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# DCF Valuation

Free Cash Flow, WACC and Terminal Value,
from Forecast to Value per Share
Course Book

Six modules, one running case, every figure computed.
AI-assisted. Not investment advice.

# About this course

This course teaches the discounted cash flow valuation an analyst in investment banking, private equity, corporate development or transaction services builds and defends: the free cash flow, the cost of capital, the terminal value, the bridge to equity, the value per share, and the sensitivities a committee asks for. It follows one company, Varnhold Medical Systems, Inc., from the first page to the last, so every number of one module is the starting point of the next.

## What you have

- This Course Book: six modules, each with objectives, the lessons, a worked example step by step, the classic mistakes, a summary and three practice questions (answers at the back).
- The Case Workbook: the whole valuation in live formulas (340 formulas, ten checks and a master check), with a start file and a solution file for each module in Step_Files.
- The Exercise Workbook: one tab per module. Given data in blue, your answers in yellow, a check that turns green or red, and a hidden solution tab built with live formulas.
- The Quiz App: 96 questions with explanations, offline in any browser. The certificate exam is online.

## How to work through it

1. Read a module, with the Case Workbook open on the module's sheet.
2. Build the module in its start file: the orange cells, then compare with the solution file.
3. Do the matching tab of the Exercise Workbook without looking at the solution.
4. Practice the module in the Quiz App until you score 80% or more.
5. Most learners need about 1.9 hours of reading and 2.0 hours of Excel work.

## The running case at a glance

| Item | Value |
|---|---|
| Company (fictional) | Varnhold Medical Systems, Inc., US-listed, surgical imaging and patient monitoring equipment |
| Valuation date | 31 March 2028; last actual year FY2027; forecast FY2028E to FY2032E |
| FY2027 revenue and EBIT margin | $1,850.0m; 16.0% |
| Free cash flow | $188.8m (FY2028E) to $305.0m (FY2032E) |
| WACC and perpetual growth | 8.90%; 3.0% |
| Enterprise value and equity value | $4,784.5m; $4,381.5m |
| Value per share | $115.93 against a share price of $112.00 (3.5%) |

## Conventions

- US dollars; amounts in millions (US$ m) unless stated; shares and options in millions; values per share in US$. Rounded figures in the text come from unrounded calculations.
- Financial year ending 31 December. Mid-year convention with a nine-month stub from the valuation date. US GAAP reporting.

- The company, its peers and every figure are fictional. Market inputs are case assumptions, set against dated published references in module 3.

## Contents


| Module | Title | Lessons |
|---|---|---|
| 1 | Intrinsic value and the DCF logic | 1.1, 1.2, 1.3, 1.4, 1.5 |
| 2 | Unlevered free cash flow | 2.1, 2.2, 2.3, 2.4, 2.5 |
| 3 | WACC | 3.1, 3.2, 3.3, 3.4, 3.5 |
| 4 | Terminal value | 4.1, 4.2, 4.3, 4.4, 4.5 |
| 5 | From enterprise value to value per share | 5.1, 5.2, 5.3, 5.4, 5.5 |
| 6 | Sensitivities and sanity checks | 6.1, 6.2, 6.3, 6.4, 6.5 |
| | Glossary, answers and sources | |

MODULE 1

# Intrinsic value and the DCF logic

**Objectives**

- Say in one sentence what a discounted cash flow valuation measures, and what it does not.
- Move between enterprise value and equity value, and know which claims sit between them.
- Recognize when a DCF is the right primary method and when it should only be a cross-check.
- Read the running case: Varnhold Medical Systems, Inc., valued at 31 March 2028.
- Anticipate the five questions an investment committee asks about any DCF.

## 1.1 What a DCF measures

A discounted cash flow valuation says what a business is worth to someone who will receive its future cash, given the risk of that cash. It has three parts: a forecast of the cash the operations will generate, a discount rate that prices the risk of that cash, and a terminal value for everything after the forecast. The result is an intrinsic value: it depends on the business, not on what the market says about it today.

The cash that matters is the unlevered free cash flow: the cash left after taxes on operating profit and after the investment needed to keep the business growing, before any payment to lenders or shareholders. Because it belongs to all providers of capital, it is discounted at the weighted average cost of capital (WACC), which blends the return lenders and shareholders require. The present value of those flows is the enterprise value.

A DCF is a disciplined way of writing down what you have to believe. Revenue growth, margins, reinvestment, the cost of capital and the long-run growth rate are all explicit; anyone can challenge any one of them. That is its strength. Its weakness is the same: every input is an opinion, and small changes in the long-run inputs move the answer a lot. The rest of the course is about making those opinions defensible and testing them.

## 1.2 Enterprise value and equity value

Enterprise value is the value of the operating business, whoever finances it. Equity value is what is left for the shareholders once every other claim on that value has been paid. The bridge between the two is the most common source of errors in a valuation, so it is worth learning as a list:

- Subtract gross debt: loans, notes and other borrowings, ideally at market value.
- Add cash and cash equivalents that are not needed to run the business.
- Subtract the noncontrolling interest: the share of consolidated subsidiaries owned by others. The parent consolidates 100% of their cash flow, so the minority's share must come out.
- Subtract debt-like items: an unfunded pension after tax, provisions that will be paid in cash, and leases when the lease cost is not already in the cash flow.
- Add non-operating assets whose cash flow is not in the forecast, such as an equity-method investment, at fair value.

The direction matters as much as the list. Going from the market price to enterprise value you add the claims; going from a DCF enterprise value to equity value you subtract them. The same table serves both ways, and the course uses it both ways in this module and in module 5.

| Varnhold at the share price, 31 Mar 2028 | US$ m |
|---|---|
| Share price | $112.00 |
| Diluted shares (treasury stock method, m) | 37.79 |
| Market capitalization | 4,232.9 |
| Plus gross debt | 620.0 |
| Less cash | (210.0) |
| Plus noncontrolling interest | 35.0 |
| Plus unfunded pension, after tax | 18.0 |
| Less equity-method investment | (60.0) |
| Enterprise value at the share price | 4,635.9 |
| EV / EBITDA FY2027A | 12.2x |

## 1.3 When a DCF is the right tool

A DCF works best when cash flows are positive or will become so on a visible path, when the business model is stable enough to forecast five to ten years, and when the buyer will hold the business for its cash rather than for a quick resale. Mature industrial and healthcare companies, infrastructure, utilities and consumer brands fit well. It is also the method of choice when there are no good comparables, because it does not need any.

It is weaker when the value depends on options rather than on a forecast (an early-stage biotech before its trials read out), when cash flows are negative for many years, or when the business is a pool of assets better valued one by one (a holding company, a bank, a real estate portfolio). Banks and insurers are valued on equity cash flows, because debt is their raw material, not their financing.

In practice a DCF never travels alone. Trading multiples of listed peers and multiples paid in recent transactions are set next to it on a football field (module 6). When the DCF and the market disagree, the disagreement is information: either the forecast is more optimistic than the market, or the market prices a risk the forecast ignores.

## 1.4 The case: Varnhold Medical Systems

Varnhold Medical Systems, Inc. is a fictional US company listed on a US exchange. It designs and makes surgical imaging systems and patient monitoring equipment, sold to hospitals with multi-year service contracts. Its financial year ends on 31 December. You value it at 31 March 2028, three months into FY2028: the last full year is FY2027, with revenue of $1,850.0m and an adjusted EBIT margin of 16.0%.

Management's plan, reviewed by you, runs five years. Revenue grows by 8.0% in FY2028, slowing to 5.0% in FY2032, as a new imaging platform ramps up and then matures. The margin rises from 16.5% to 18.0% with scale. Capital expenditure falls from 5.8% to 5.4% of revenue once the new plant is built. Working capital stays at 18% of revenue. A restructuring of the European sales network costs $12.0m in cash in FY2028.

The share trades at $112.00, in a 52-week range of $92.00 to $128.00. Four listed peers (fictional, called A to D) give the betas and the trading multiples. The opening balance sheet at the valuation date gives the bridge. Every figure in the course comes from these inputs, computed in the Case Workbook; nothing is typed by

hand.

## 1.5 What an investment committee looks at

A committee does not re-run your model. It asks whether the answer is believable and what would change it. Expect five questions, and prepare a one-line answer for each:

- What do you have to believe? The growth, margin and reinvestment path, stated in plain words, and how it compares with the company's history and its peers.
- Where does the value sit? The share of the terminal value in enterprise value, and what the terminal value implies as a multiple and as a growth rate.
- How sure is the discount rate? The sources and dates of the risk-free rate, the equity risk premium and the beta, and the range they allow.
- What does it say against the market? The premium or discount to the share price and to the peers' multiples, and the reason for it.
- What breaks it? The two or three inputs that move the value most, from the sensitivity tables.

The last page of this course is a review checklist built on those five questions. Build the model so that each answer can be read from one cell.

## Worked example, step by step

1. Options in the money at $112.00: tranches 1 and 2 (strikes $60.00 and $95.00); tranche 3 (strike $160.00) is out of the money.
2. Net new shares by the treasury stock method: 1.20 x (1 - 60 / 112) = 0.5571m and 0.90 x (1 - 95 / 112) = 0.1366m.
3. Diluted shares: 36.50 basic + 0.60 RSUs + 0.6938 = 37.7938m.
4. Market capitalization: $112.00 x 37.7938m = $4,232.9m.
5. Net claims: debt 620.0 - cash 210.0 + NCI 35.0 + pension 18.0 - investment 60.0 = $403.0m.
6. Enterprise value at the share price: 4,232.9 + 403.0 = $4,635.9m.
7. EBITDA FY2027A: $1,850.0m x (16.0% + 4.5%) = $379.25m; trading multiple 12.22x.

## Pitfalls

- Using basic shares for the market capitalization: options and RSUs in the money are claims on the equity.
- Adding the noncontrolling interest when going from enterprise value to equity value. It is subtracted; it is added only when going from market capitalization to enterprise value.
- Forgetting non-operating assets: an equity-method investment is outside the consolidated cash flow and must be added at fair value.
- Comparing a DCF equity value per share with an enterprise value multiple without bridging first.
- Treating the DCF value as a fact. It is the price of a set of beliefs; the committee wants the beliefs.

## Summary

- A DCF values the unlevered free cash flow at the WACC: that gives enterprise value.
- Equity value = enterprise value - debt + cash - noncontrolling interest - debt-like items + non-operating assets.
- The DCF suits stable, cash-generating businesses; it is a cross-check where value lies in options or in separable assets.
- At $112.00, Varnhold's market capitalization is $4,232.9m and its enterprise value $4,635.9m, 12.2x FY2027 EBITDA.
- A committee wants five answers: what to believe, where the value sits, how sure the discount rate is, how it compares with the market, what breaks it.

## Build it in Excel

Open Step_01_Intrinsic_Value_start.xlsx and fill the orange cells of the Market sheet (20 cells), row by row as below, then compare with Step_01_Intrinsic_Value_solution.xlsx. Then do tab M1 of the Exercise Workbook.

| Cells | Row | Formula of the first cell | First value |
|---|---|---|---|
| Market!D5 | Share price (US$) | =Inputs!D33 | $112.00 |
| Market!D6 | Tranche 1 in the money at the share price (1 = yes) | =IF(Inputs!E41<D5,1,0) | 1 |
| Market!D7 | Tranche 2 in the money at the share price (1 = yes) | =IF(Inputs!E42<D5,1,0) | 1 |
| Market!D8 | Tranche 3 in the money at the share price (1 = yes) | =IF(Inputs!E43<D5,1,0) | 0 |
| Market!D9 | Tranche 1: net new shares, treasury stock method (m) | =D6*Inputs!D41*(1-Inputs!E41/D5) | 0.5571 |
| Market!D10 | Tranche 2: net new shares, treasury stock method (m) | =D7*Inputs!D42*(1-Inputs!E42/D5) | 0.1366 |
| Market!D11 | Tranche 3: net new shares, treasury stock method (m) | =D8*Inputs!D43*(1-Inputs!E43/D5) | 0.0000 |
| Market!D12 | Basic shares (m) | =Inputs!D31 | 36.50 |
| Market!D13 | Restricted stock units (m) | =Inputs!D32 | 0.60 |
| Market!D14 | Diluted shares at the share price (m) | =D12+D13+SUM(D9:D11) | 37.7938 |
| Market!D15 | Market capitalization, diluted (US$ m) | =D5*D14 | 4,232.9 |
| Market!D16 | Plus: gross debt (US$ m) | =Inputs!D25 | 620.0 |
| Market!D17 | Less: cash and equivalents (US$ m) | =Inputs!D26 | 210.0 |
| Market!D18 | Plus: noncontrolling interest (US$ m) | =Inputs!D27 | 35.0 |
| Market!D19 | Plus: unfunded pension, after tax (US$ m) | =Inputs!D29 | 18.0 |
| Market!D20 | Less: equity-method investment (US$ m) | =Inputs!D28 | 60.0 |
| Market!D21 | Net claims between enterprise value and equity value (US$ m) | =D16-D17+D18+D19-D20 | 403.0 |

| Cells | Row | Formula of the first cell | First value |
|---|---|---|---|
| Market!D22 | Enterprise value at the share price (US$ m) | =D15+D21 | 4,635.9 |
| Market!D23 | EBITDA FY2027A (US$ m) | =Inputs!D5*(Inputs!D7+Inputs!D13) | 379.2 |
| Market!D24 | Trading multiple: EV / EBITDA FY2027A (x) | =D22/D23 | 12.22x |

## Practice questions

**1.1** Varnhold: share price $112.00, tranche 1 of 1.2m options at a strike of $60.00. Net new shares by the treasury stock method?

A. 0.000m

B. 0.557m

C. 0.643m

D. 1.200m

**1.2** Diluted shares at $112.00: basic 36.50m, RSUs 0.60m, options 0.694m net. Total?

A. 37.100m

B. 39.800m

C. 36.500m

D. 37.794m

**1.3** Varnhold's EBITDA FY2027 is $379.25m and its enterprise value at the share price $4,635.9m. Trading multiple?

A. 2.51x

B. 12.22x

C. 15.66x

D. 11.16x