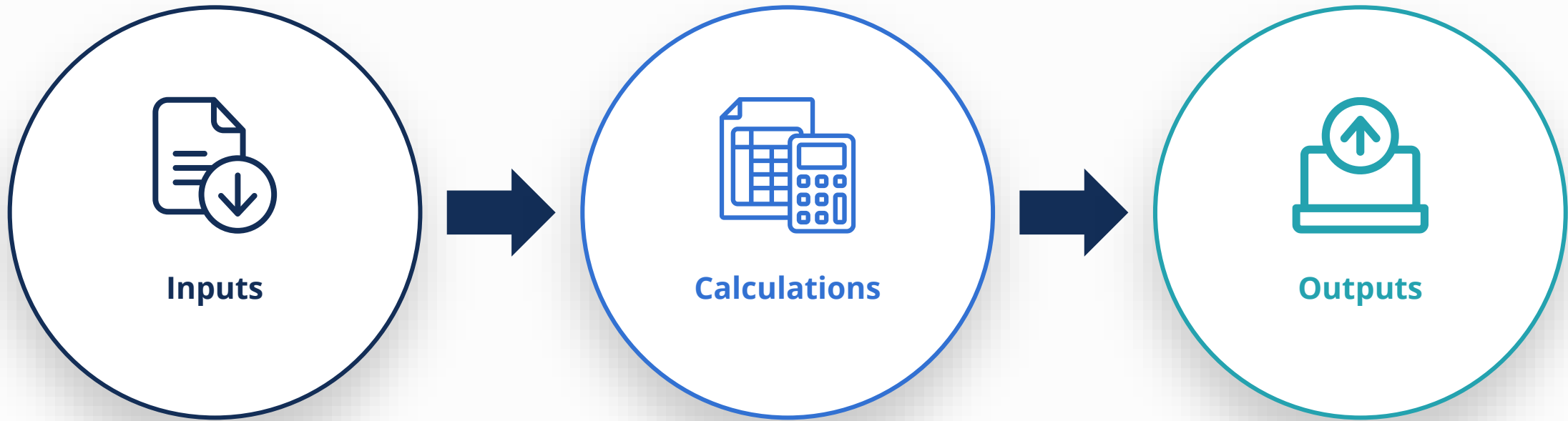
You don't really have a deep understanding of a business until you've **modeled** it.



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.



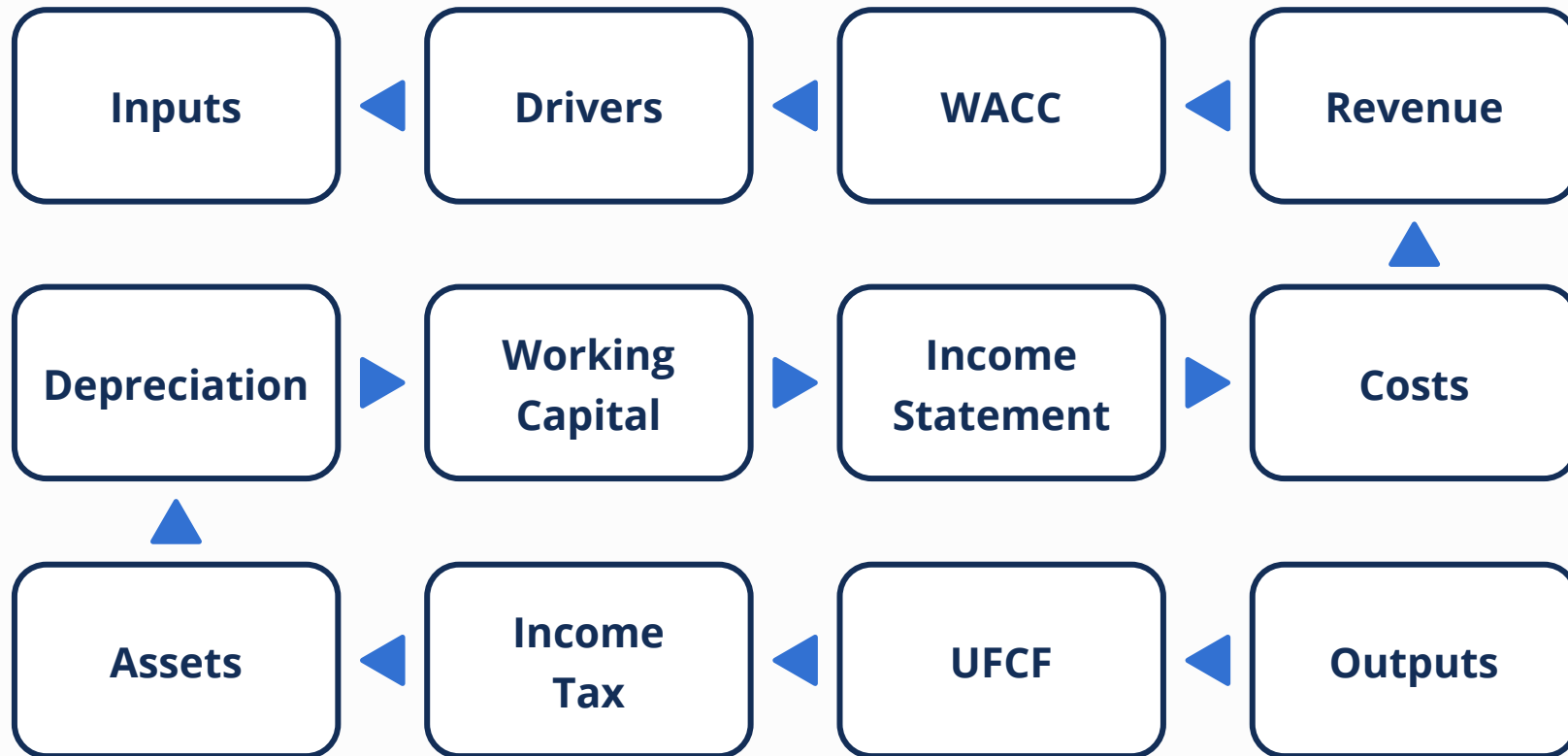
Communication

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**.

Presentation

Cover

Cover

Outputs

Dashboard

Inputs

Drivers

WACC

Inputs

Appendix

Model

Revenue

Costs

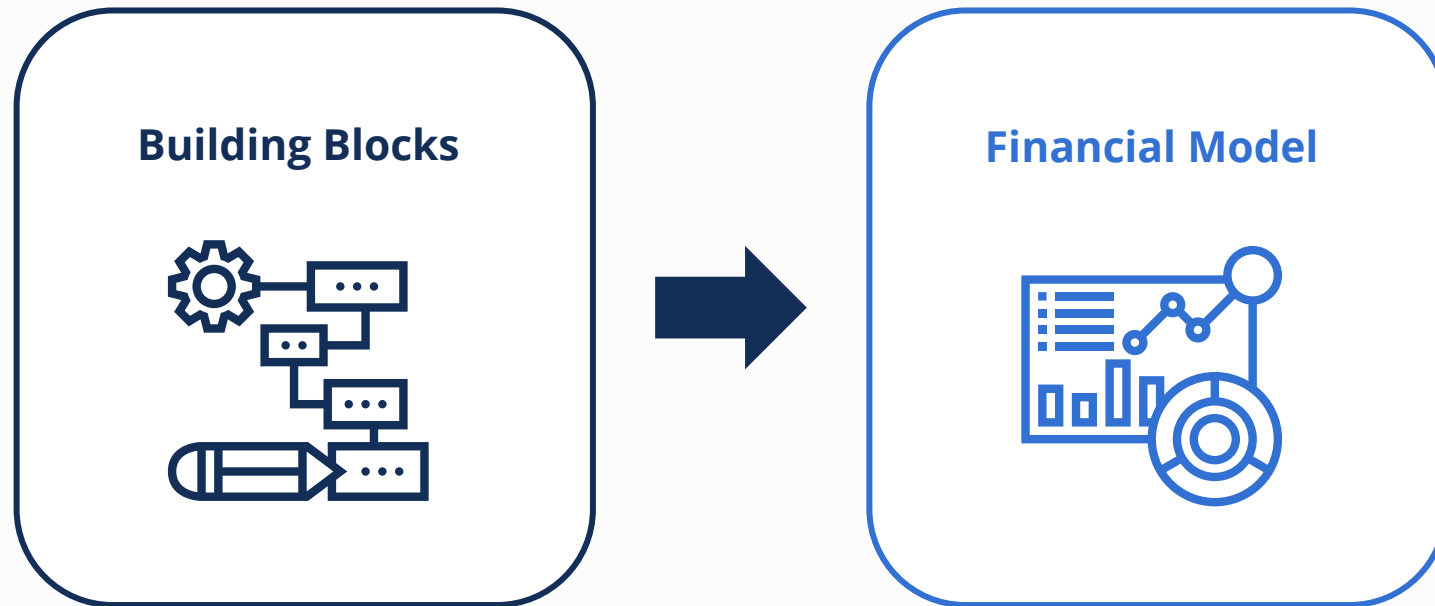
...

UFCF

DCF

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

Driver Switch Base Case ▼

Sales Volume Growth

Best Case
Base Case
Worst Case

Year 1	Year 2	Year 3
--------	--------	--------

2.0%	1.0%	1.0%
------	------	------

3.0%	2.0%	2.0%
2.0%	1.0%	1.0%
1.0%	1.0%	0.5%

Pricing Increases

Best Case
Base Case
Worst Case

3.0%	1.0%	1.0%
------	------	------

3.5%	2.0%	2.0%
3.0%	1.0%	1.0%
1.0%	1.0%	0.5%

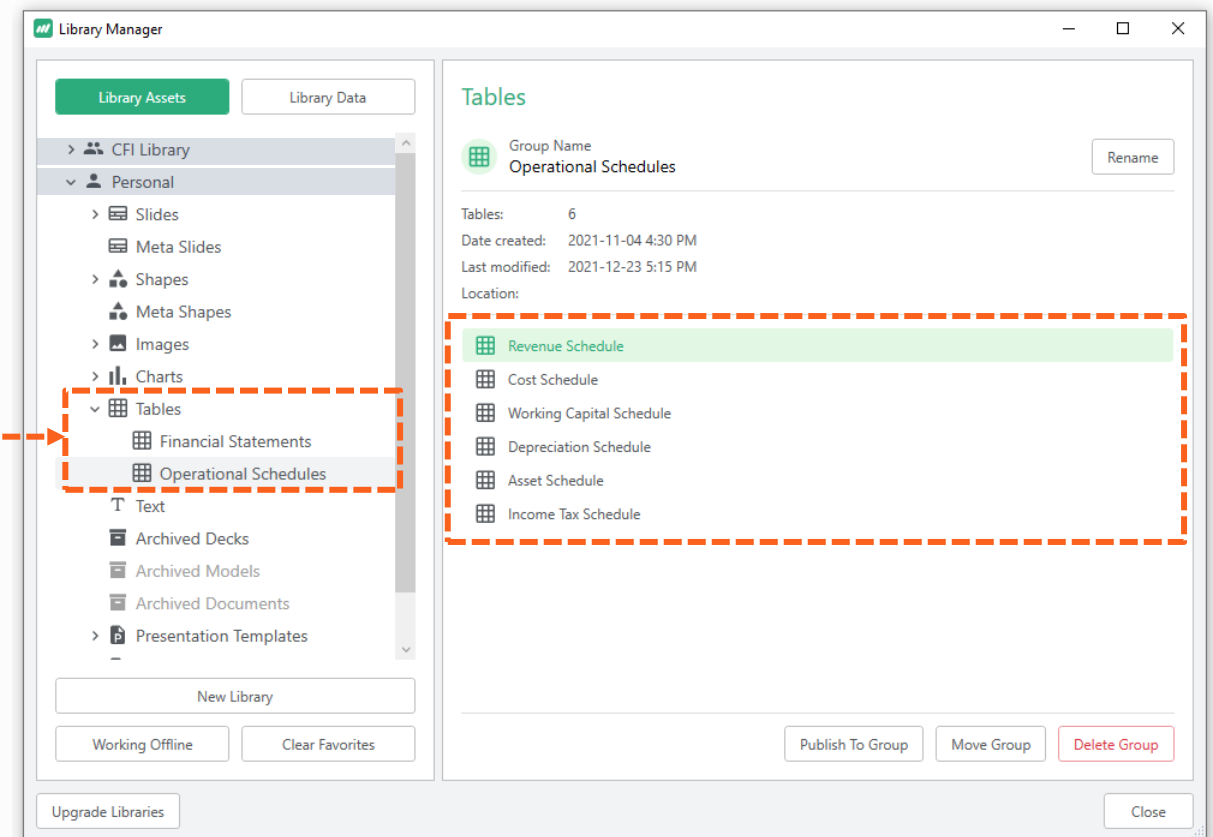
Macabacus (Optional)

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						
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'. These amounts will be paid to the government as tax payments. These represent **physical cash outflows** from the company.

Deferred Taxes

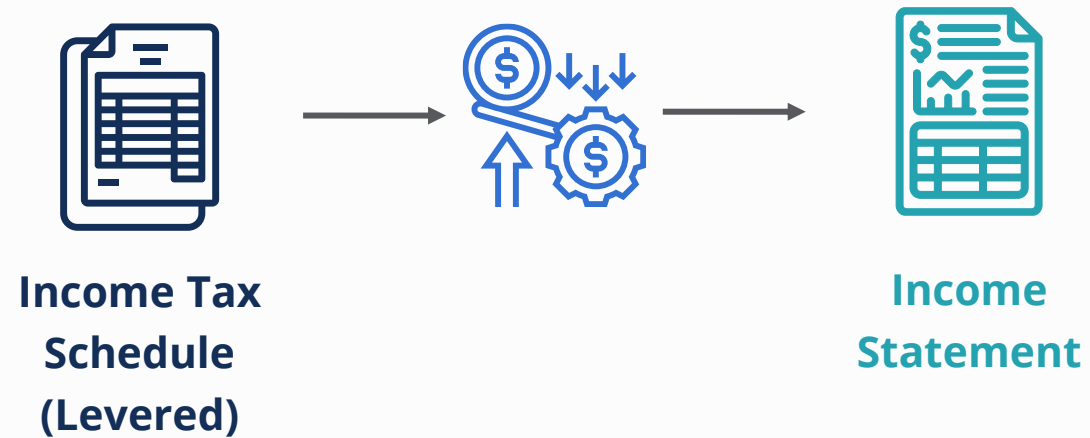
These are taxes that are being deferred into future periods. Governments often allow these deferrals to encourage investment. These are **non-cash taxes** for the company.

Total Taxes

This is simply the current taxes plus the deferred taxes. Income Statements often only show **one line for Total Taxes**. 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.



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

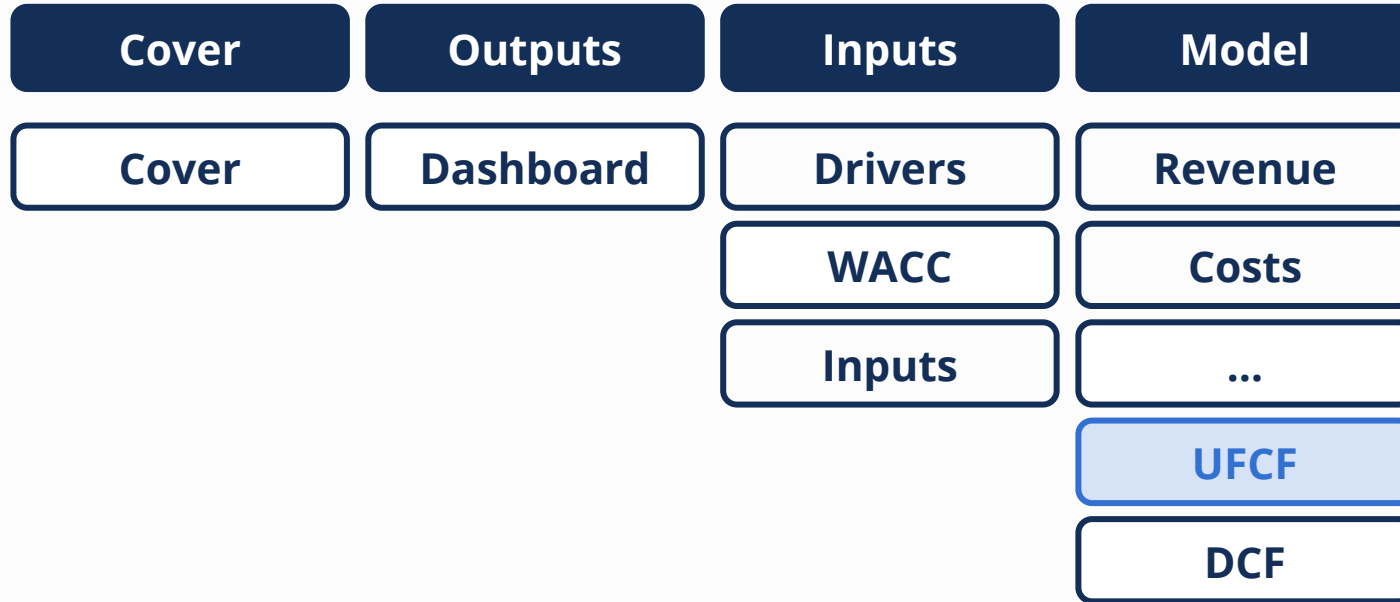
We take the **difference** between the current taxes.

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

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

UFCF Schedule

Unlevered Free Cash Flow



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**.

The diagram illustrates the calculation of Enterprise Value. It starts with a box containing the fraction $\frac{\text{UFCF}}{\text{WACC}}$. A thick blue arrow points from this box to a larger box containing the fraction $\frac{\text{Cash flows available to all capital providers}}{\text{Cost of capital from all capital providers}}$. To the right of this second box is an equals sign, followed by a box containing the text "Enterprise Value".

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

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**.

The diagram illustrates the calculation of Equity Value. It starts with a box containing the formula $\frac{\text{LFCF}}{Re}$. A thick blue arrow points from this box to a larger box containing the text "Cash flows available to **equity providers**" over a horizontal line, and "Cost of capital from **equity providers**" below the line. To the right of this box is an equals sign, followed by a box containing the text "Equity Value".

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

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

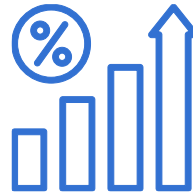
A DCF Modeling course would not be complete without discussing the impact of **time on money**.

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


$$60,000 \times (1 + 10\%) = 66,000$$


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.

The diagram illustrates the formula for Enterprise Value. It starts with a box containing the fraction $\frac{\text{UFCF}}{\text{WACC}}$. A thick blue arrow points from this box to a larger box containing the fraction $\frac{\text{Cash flows available to all capital providers}}{\text{Cost of capital from all capital providers}}$. To the right of this box is an equals sign, followed by a box containing the text "Enterprise Value".

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

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

R_d = Cost of Debt

W_e = Weight of Equity

R_e = Cost of Equity

Example:

$$\begin{aligned} WACC &= (0.25 * 0.050) + (0.75 * 0.108) \\ &= 0.094 \\ &= 9.4\% \end{aligned}$$

Where:

W_d = 25%

R_d = 5.0%

W_e = 75%

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:

R_d = Cost of Debt (After-Tax)

R_p = Cost of Debt (Pre-Tax)

T = Tax Rate

Example:

$$\begin{aligned} R_d &= 0.0625 (1 - 0.20) \\ &= 0.050 \\ &= 5.0\% \end{aligned}$$

Where:

R_d = Cost of Debt (After-Tax) ?

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:

R_e = Cost of Equity

R_f = Risk Free Rate

R_c = Country Risk Premium

R_m = Market Risk Premium

B_L = Levered Beta

Example:

$$\begin{aligned} R_e &= 2.4\% + 3.6\% + (4.7\% \times 1.03) \\ &= 10.8\% \end{aligned}$$

Where:

R_e = Cost of Equity?

R_f = 2.4%

R_c = 3.6%

R_m = 4.7%

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

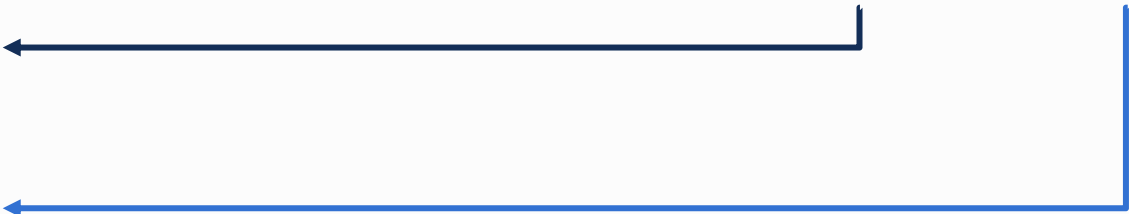
All figures in USD thousands

Valuation (YY-MM-DD)	Discrete Forecast				Term (YY-MM-DD)
	(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.

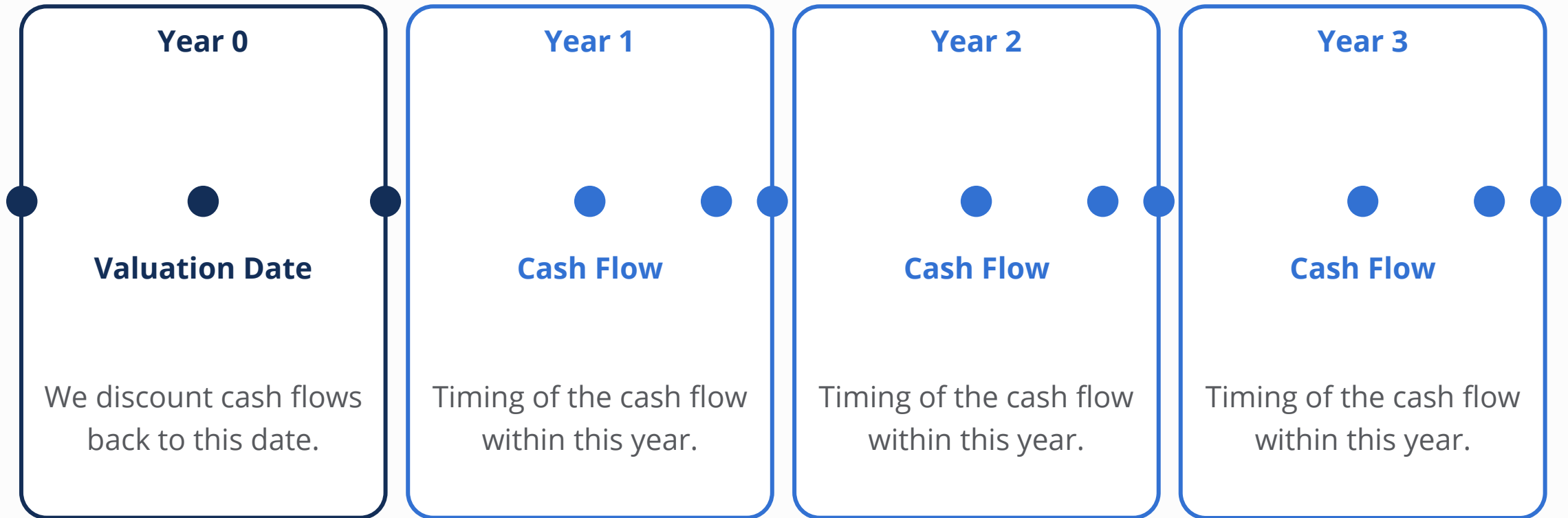


It's very important to be accurate with the terminal cash flow since it **repeats and grows forever.**

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**.



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.

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.

All figures in USD thousands

Fiscal Year End
Cash Flow Timing

Unlevered Free Cash Flow

Valuation	Discrete Forecast				Term
(YY-MM-DD)	(YY-MM-DD)	(YY-MM-DD)	(YY-MM-DD)	(YY-MM-DD)	(YY-MM-DD)
23-01-01	23-10-01	24-10-01	25-10-01	26-10-01	
23-01-01	23-04-01	24-04-01	25-04-01	26-04-01	

	-	14,500	15,700	16,500	17,000
--	---	--------	--------	--------	--------



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						
WACC	Terminal Growth Rate					
	1.0%	1.5%	2.0%	2.5%	3.0%	
	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						
WACC	Terminal Growth Rate					
	1.0%	1.5%	2.0%	2.5%	3.0%	
	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