Exercise 2C: Monte Carlo Valuation

MGMT 675: Generative AI for Finance

Pick a specific finance role (e.g., equity research analyst, credit underwriter, portfolio manager, compliance officer). Using Claude.ai, have a conversation in which you identify five concrete tasks that AI could automate or augment in that role.

For each task:

- Describe what the task involves today (without AI)
- Classify it as **"maker" work** (producing output: models, reports, presentations) or **"checker" work** (reviewing, validating, catching errors)
- Explain how AI would change the task

Write a brief argument for which of the five tasks would deliver the most value if automated first.

Deliverables.

- One-page summary with classifications and recommendation (`1A-Summary.pdf`)
- Screenshot of Claude conversation (`1A-Screenshot.png`)

Ask Claude and at least one other AI (ChatGPT, Gemini, or Copilot) the same finance question:

> *"Explain the Modigliani-Miller theorem and its real-world limitations."*

Compare the two responses on accuracy, depth, and clarity. Then start a **new** Claude conversation and ask it to critique the other model's answer. Pay attention to what the critique catches and what it misses.

Write a half-page reflection on what you learned about cross-evaluation as a verification technique.

Deliverables.

- Screenshots of all three conversations (`1B-Screenshot1.png`, `1B-Screenshot2.png`, `1B-Screenshot3.png`)
- Reflection (`1B-Reflection.pdf`, half page)

Using Claude.ai Artifacts, create an interactive app that lets a user input:

- Coupon rate
- Yield to maturity
- Face value
- Years to maturity

Assume semi-annual coupons. The app should compute the bond price and display an interactive chart showing how the price changes as the yield varies from 0% to 15%.

Publish the artifact so it has a shareable link.

Deliverables.

- Shareable artifact link (`1C-Link.txt`)
- Screenshot of the published artifact (`1C-Screenshot.png`)

Download monthly return data for five ETFs of your choice (e.g., SPY, AGG, GLD, VNQ, EFA) and the one-month T-bill rate from a source such as FRED or Yahoo Finance. Upload the data to Claude and ask it to:

(a) Estimate expected returns, standard deviations, and correlations from the historical data
(b) Compute the tangency portfolio weights, expected return, standard deviation, and Sharpe ratio
(c) Plot the efficient frontier and the capital allocation line
(d) Re-solve with a **no-short-sales** constraint (all weights ≥ 0)
(e) Re-solve with a **maximum 40% allocation** constraint (no single weight > 0.40)

Compare the portfolio weights and Sharpe ratios across all three cases. Write a one-page memo discussing how constraints affect diversification and performance.

Deliverables.

- Data file (`2A-Data.xlsx`)
- Plot showing all three efficient frontiers (`2A-Plot.png`)
- Memo (`2A-Memo.pdf`, 1 page)

Build a two-stage discounted cash flow model for a hypothetical or real company. Start by providing Claude with a small set of assumptions:

- Sales growth rate, COGS as % of sales, SG&A, depreciation, tax rate

- NWC as % of sales, PP&E as % of sales
- WACC, terminal growth rate

The model should include:

1. **Pro forma income statement** (5-year forecast): Sales → COGS → Gross Profit → SG&A → Depreciation → EBIT → Taxes → NOPAT
2. **Pro forma balance sheet**: NWC and PP&E as % of sales, capital expenditure derived from target PP&E
3. **Free cash flow**: NOPAT + Depreciation − CapEx − ΔNWC
4. **Terminal value**: growing perpetuity method ($\text{TV} = \text{FCF}_{T+1}/(\text{WACC} - g)$)
5. **Enterprise value** and **per-share equity value**
6. **Two-way sensitivity table**: WACC (rows) vs. terminal growth rate (columns)

Produce the output as an Excel workbook with clearly labeled sheets.

Deliverables.

- Excel workbook with DCF model (`2B-DCF.xlsx`)
- Screenshot of the Claude conversation (`2B-Screenshot.png`)

Take the DCF model from Exercise 2B. Instead of using fixed assumptions, assign probability distributions to four key inputs. For example:

- Sales growth rate: Normal(8%, 3%)
- COGS as % of sales: Normal(60%, 2%)
- Terminal growth rate: Uniform(1.5%, 3.5%)
- WACC: Normal(10%, 1.5%)

Ask Claude to run 10,000 simulations and produce:

1. A **histogram** of enterprise values
2. **Summary statistics**: mean, median, 10th percentile, 90th percentile
3. A **tornado chart** showing which assumption drives the most variation in valuation

Write a brief paragraph identifying the key driver of valuation uncertainty and explaining why.

Deliverables.

- Histogram and tornado chart (`2C-Histogram.png`, `2C-Tornado.png`)
- Summary statistics and key-driver paragraph (`2C-Summary.pdf`, half page)