

Module 09: Final Projects - Real-World Capstone

Welcome to the Final Challenge!

Mauricio, you've come so far! From VS Code basics to Monte Carlo simulations and machine learning. Now it's time to put EVERYTHING together in real-world projects that you can use at PE Club immediately.

This module is different - these are **complete, production-ready applications** that integrate all 8 previous modules. Each project is something you could actually deploy at work on Monday.

Learning Objectives

By completing this module, you will:

1. Build Complete End-to-End Models

- Full LBO model with all schedules
- Comprehensive DCF with sensitivity analysis
- M&A accretion/dilution model
- PE fund portfolio tracker

2. Integrate Advanced Techniques

- Combine Monte Carlo with traditional models
- API data integration
- Automated reporting (PDF generation)
- Machine learning forecasting

3. Create Production-Ready Tools

- Error handling and validation
- Professional documentation
- Excel export functionality
- User-friendly interfaces

4. Demonstrate PE Club Readiness

- Real deal analysis workflows
 - Presentation-quality output
 - Scalable, reusable code
 - Industry best practices
-

Project Overview

We'll build **4 complete capstone projects** that showcase everything you've learned:

Project 1: Complete LBO Model with Monte Carlo Simulation

Full leveraged buyout model combining traditional finance with probabilistic analysis.

What it includes:

- Sources & Uses table
- Debt schedule (Senior, Mezzanine)
- Cash flow waterfall
- Returns calculation (MOIC, IRR)
- Monte Carlo simulation (10,000 scenarios)
- Sensitivity analysis
- Risk metrics (VaR, CVaR)
- PDF report generation

Skills demonstrated:

- Modules 05 (LBO), 08 (Monte Carlo)
- Professional model structure
- Risk quantification
- Automated reporting

Project 2: API-Powered DCF Valuation Tool

Automated DCF model that pulls live financial data and generates valuation ranges.

What it includes:

- Live data from yfinance API
- Automated financial statement analysis
- Free cash flow projections
- WACC calculation
- Terminal value (Gordon Growth & Exit Multiple)
- Sensitivity tables
- Comparable companies analysis
- Excel export with formatting

Skills demonstrated:

- Modules 04 (DCF), 08 (APIs)
- Data automation
- Professional Excel output
- Comprehensive valuation

Project 3: M&A Synergy Analyzer with ML

Complete merger model with machine learning-powered synergy predictions.

What it includes:

- Pro forma financials

- Accretion/dilution analysis
- Synergy estimation (Random Forest ML)
- Purchase price allocation
- EPS impact analysis
- Goodwill calculation
- Integration timeline modeling
- Board presentation output

Skills demonstrated:

- Modules 06 (M&A), 08 (ML)
- Advanced financial modeling
- Predictive analytics
- Stakeholder communication

Project 4: PE Fund Portfolio Dashboard 

Complete portfolio tracking system for a PE fund (like PE Club).

What it includes:

- Portfolio company tracking
- Returns aggregation (IRR, MOIC, DPI, TVPI)
- Waterfall distribution (LP/GP split, carry)
- Portfolio valuation (mark-to-market)
- Performance attribution
- Fund-level metrics
- Investor reporting
- Interactive visualizations

Skills demonstrated:

- Module 07 (PE Fund Modeling)
- Data management
- Multi-company aggregation
- Investor relations

 **Why These Projects Matter****For Your Career at PE Club:****1. Immediate Application**

- Use these tools on real deals starting Monday
- Impress colleagues with automation
- Save 10+ hours per week on analysis

2. Differentiation

- 95% of analysts can't code these models
- Combining finance + Python + AI = rare skillset
- Position yourself for rapid advancement

3. Portfolio Pieces

- Show these to future employers
- Demonstrate technical sophistication
- Prove you can deliver production-quality work

For Your Development:

1. Integration of Knowledge

- See how all modules connect
- Understand real workflow
- Build intuition for complex problems

2. Professional Standards

- Learn production code quality
- Understand error handling
- Practice documentation

3. Confidence Building

- Complete complex projects
- Prove you can go from idea to delivery
- Develop problem-solving skills

Technical Requirements

Before starting projects, ensure you have:

Python Packages:

```
# Core data analysis
pandas
numpy

# Financial data
yfinance

# Machine learning
scikit-learn

# Statistical analysis
scipy

# Visualization
```

```
matplotlib  
seaborn  
  
# PDF generation  
reportlab  
  
# Excel formatting  
openpyxl  
xlsxwriter
```

Installation:

```
pip install pandas numpy yfinance scikit-learn scipy matplotlib seaborn  
reportlab openpyxl xlsxwriter
```

🚀 How to Approach These Projects

Phase 1: Understanding (30 minutes per project)

- Read through the entire project description
- Understand the business problem
- Review the expected outputs
- Identify which modules are relevant

Phase 2: Planning (20 minutes per project)

- Break down into smaller components
- Identify data inputs needed
- Plan the workflow/pipeline
- Consider edge cases

Phase 3: Building (2-3 hours per project)

- Start with basic structure
- Add one feature at a time
- Test incrementally
- Refactor for clarity

Phase 4: Enhancement (1 hour per project)

- Add error handling
- Improve documentation
- Create professional output
- Test with different scenarios

Phase 5: Deployment (30 minutes per project)

- Create usage examples
 - Write user guide
 - Package for reuse
 - Share with colleagues
-

Project Completion Checklist

For each project, ensure you have:

Functionality:

- Core calculations are correct
- Edge cases handled
- Input validation works
- Outputs are accurate

Code Quality:

- Clear variable names
- Comprehensive docstrings
- Type hints included
- Comments explain "why"

Professional Output:

- Excel export works
- PDF report generates
- Formatting is clean
- Charts are readable

Documentation:

- Usage examples provided
- Parameters explained
- Assumptions documented
- Limitations noted

Testing:

- Tested with sample data
 - Tested with real data
 - Edge cases verified
 - Error handling confirmed
-

Success Metrics

You'll know you've succeeded when:

1. Technical Mastery

- All 4 projects run without errors
- Code follows professional standards
- Outputs are presentation-quality
- Models are accurate and reliable

2. Business Value

- Could use these at PE Club immediately
- Save significant time vs. Excel
- Provide insights not possible manually
- Impress senior colleagues

3. Personal Growth

- Confident in Python for finance
 - Comfortable with complex projects
 - Can debug and enhance code
 - Ready to build new tools
-

Tips from Sergio

Dear Mauricio,

These final projects are where everything comes together. They're challenging, but you're ready.

Remember:

1. Start Simple

- Get basic version working first
- Add complexity incrementally
- Test at each step

2. Use What You've Learned

- Reference previous modules
- Reuse proven patterns
- Build on solid foundation

3. Think Like a User

- Make it easy to use
- Provide clear outputs
- Handle errors gracefully

4. Be Professional

- Code you'd be proud to share
- Documentation you'd want to read
- Quality you'd expect from others

5. Have Fun!

- These are cool projects
- You're building real tools
- Enjoy the creative process

You've learned so much - from knowing nothing about VS Code to building Monte Carlo simulations and ML models. These projects prove you can compete with anyone in the industry.

I'm incredibly proud of how far you've come.

Now go build something amazing!

— Dad

🎬 Let's Get Started!

Choose any project to start with. I recommend:

Beginner Path:

1. Project 4 (Portfolio Dashboard) - consolidates Module 07
2. Project 1 (LBO Model) - adds Monte Carlo to Module 05
3. Project 2 (DCF Tool) - integrates APIs with Module 04
4. Project 4 (M&A Analyzer) - most complex, combines most modules

Advanced Path:

1. Project 2 (DCF Tool) - API integration practice
2. Project 3 (M&A Analyzer) - ML integration
3. Project 1 (LBO Model) - probabilistic modeling
4. Project 4 (Portfolio Dashboard) - complete system

Time Investment:

- Each project: 4-6 hours (spread over days)
 - Total module: 16-24 hours
 - Worth every minute!
-

📁 Project Structure

Each project will have:

```
Module_09_Projects/
├── 01_Final_Projects_Overview.md
├── solutions.py
└── sample_data/
    ├── lbo_inputs.json
    ├── dcf_inputs.json
    └── ma_inputs.json
```

← You are here
← All 4 projects implemented
← Example input files

```
└── portfolio_data.csv  
└── outputs/                                ← Generated reports  
    ├── lbo_analysis_report.pdf  
    ├── dcf_valuation.xlsx  
    ├── ma_synergy_analysis.pdf  
    └── portfolio_dashboard.xlsx
```

🎓 Learning Outcomes

After completing all projects, you will have:

Technical Skills:

- Built 4 complete financial applications
- Integrated APIs, ML, and traditional finance
- Created automated reporting systems
- Developed production-quality code

Business Skills:

- Understood real PE/IB workflows
- Practiced deal analysis end-to-end
- Developed presentation skills
- Learned industry best practices

Career Skills:

- Portfolio of impressive projects
- Demonstrable Python expertise
- Automation and efficiency mindset
- Confidence in technical abilities

🚀 Next Steps

1. **Review all 4 project descriptions below**
2. **Choose your starting project**
3. **Open `solutions.py` to see implementations**
4. **Run examples with sample data**
5. **Customize for your needs**
6. **Deploy at PE Club!**

Project 1: Complete LBO Model with Monte Carlo

Business Context

PE Club is evaluating a **€500M leveraged buyout** of a European software company. Traditional LBO models show a 22% IRR, but the Investment Committee wants to understand the **probability distribution** of outcomes and **downside risk**.

You need to build a complete LBO model that:

- Calculates traditional returns (MOIC, IRR)
- Runs 10,000 Monte Carlo simulations
- Quantifies risk (VaR, probability of loss)
- Generates a professional PDF report

Model Components

1. Sources & Uses

Sources:		Uses:	
– Senior Debt	€300M	– Purchase Price	€500M
– Mezzanine Debt	€50M	– Transaction Fees	€25M
– Equity	€175M	– Refinancing	€25M
Total Sources:	€525M	Total Uses:	€525M

2. Operating Assumptions

- Entry EBITDA: €50M
- Entry Multiple: 10.0x
- Revenue Growth: 8% ± 3% (Monte Carlo variable)
- EBITDA Margin: 30% ± 5% (Monte Carlo variable)
- CapEx: 5% of revenue
- Working Capital: 10% of revenue change

3. Debt Structure

- Senior Debt: €300M at 5.0%, amortizes 10% annually
- Mezzanine: €50M at 9.0%, PIK for 3 years, then cash
- Debt/EBITDA covenant: Must stay below 5.0x

4. Exit Assumptions

- Holding Period: 5 years
- Exit Multiple: 11.0x ± 2.0x (Monte Carlo variable)
- Exit via strategic sale

5. Monte Carlo Variables

- Revenue Growth Rate (normal distribution)
- EBITDA Margin (normal distribution)
- Exit Multiple (normal distribution)
- Debt Paydown Rate (varies with FCF generation)

Expected Outputs

Console Output:

```
=====
=====
LBO ANALYSIS: European Software Company
=====
=====

DEAL STRUCTURE:
Entry EV:           €500M
Entry EBITDA:       €50M
Entry Multiple:     10.0x
Equity Investment: €175M
Total Debt:         €350M

BASE CASE RETURNS:
Exit EBITDA:        €73.5M (8% CAGR)
Exit Multiple:       11.0x
Exit EV:             €808M
Remaining Debt:     €175M
Exit Equity Value:  €633M
MOIC:               3.6x
IRR:                29.2%

MONTE CARLO SIMULATION (10,000 iterations):
Mean IRR:            28.4%
Median IRR:          28.9%
Std Dev:             8.9%

IRR PERCENTILES:
10th (Downside):    16.8%
25th:                22.7%
50th (Median):      28.9%
75th:                34.5%
90th (Upside):      39.7%

PROBABILITY ANALYSIS:
P(IRR ≥ 25%):       66%
P(IRR ≥ 20%):       83%
P(IRR ≥ 15%):       93%
P(Loss):             0.1%

RISK METRICS:
VaR (95%):          13.2%
CVaR (95%):          8.9%
Sharpe Ratio:         3.19

RECOMMENDATION:  STRONG BUY
High probability of exceeding 20% hurdle rate
```

Downside well protected (10th percentile > 15%)
Attractive risk-adjusted returns

PDF Report Includes:

1. Executive summary with recommendation
2. Sources & Uses table
3. 5-year financial projections
4. Debt schedule
5. Returns calculation
6. Monte Carlo distribution histogram
7. Tornado chart (sensitivity analysis)
8. Risk metrics summary

Excel Export:

- Complete model with all schedules
- Scenario analysis
- Charts and formatting

Key Learning Points

1. **Integration:** Combines traditional LBO (Module 05) with Monte Carlo (Module 08)
2. **Risk Analysis:** Quantifies uncertainty, not just point estimates
3. **Professional Output:** IC-ready presentation
4. **Real-World:** Actual PE workflow and decision-making

Project 2: API-Powered DCF Valuation Tool

Business Context

PE Club is considering investing in **Microsoft (MSFT)**. Instead of manually entering financial data from Bloomberg, you'll build an automated DCF that:

- Pulls latest financials from Yahoo Finance
- Projects cash flows with customizable assumptions
- Calculates intrinsic value
- Generates valuation ranges
- Exports professional Excel model

Model Components

1. Data Acquisition (Automated)

```
import yfinance as yf
```

```
# Automatically download:  
- Income statement (3 years historical)  
- Balance sheet (3 years historical)  
- Cash flow statement (3 years historical)  
- Current stock price  
- Shares outstanding  
- Market cap
```

2. Financial Analysis

Historical Analysis:

- Revenue CAGR (3-year)
- EBITDA margin trend
- CapEx as % of revenue
- Working capital changes
- FCF conversion rate

3. Projections (5 years)

User-Defined Assumptions:

- Revenue growth rate (with fade)
- EBITDA margin expansion
- Tax rate
- CapEx ratio
- NWC investment

Calculated Automatically:

- EBITDA = Revenue × Margin
- D&A (from historical %)
- EBIT = EBITDA - D&A
- Tax = EBIT × Tax Rate
- NOPAT = EBIT - Tax
- CapEx = Revenue × CapEx %
- Δ NWC = Revenue Growth × NWC %
- FCF = NOPAT + D&A - CapEx - Δ NWC

4. Terminal Value

Two Methods:

1. Perpetuity Growth: $TV = FCF_{year5} \times (1+g) / (WACC - g)$
2. Exit Multiple: $TV = EBITDA_{year5} \times \text{Exit_Multiple}$

5. WACC Calculation

$$WACC = (E/V \times \text{Cost of Equity}) + (D/V \times \text{Cost of Debt} \times (1-\text{Tax}))$$

Where:

- Cost of Equity: CAPM = $R_f + \beta(R_m - R_f)$
- Cost of Debt: From financial data
- E/V, D/V: From balance sheet

6. Valuation

$$\text{Enterprise Value} = PV(\text{FCFs}) + PV(\text{Terminal Value})$$

$$\text{Equity Value} = EV - \text{Net Debt}$$

$$\text{Value per Share} = \text{Equity Value} / \text{Shares Outstanding}$$

$$\text{Upside/(Downside)} = (\text{Intrinsic Value} - \text{Current Price}) / \text{Current Price}$$

Expected Outputs

Console Output:

```
=====
=====
DCF VALUATION: Microsoft Corporation (MSFT)
=====
=====
```

CURRENT MARKET DATA:

Current Price:	\$374.32
Shares Outstanding:	7,430M
Market Cap:	\$2,781B
Enterprise Value:	\$2,850B

HISTORICAL PERFORMANCE (3-Year):

Revenue CAGR:	12.3%
EBITDA Margin:	45.6%
FCF Conversion:	89.2%
CapEx % of Revenue:	11.2%

VALUATION ASSUMPTIONS:

Revenue Growth (Y1-3):	10.0%
Revenue Growth (Y4-5):	7.0%
EBITDA Margin:	46.0%
Tax Rate:	21.0%
WACC:	9.2%
Terminal Growth:	3.0%

PROJECTED FREE CASH FLOWS:

Year 1:	\$67.2B
Year 2:	\$73.5B

Year 3:	\$80.3B
Year 4:	\$85.1B
Year 5:	\$90.2B

TERMINAL VALUE:

Perpetuity Method:	\$1,498B
Exit Multiple Method:	\$1,523B (15.0x EBITDA)
Average:	\$1,511B

VALUATION SUMMARY:

PV of Cash Flows:	\$286B
PV of Terminal Value:	\$982B
Enterprise Value:	\$1,268B
Less: Net Debt:	(\$70B)
Equity Value:	\$1,198B
Value per Share:	\$161.20
Current Price:	\$374.32
Implied Return:	-56.9%

SENSITIVITY ANALYSIS:

	WACC				
	8.0%	9.0%	10.0%	11.0%	
Terminal	2.0%	\$185	\$165	\$148	\$133
Growth	2.5%	\$198	\$175	\$156	\$140
	3.0%	\$213	\$187	\$165	\$147
	3.5%	\$230	\$200	\$176	\$156

RECOMMENDATION: Based on DCF, stock appears overvalued

Consider waiting for better entry point

Monitor for catalysts that could justify premium

Excel Export:

- Data Sheet:** Downloaded historical financials
- Assumptions Sheet:** User inputs (color-coded)
- Projections Sheet:** 5-year model
- Valuation Sheet:** DCF calculation
- Sensitivity Sheet:** 2-way tables
- Charts Sheet:** Revenue/EBITDA trends, WACC bridge
- Comparables Sheet:** Peer multiples from API

Key Learning Points

- Automation:** No manual data entry - live API integration
- Completeness:** Full DCF from data → valuation → output
- Flexibility:** Easy to change assumptions and rerun
- Professional:** Excel output ready for IC presentation

Project 3: M&A Synergy Analyzer with ML

Business Context

A PE Club portfolio company (€2B revenue) wants to acquire a competitor (€800M revenue) for €1.2B. The deal team believes there are significant synergies, but wants to:

- Quantify accretion/dilution to EPS
- Use ML to predict realistic synergy capture
- Model integration timeline and costs
- Generate board presentation materials

Model Components

1. Pre-Merger Financials

Acquirer (Portfolio Co):

- Revenue:	€2,000M
- EBITDA:	€400M (20% margin)
- D&A:	€100M
- EBIT:	€300M
- Interest:	€50M
- Tax (25%):	€63M
- Net Income:	€187M
- Shares:	100M
- EPS:	€1.87

Target:

- Revenue:	€800M
- EBITDA:	€120M (15% margin)
- D&A:	€40M
- EBIT:	€80M
- Interest:	€20M
- Tax (25%):	€15M
- Net Income:	€45M

2. Deal Structure

Purchase Price:

€1,200M

Payment:

50% cash, 50% stock

Cash Portion:

€600M (financed with new debt at 4.5%)

Stock Portion:

€600M (issue 30M new shares)

Transaction Fees:

€24M

3. Synergy Categories

Revenue Synergies (ML-predicted probability):

- Cross-selling: €50M (70% probability)
- New markets: €30M (60% probability)
- Pricing power: €20M (50% probability)

Cost Synergies (ML-predicted probability):

- Headcount reduction: €40M (85% probability)
- Procurement: €25M (80% probability)
- Facilities: €15M (90% probability)
- IT consolidation: €20M (75% probability)

Total Identified: €200M

ML-Adjusted Expected: €142M (71% capture rate)

4. Machine Learning Component

Train Random Forest model on historical M&A deals to predict:

- Synergy realization rate
- Integration timeline
- Risk factors

Training Features:

- Revenue overlap %
- Geographic overlap
- Culture similarity score
- Deal size ratio
- Industry sector
- Financing type

Model Output:

- Expected synergy capture: 71%
- Time to full synergies: 3.2 years
- Integration risk score: Medium
- Probability of success: 78%

5. Pro Forma Financials (Year 1)

Combined Pre-Synergies:

- Revenue: €2,800M
- EBITDA: €520M
- EBIT: €380M
- Interest: €97M (includes new debt)
- Tax: €71M
- Net Income: €212M

Combined Post-Synergies (ML-adjusted):

- Revenue:	€2,835M (+€35M from revenue synergies)
- EBITDA:	€627M (+€107M from cost synergies)
- EBIT:	€487M
- Interest:	€97M
- Tax:	€98M
- Net Income:	€292M
Shares Outstanding:	130M (100M + 30M issued)
Pro Forma EPS:	€2.25
Accretion Analysis:	
- Standalone EPS:	€1.87
- Pro Forma EPS:	€2.25
- Accretion:	+€0.38 (+20.3%) ✓ ACCRETIVE

6. Purchase Price Allocation

Fair Value of Assets:	€900M
Goodwill:	€300M (€1,200M - €900M)
Useful Life:	10 years
Annual Amortization:	€30M

Expected Outputs

Console Output:

=====
=====
M&A SYNERGY ANALYSIS: Portfolio Co + Target Acquisition
=====
=====

DEAL SUMMARY:

Purchase Price:	€1,200M
Target Revenue:	€800M
Purchase Multiple:	10.0x EBITDA
Payment Structure:	50% cash, 50% stock

MACHINE LEARNING SYNERGY PREDICTION:

Model: Random Forest (trained on 500 historical deals)

Identified Synergies:	€200M
ML-Adjusted Expected:	€142M
Implied Capture Rate:	71%

Confidence Intervals:	
Conservative (25%):	€98M
Base Case (50%):	€142M
Optimistic (75%):	€178M

Integration Timeline:

Year 1:	30% (€42M)
Year 2:	65% (€92M)
Year 3:	100% (€142M)

ACCRETION/DILUTION ANALYSIS:

Standalone Acquirer EPS: €1.87

Pro Forma EPS (no synergies): €1.63 (-12.8% DILUTIVE)

Pro Forma EPS (with synergies): €2.25 (+20.3% ACCRETIVE)

- Deal is ACCRETIVE with ML-adjusted synergies
- ⚠ Requires 71% synergy capture to achieve accretion

BREAK EVEN ANALYSIS:

Minimum synergies for EPS neutrality: €85M (43% capture)

Probability of achieving breakeven: 92%

SENSITIVITY: Pro Forma EPS at Various Synergy Levels

Synergy Capture	Pro Forma EPS	vs Standalone
0%	€1.63	-12.8%
25%	€1.76	-5.9%
50%	€1.94	+3.7%
71% (ML Base)	€2.25	+20.3%
100%	€2.58	+38.0%

RECOMMENDATION: APPROVE ACQUISITION

ML model predicts 71% synergy capture (high confidence)

20% EPS accretion in base case

92% probability of EPS neutral or better

Strategic rationale strong (market expansion, cost synergies)

PDF Report Includes:

1. Executive summary with ML insights
2. Deal structure and financing
3. Pro forma financials (3 scenarios)
4. Synergy bridge (identified → ML-adjusted)
5. EPS accretion/dilution waterfall
6. Integration timeline Gantt chart
7. Risk factors and mitigation
8. Board recommendation

Key Learning Points

1. **ML Integration:** Uses machine learning to improve synergy estimates
2. **Realism:** Addresses common pitfall of over-estimating synergies
3. **Comprehensive:** Full M&A analysis from structure to recommendation
4. **Decision Support:** Provides probabilistic outcomes, not just point estimates

Project 4: PE Fund Portfolio Dashboard

Business Context

You're managing a PE fund with **8 portfolio companies** across different sectors and vintages. Limited Partners (LPs) want quarterly reporting on:

- Individual company performance
- Portfolio-level returns (IRR, MOIC, DPI, TVPI)
- Waterfall distribution (LP/GP split, carry calculation)
- Mark-to-market valuations
- Performance attribution

You need a dashboard that aggregates all data and generates LP-ready reports.

Model Components

1. Portfolio Companies (8 investments)

Company A (SaaS):

- Investment Date: Q1 2020
- Equity Invested: €50M
- Entry EBITDA: €10M
- Current EBITDA: €18M
- Current Valuation: €180M (10.0x EBITDA)
- Distributions: €15M (partial realization)
- Status: Held

Company B (Manufacturing):

- Investment Date: Q3 2020
- Equity Invested: €80M
- Entry EBITDA: €20M
- Exit Date: Q2 2024
- Exit Proceeds: €240M
- Status: Realized

Company C (Healthcare):

- Investment Date: Q2 2021
- Equity Invested: €60M
- Entry EBITDA: €12M
- Current EBITDA: €16M
- Current Valuation: €128M (8.0x EBITDA)
- Status: Held

[... 5 more companies with similar data]

2. Fund Structure

Fund Details:

- Total Committed:	€500M
- Management Fee:	2.0% on committed capital
- Carry:	20% over 8% hurdle
- LP/GP Split:	80% / 20% (after hurdle)
- Fund Life:	10 years (vintage 2020)

3. Portfolio Metrics

Realized Investments:

Total Equity In:	€220M
Total Proceeds:	€680M
Realized MOIC:	3.1x
Realized IRR:	32.4%

Unrealized Investments:

Total Equity In:	€280M
Mark-to-Market:	€520M
Unrealized MOIC:	1.9x

Portfolio-Level:

Total Invested:	€500M
Distributions to Date:	€680M
NAV (unrealized):	€520M
DPI (Distributions/Paid-In):	1.36x
RVPI (Residual Value/Paid-In):	1.04x
TVPI (Total Value/Paid-In):	2.40x
Portfolio IRR (since inception):	24.8%

4. Waterfall Distribution

Total Value: €1,200M

Step 1: Return of Capital to LPs

Amount:	€500M (100% committed capital)
To LPs:	€500M
To GP:	€0

Step 2: Preferred Return (8% hurdle)

Hurdle Amount:	€200M (8% on €500M × 5 years avg)
To LPs:	€200M
To GP:	€0

Step 3: Catch-Up (GP gets to 20%)

Remaining:	€500M
GP Catch-Up:	€140M (to reach 20% overall)
To LPs:	€360M

Step 4: Carry Split (80/20)

Remaining:	€0
To LPs (80%):	€0
To GP (20%):	€0

FINAL DISTRIBUTION:

To LPs:	€1,060M (88.3% of total)
To GP:	€140M (11.7% of total)

LP MOIC: 2.12x

GP MOIC: N/A (carry only)

5. Performance Attribution

Portfolio Returns Attribution:

- Company B (Exited): +12.3% contribution to IRR
 - Company A (SaaS growth): +5.8% contribution
 - Company C (Healthcare): +3.2% contribution
 - Company D (Retail): -1.5% contribution (underperforming)
- [... breakdown for all companies]

Sector Attribution:

- Technology (4 co's): 48% of value, 15.2% IRR contribution
- Healthcare (2 co's): 22% of value, 5.8% IRR contribution
- Industrials (2 co's): 30% of value, 3.8% IRR contribution

Vintage Attribution:

- 2020 vintage (3 co's): Best performers, 32% IRR
- 2021 vintage (3 co's): On track, 21% IRR
- 2022 vintage (2 co's): Early stage, 12% IRR

Expected Outputs

Console Output:

```
=====
=====
PE FUND PORTFOLIO DASHBOARD - Q4 2024
=====
```

FUND OVERVIEW:

Fund Name:	PE Club Fund I
Vintage:	2020
Total Commitments:	€500M
Deployed Capital:	€500M (100%)
Fund Age:	4.8 years

PORTFOLIO SUMMARY:

Total Companies:	8
Active Investments:	5
FullyExited:	3
Partial Exits:	1

AGGREGATE PERFORMANCE:**REALIZED:**

Equity Invested:	€220M
Proceeds Realized:	€680M
Realized MOIC:	3.09x
Realized IRR:	32.4%

UNREALIZED:

Equity Invested:	€280M
Current Valuation:	€520M
Unrealized MOIC:	1.86x

PORTFOLIO TOTAL:

Total Invested:	€500M
Distributions:	€680M
Residual Value (NAV):	€520M
Total Value:	€1,200M

DPI:	1.36x
RVPI:	1.04x
TVPI:	2.40x
Portfolio IRR:	24.8%

TOP PERFORMERS:

1. Company B (Manufacturing): 3.0x MOIC, 28% IRR [EXITED]
2. Company A (SaaS): 3.6x MOIC, 30% IRR [HELD]
3. Company F (Tech): 2.8x MOIC, 26% IRR [HELD]

UNDERPERFORMERS:

1. Company D (Retail): 0.9x MOIC, -2% IRR [HELD]
2. Company H (Energy): 1.1x MOIC, 3% IRR [HELD]

WATERFALL DISTRIBUTION (at current valuation):

Total Value to Distribute: €1,200M

To Limited Partners:	€1,060M (88.3%)
- Return of Capital:	€500M
- Preferred Return (8%):	€200M

– Remaining Profits:	€360M
To General Partner:	€140M (11.7%)
– Catch-Up:	€140M
– Carry:	€0
LP Net MOIC:	2.12x
LP Net IRR:	19.6%
SECTOR BREAKDOWN:	
Technology (4):	€576M (48%), IRR: 28.2%
Healthcare (2):	€264M (22%), IRR: 18.5%
Industrials (2):	€360M (30%), IRR: 15.3%
QUARTERLY CHANGE:	
NAV increase:	+€45M (+9.5% QoQ)
New investments:	0
Full exits:	0
Distributions:	€25M (Company A partial sale)

Excel Dashboard:

- Summary Sheet:** Key metrics, charts
- Company Details:** Individual IRRs, MOICs, valuations
- Waterfall:** LP/GP distribution calculation
- Attribution:** Performance by sector, vintage, company
- Cash Flows:** Historical and projected
- NAV Roll-Forward:** Beginning → Changes → Ending
- Benchmark Comparison:** vs. industry benchmarks

PDF Quarterly Report:

- Fund performance summary
- Portfolio company updates
- Valuation methodology
- Distribution history and forecast
- Market commentary
- Appendix with detailed financials

Key Learning Points

- Portfolio Management:** Multi-company aggregation and tracking
- LP Reporting:** Professional investor communication
- Waterfall Mechanics:** Complex carry and distribution logic
- Performance Measurement:** Industry-standard metrics (DPI, TVPI, IRR)



When you complete all 4 projects, you will have:

✓ Built production-ready financial tools ✓ Integrated 8+ modules of learning ✓ Demonstrated PE/IB professional competence ✓ Created portfolio pieces for your career ✓ Developed automation and efficiency mindset ✓ Proven you can deliver complex projects

You're ready to excel at PE Club and beyond!

Additional Resources

For Further Enhancement:

1. **Add Web Interface:** Use Streamlit or Flask to create browser-based dashboard
2. **Database Integration:** Store data in SQLite or PostgreSQL
3. **Real-Time Updates:** Integrate with Bloomberg API or similar
4. **Cloud Deployment:** Deploy to AWS, Azure, or GCP
5. **Team Collaboration:** Add Git workflows for multi-user development

Advanced Topics:

- **Optimization:** Use `scipy.optimize` for capital allocation
 - **Scenario Analysis:** Add economic scenario modeling
 - **ESG Integration:** Track environmental, social, governance metrics
 - **Risk Management:** Add VaR, stress testing across portfolio
 - **Automation:** Schedule reports to run automatically
-

You've Got This!

These projects are the culmination of everything you've learned. Take your time, build incrementally, and enjoy seeing all the pieces come together.

When you're done, you'll have a toolkit that 95% of PE professionals don't have.

Ready to change how you work? Let's build! 

Module 09 - Final Projects Financial Modeling Course for Mauricio Created with ❤️ by Sergio