Valuing Companies with AI

MGMT 675: Generative AI for Finance

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Goals

- Build **pro forma financial statements** from a small set of assumptions
- Compute **free cash flow to the firm** from the pro formas
- Perform a **two-stage DCF valuation**
- Conduct **sensitivity analysis** on key inputs
- Use **Monte Carlo simulation** to compute expected cash flows and a distribution of values
- Do all of this using AI across multiple platforms

Pro Forma Statements

The Assumption Set

A pro forma model is driven by a small number of assumptions. Everything else is computed from these.

Assumption	Driver
Sales growth rate	% per year
COGS	% of sales
SG&A	Base amount + % of sales
Net working capital (NWC)	% of sales
PP&E	% of sales
Net other operating assets	% of sales
Depreciation	% of PP&E
Tax rate	% of pre-tax income

Capital expenditures are not assumed directly. **Cap ex = target PP&E − prior PP&E + depreciation**, i.e., whatever is needed to hit the PP&E target after accounting for depreciation.

Pro Forma Income Statement

Line Item	How It's Computed
Sales	Prior sales $\times$ (1 + growth rate)
COGS	COGS% $\times$ sales
Gross profit	Sales $-$ COGS
SG&A	Base + SG&A% $\times$ sales
Depreciation	Depr% $\times$ PP&E
EBIT	Gross profit $-$ SG&A $-$ depreciation
Taxes	Tax rate $\times$ EBIT
NOPAT	EBIT $-$ taxes

We use **NOPAT** (net operating profit after tax) rather than net income because DCF values the *operations* of the firm, independent of how they are financed.

Pro Forma Balance Sheet and Cap Ex

Balance Sheet Items

- **NWC** = NWC% $\times$ sales
- **PP&E** = PP&E% $\times$ sales
- **Net other OA** = Net other OA% $\times$ sales
- Change in each = current $-$ prior year

Capital Expenditures

- Target $\text{PP\&E}_t = \text{PP\&E\%} \times \text{sales}_t$
- $\text{Depreciation}_t = \text{depr\%} \times \text{PP\&E}_{t-1}$
- **$\text{Cap ex}_t = \text{PP\&E}_t - \text{PP\&E}_{t-1} + \text{depr}_t$**

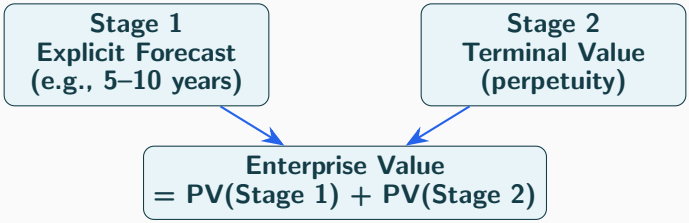
Free Cash Flow to the Firm

FCF = NOPAT + Depreciation $-$ Cap Ex $-$ ΔNWC $-$ ΔNet Other OA

Equivalently: FCF = NOPAT $-$ net investment in PP&E $-$ net investment in NWC $-$ net investment in other operating assets.

Two-Stage DCF

Two-Stage DCF: Overview



- **Stage 1**: Project FCF each year from pro forma assumptions
- **Stage 2**: Terminal value = FCF_{T+1} / (WACC $-$ g), where g is the long-run growth rate
- Discount all cash flows at the **WACC**
- **Equity value** = Enterprise value $-$ net debt

Terminal Value

The terminal value typically accounts for **60–80%** of total enterprise value. Getting it right matters more than the explicit forecast.

Growing Perpetuity

- $\text{TV} = \text{FCF}_{T+1} \,/\, (\text{WACC} - g)$
- $\text{FCF}_{T+1} = \text{year } T \text{ FCF} \times (1 + g)$
- g = long-run nominal growth (typically 2–3%)
- Requires $g < \text{WACC}$

Exit Multiple

- $\text{TV} = \text{EBITDA}_T \times \text{exit multiple}$
- Multiple from comparable firms
- Common in practice (M&A, PE)
- Cross-check against perpetuity method

Sensitivity Analysis

Sensitivity Tables

A sensitivity table shows how the output (e.g., equity value per share) changes as you vary one or two key inputs.

One-Way Table

- Vary a single input (e.g., WACC from 8% to 12%)
- Hold everything else constant
- Shows which inputs matter most

Two-Way Table

- Vary two inputs simultaneously
- Classic: WACC vs. terminal growth rate
- Also useful: sales growth vs. COGS margin
- Reveals interaction effects

Ask Claude to produce sensitivity tables in Excel (with formulas) or as formatted output. In Excel, the Data Table feature automates two-way tables.

Monte Carlo Simulation

Why Simulate?

- Sensitivity tables vary one or two inputs at a time
- In reality, **all assumptions are uncertain simultaneously**
- Monte Carlo simulation draws random values for each assumption, computes FCF and enterprise value, and repeats thousands of times
- The result: a **distribution** of enterprise values, not a single point estimate

Simulation Setup

Assign a probability distribution to each uncertain assumption, then sample and compute.

Assumption	Distribution	Example
Sales growth	Normal	$\mu = 8\%$, $\sigma = 3\%$
COGS %	Normal	$\mu = 60\%$, $\sigma = 2\%$
Terminal growth	Uniform	1.5% to 3.5%
WACC	Normal	$\mu = 10\%$, $\sigma = 1\%$

- Run 10,000 simulations $\rightarrow$ 10,000 enterprise values
- Report mean, median, 10th/90th percentiles
- Plot a histogram of the value distribution
- Identify which assumptions drive the most variance

Doing It with AI

Multiple Ways to Build a DCF with AI

Platform	What to Ask
Chat	"Build a two-stage DCF model for a company with these assumptions ... Generate an Excel file with pro formas, FCF, and a sensitivity table."
Cowork	Point Claude at a folder with data files. "Read the financial data, build pro formas, run a DCF, and save the results to Excel."
Code	"Build a DCF model in Python. Fetch Apple's financials from FMP, estimate assumptions from historical data, and run a Monte Carlo simulation."
Excel add-in	Open a blank workbook. "Build a two-stage DCF with pro forma statements, a sensitivity table for WACC vs. terminal growth, and a tornado chart."

Key difference: Chat and Cowork generate spreadsheets via Python (no internet). Code mode can **fetch live data** from APIs before building the model.

These exercises work with any capable AI – ChatGPT, Gemini, or Claude.

Exercises

Exercise: DCF in Chat or Cowork

- In Claude.ai or Claude Desktop (Chat or Cowork), ask Claude to build a two-stage DCF model for a hypothetical company with the following assumptions:
  - Current sales: \$500M; sales growth: 10% (years 1–5), 3% terminal
  - COGS: 58% of sales; SG&A: \$20M + 12% of sales
  - NWC: 15% of sales; PP&E: 40% of sales; net other OA: 5% of sales; depreciation: 10% of PP&E
  - Tax rate: 25%; WACC: 9%; net debt: \$200M; shares: 50M
- Ask Claude to generate an Excel file with:
  - Pro forma income statements and balance sheet items
  - Free cash flow calculation
  - Enterprise value and equity value per share
  - A two-way sensitivity table: WACC (7–11%) vs. terminal growth (1–4%)

Exercise: DCF with Live Data in Code Mode

- In Code mode, ask Claude to fetch Apple's income statement and balance sheet from Financial Modeling Prep (or Alpha Vantage).
- Ask it to estimate historical averages for each assumption (COGS%, SG&A%, NWC%, PP&E%, net other OA%, depreciation%).
- Ask it to build a 5-year pro forma model using those historical averages, perform a two-stage DCF, and produce sensitivity tables.
- Compare the AI-estimated equity value to Apple's current market cap.

Exercise: Monte Carlo Simulation

- Using the DCF model from either exercise above, ask Claude to run a Monte Carlo simulation with 10,000 trials.
- Ask it to vary sales growth, COGS%, WACC, and terminal growth rate using normal or uniform distributions of your choice.
- Ask for:
  - A histogram of simulated equity values per share
  - The mean, median, 10th percentile, and 90th percentile
  - A tornado chart showing which assumption has the largest impact on value
- Discuss: How does the range of simulated values compare to the single point estimate?

Exercise: DCF in the Excel Add-in

- Open a blank Excel workbook and launch the Claude add-in.
- Ask Claude to build a two-stage DCF model with:
  - An assumptions panel at the top (editable cells)
  - Pro forma income statements with **Excel formulas** (not hardcoded values)
  - FCF and enterprise value calculations
  - A two-way sensitivity table using Excel's Data Table feature
- Change a few assumptions manually and verify the model recalculates correctly.
- Ask Claude to add conditional formatting to highlight the cells where equity value per share is negative.