

# Fundamentals of DCF Models

## with LLM as Co-Pilot

Miao Liu

Boston College

April 15, 2026

# Overview

① DCF: Overview

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## What valuation is trying to answer

### Cash generation

What operating cash flows can the business produce over time?

### Risk

How risky are those cash flows, and what return do investors require?

### Value today

What are those future cash flows worth per share today?

- ▶ DCF converts a **business story** into a **value range**.
- ▶ The model is a disciplined way to ask: **what must be true for this price to make sense?**

## Price is not the same as value

### Market price

- ▶ Set by buyers and sellers **today**
- ▶ Moves with news, sentiment, flows, and rates
- ▶ Can be noisy in the short run

### Intrinsic value

- ▶ Based on **expected future cash flows**
- ▶ Requires assumptions about growth, returns, and risk
- ▶ Changes when the economics change

- ▶ Valuation does not predict tomorrow's price; it estimates a **reasonable value range**.

## Present value intuition



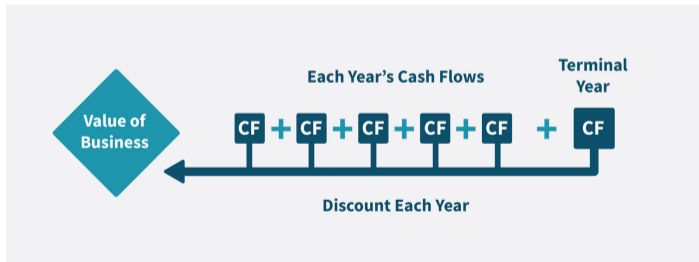
- ▶ A dollar later is worth less than a dollar today.
- ▶ The discount rate captures **time value** and **risk**.

$$PV = \frac{100}{1.10} = 90.9$$

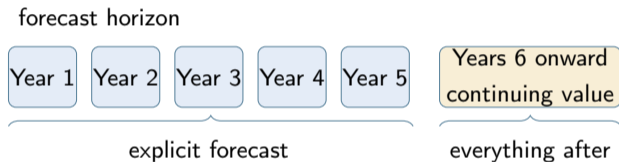
## DCF - the Leading Valuation Model

### Objective:

Think of a company as a black box that generates cash flows every year. Our task is to capture its true value by estimating these future cash flows and discounting them back to today's dollars. In essence, we are translating future earnings into a present value that reflects both time and risk.



## Why DCF needs a continuing value



- ▶ Businesses usually live beyond the next 5 to 10 years.
- ▶ The explicit forecast captures the **transition period**.
- ▶ The continuing value captures the **mature period**.

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## Introduction to DCF Model

### Key Components:

- ▶ **Forecast Free Cash Flows (FCF):** Predict cash flows available to all investors after covering operating expenses and capital expenditures.
- ▶ **Estimate Terminal Value (TV):** Determine the value of cash flows beyond the explicit forecast period.
- ▶ **Discount Rate (WACC):** Compute the weighted average cost of capital, which blends the returns required by debt and equity holders and reflects the risk inherent in the cash flows.
- ▶ **Enterprise and Equity Value:** Sum the discounted cash flows to obtain the company's total (enterprise) value, and subtract debt to determine equity value.

$$\text{Enterprise Value} = \sum_{t=1}^n \frac{FCF_t}{(1 + WACC)^t} + \frac{TV}{(1 + WACC)^n}$$

$$\text{Equity Value} = \text{Enterprise Value} - \text{Debt Value}$$

## Introduction to NOPLAT

- ▶ Net Operating Profit Less Adjusted Taxes focuses on operating performance.
- ▶ It excludes the effects of financing (interest expense) and nonoperating items (e.g., gains and losses), hence providing a clearer picture of operational efficiency.

### Reorganized Income Statement (2024, in Millions)

Revenues	\$240
COGS	\$(140)
Depreciation	\$(10)
<b>EBITA</b>	<b>\$90</b>
Operating Taxes (20%)	\$(18)
<b>NOPLAT</b>	<b>\$72</b>
Nonoperating Taxes	\$1
Interest Expense	\$(5)
<b>Net Income</b>	<b>\$68</b>

## Introducing Invested Capital

- ▶ **Invested Capital** represents the total funds invested in a company's operations.

### Reorganized Balance Sheet Calculation

	2023	2024
Cash	30	35
Accounts Receivable	50	55
Inventory	40	45
<b>Total Current Assets</b>	120	135
Accounts Payable	(35)	(40)
<b>Operating Working Capital</b>	85	95
Net PPE	120	125
<b>Invested Capital</b>	205	220

## Relation between Invested Capital and ROIC

- ▶ **Invested Capital** represents the total funds invested in a company's operations.
- ▶ **Operating Working Capital** represents the net investment in short-term operating assets. It reflects the funds tied up in supporting the day-to-day operations of the business.
- ▶ Changes in Invested Capital from one year to the next is called **Capital Expenditures**.
- ▶ **ROIC** is Return on Invested Capital: 
$$\text{ROIC} = \frac{\text{NOPLAT}}{\text{Invested Capital}}$$
- ▶ A higher ROIC indicates better capital efficiency, while a lower ROIC suggests inefficient use of funds.

## Growth helps only if returns are good

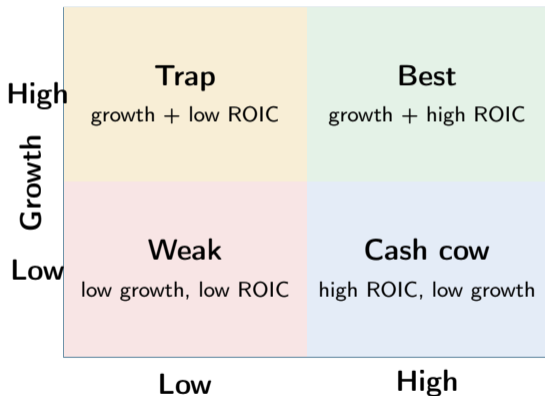
value effect

ROIC relative to WACC	good business but limited runway	<b>best case</b> high returns + runway
	weak business little value creation	<b>danger zone</b> growth destroys value
	low growth	high growth

- ▶ Growth is valuable only when new capital earns **more than the cost of capital**.
- ▶ Fast growth with poor returns can make a firm **less valuable**.

## Two value drivers

- ▶ **Growth** expands the cash-flow base.
- ▶ **ROIC** determines whether growth creates value.
- ▶ If  $ROIC < WACC$ , more growth can destroy value faster.



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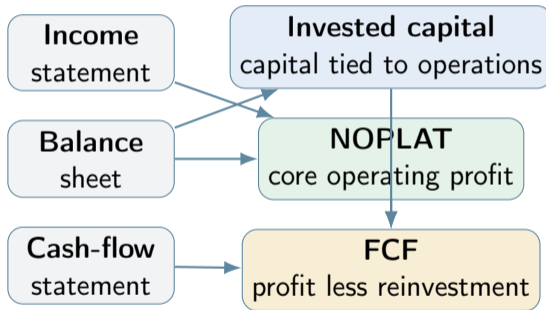
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## Reorganize the statements first

- ▶ Separate **operating**, **financing**, and **nonoperating** items.
- ▶ Remove clearly **one-off** items from the base.
- ▶ Keep the treatment **internally consistent** across NOPLAT, invested capital, WACC, and the equity bridge.



## Operating, financing, and nonoperating are different

### Operating

Revenue, COGS, SG&A, D&A, receivables, inventory, payables, PPE, operating leases

### Financing

Interest expense, debt, debt issuance, debt repayment, preferred stock, financing leases if treated as debt

### Nonoperating

Excess cash, marketable securities, equity stakes, discontinued operations, unusual gains and losses

- ▶ DCF values the **operations**. Everything else is handled separately.

## Why reported statements are not model-ready

### Mixed categories

GAAP statements combine operating items, financing items, and nonoperating items.

### Noisy line items

One-time gains, tax quirks, and accounting labels can hide the economics.

### Different objectives

Accounting statements explain performance; valuation statements forecast cash flow.

### Need consistency

The numerator, denominator, discount rate, and bridge items must all match.

## Running mini-case: ApexCo reported statements

### Income statement (\$m)

	2023	2024
Revenue	460	500
Operating costs ex D&A	(390)	(420)
D&A	(18)	(20)
EBITA	52	60
Interest expense	(8)	(8)
Pretax income	44	52
Taxes	(11)	(13)
Net income	33	39

### Balance sheet (\$m)

	2023	2024
Cash & investments	25	30
Accounts receivable	50	54
Inventory	40	44
Other operating CA	10	11
Net PPE	250	275
Total assets	375	414
Accounts payable	35	38
Accrued op. liabilities	15	16
Debt	130	120
Equity	195	240
Total liab. & equity	375	414

## ApexCo: reclassified income statement

	2023	2024
Revenue	460	500
Operating costs ex D&A	(390)	(420)
D&A	(18)	(20)
<b>EBITA</b>	<b>52</b>	<b>60</b>
Operating tax at 25%	(13)	(15)
<b>NOPLAT</b>	<b>39</b>	<b>45</b>

- ▶ Interest expense is **not** part of operating profit.
- ▶ NOPLAT asks: what would operations earn **before financing**?

## ApexCo: reclassified balance sheet

	2023	2024
Accounts receivable	50	54
Inventory	40	44
Other operating CA	10	11
Net PPE	250	275
Operating assets	350	384
Accounts payable	(35)	(38)
Accrued operating liabilities	(15)	(16)
<b>Invested capital</b>	<b>300</b>	<b>330</b>

- ▶ Cash and investments are excluded here.
- ▶ Debt is also excluded here.
- ▶ Invested capital measures **capital tied to operations.**

## Invested capital = capital tied to operations

Operating view (\$m)		
	2023	2024
Accounts receivable	50	54
Inventory	40	44
Other operating CA	10	11
Accounts payable	(35)	(38)
Accrued op. liabilities	(15)	(16)
Operating working capital	50	55
Net PPE	250	275
<b>Invested capital</b>	<b>300</b>	<b>330</b>

$$\text{Invested Capital} = \text{Debt} + \text{Equity} \\ - \text{Nonoperating Assets}$$

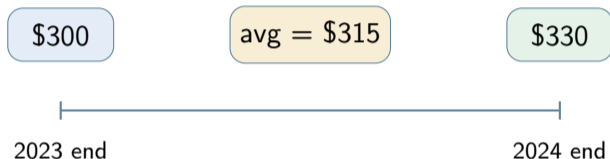
- ▶ 2024 funding view:

$$120 + 240 - 30 = 330$$

- ▶ Use **average invested capital** when matching annual NOPLAT:

$$\text{Avg. IC}_{2024} = \frac{300 + 330}{2} = 315$$

## Average invested capital and why average matters



- ▶ NOPLAT for 2024 was generated **throughout** the year.
- ▶ The denominator should reflect capital used during the year.
- ▶ Using only ending capital can distort ROIC.

## Common invested capital judgments

Item	Typical treatment	Why
Excess cash	Exclude from invested capital	It is a nonoperating asset and is added later in the EV-to-equity bridge.
Goodwill	Usually include	It reflects capital invested in acquired operations.
Operating leases	Include if treated as operating assets and liabilities	Keep ROIC and WACC treatment consistent.
Equity stakes	Usually exclude	They are usually valued separately from core operations.

## Free cash flow to the firm

$$\text{FCF} = \text{NOPLAT} - \text{Net investment}$$

$$\begin{aligned} \text{FCF} &= \text{NOPLAT} + \text{D\&A} \\ &\quad - \text{Capex} - \Delta\text{OWC} \end{aligned}$$

- ▶ Net investment =  $\Delta$ Invested capital
- ▶ Do **not** confuse net investment with capex alone.

### ApexCo 2024 FCF bridge (\$m)

NOPLAT	45
+ D&A	20
- Capex	(45)
- Increase in OWC	(5)
<b>FCF</b>	<b>15</b>

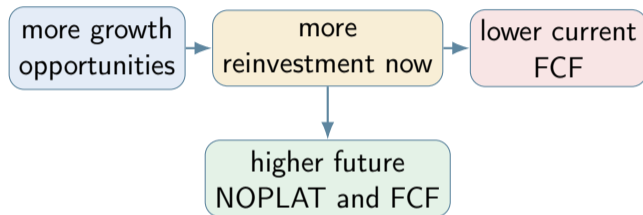
Same result: Net investment =  $330 - 300 = 30$ , so  
 $45 - 30 = 15$ .

## From NOPLAT to FCF: worked example

$$\begin{aligned}\text{FCF} &= \text{NOPLAT} - \text{Net investment} \\ &= 45 - (330 - 300) = 15\end{aligned}$$

- ▶ ApexCo generated \$45m of operating profit after tax.
- ▶ It reinvested \$30m into operations.
- ▶ The remaining \$15m is free cash flow to all capital providers.

## Why growth can reduce near-term free cash flow



- ▶ Low current FCF is not always bad; sometimes it reflects **value-creating reinvestment**.

## Accounting profit is not cash flow

Measure	ApexCo 2024	What it tells you
Net income	39	Profit after financing costs
NOPLAT	45	Operating profit after tax
Free cash flow	15	Cash left after reinvestment

- ▶ Profitability and cash generation are related, but they are **not the same thing**.

## ROIC is easier to forecast in two parts

$$\text{ROIC} = \frac{\text{NOPLAT}}{\text{Average invested capital}} = \frac{\text{NOPLAT}}{\text{Revenue}} \times \frac{\text{Revenue}}{\text{Average invested capital}}$$

**NOPLAT margin**  
pricing, mix, cost discipline

**Invested capital turnover**  
working capital and fixed-capital intensity

$$\text{ApexCo 2024 ROIC} = \frac{45}{315} = \left( \frac{45}{500} \right) \times \left( \frac{500}{315} \right) = 9.0\% \times 1.59 = 14.3\%$$

## Margin and turnover intuition

### Margin

$$\frac{\text{NOPLAT}}{\text{Revenue}} = \frac{45}{500} = 9.0\%$$

How much operating profit is earned on each dollar of sales?

### Turnover

$$\frac{\text{Revenue}}{\text{Avg. IC}} = \frac{500}{315} = 1.59\times$$

How much revenue is generated per dollar of invested capital?

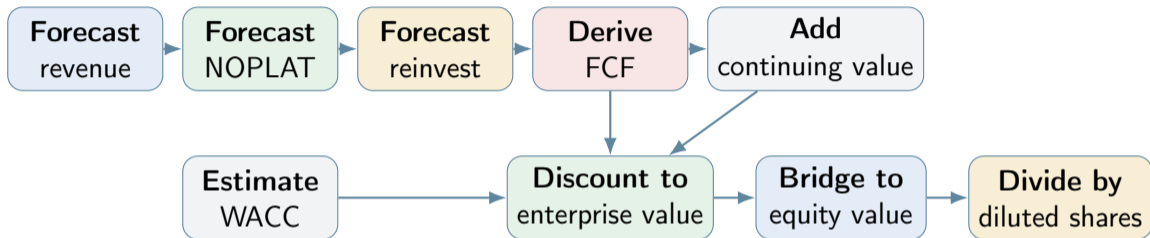
$$\text{ROIC} = 9.0\% \times 1.59 = 14.3\%$$

## High ROIC can come from very different businesses

Company	NOPLAT margin	IC turnover	ROIC
LuxuryCo	20%	0.8×	16%
RetailCo	4%	4.0×	16%

- ▶ The same ROIC can come from **pricing power** or **asset efficiency**.
- ▶ Forecasting improves when you ask **which driver is doing the work**.

## DCF in one picture



$$\text{Enterprise Value} = \sum_{t=1}^n \frac{FCF_t}{(1 + WACC)^t} + \frac{CV_n}{(1 + WACC)^n}$$

## Enterprise value is not equity value

$$\begin{aligned} \text{Equity Value} = & \text{Enterprise Value} - \text{Debt-like claims} \\ & - \text{Other nonequity claims} + \text{Nonoperating assets} \end{aligned}$$

### Common deductions

Debt, lease liabilities (if capitalized), preferred stock, minority interest, pension deficits, other debt-like obligations

### Common additions

Excess cash, marketable securities, unconsolidated investments, other nonoperating assets

## Simple EV-to-equity bridge example

$$\begin{array}{r} \text{EV} = 600 \\ + \text{ Excess cash} = 30 \\ - \text{ Debt} = (120) \\ \hline \text{Equity value} = 510 \end{array}$$

- ▶ Enterprise value belongs to **all** capital providers.
- ▶ Equity value is the **residual** after non-equity claims are handled.
- ▶ If diluted shares are 100, then value per share is \$5.10.

## Three consistency rules

### Cash flow match

FCFF goes with WACC.  
FCFE goes with cost of equity.

### Value match

Enterprise multiples use enterprise numerators; equity multiples use equity numerators.

### Capital match

NOPLAT must be paired with invested capital, not equity book value.

## Takeaways

- ▶ DCF begins with **clean operating statements**.
- ▶ FCF depends on both **profitability** and **reinvestment**.
- ▶ Enterprise value and equity value are **not the same object**.

**Next:** forecast ROIC, growth, and continuing value.