VEE Finance

1.1 Equity Financing

Equity Funding for Private Companies

Source of funding for private companies:

- Angel Investors
- Venture Capital Firms
- Institutional Investors
- Corporate Investors

When a private company first sells equity, it typically issues preferred stock instead of common stock.

A *funding round* occurs when a private company raises money. An initial funding round might start with a "seed round", and then in later funding rounds the securities are named "Series A", "Series B", etc.

Pre-Money and Post-Money Valuation

- *pre-money valuation* - value of firm *before* funding round
- *post-money valuation* - value of the firm *after* a funding round

Post-money valuation = V_{post}
= Pre-money valuation + Amount invested = $V_{\text{pre}} + A$
= Total shares after funding round × Pre-money price per share = $S_T \times P$

Percentage Ownership O:
$= \frac{\text{Amount invested}}{\text{Post-money valuation}} = \frac{\text{shares owned} \times \text{Pre-money price per share}}{\text{Post-money valuation}} = \frac{\text{shares owned}}{\text{Total shares}}$

$O(\text{Round}i, \text{Investor}j) = \frac{S(j)}{\sum_{k=1}^{k=i} S(k)} = O_j \cdot \prod_{k=j+1}^{k=i}(1 - O_k)$

Round	Price Per Share	Shares	Total Shares	Pre-Money Valuation	Amount Raised	Post-Money Valuation
1	$P(1) = \frac{A(1)}{S(1)}$	$S(1)$	$S(1)$	$V_{Pre}(1) = 0$	$A(1) = P(1)S(1)$	$V_{Post}(1) = V_{Pre}(1) + A(1)$
2	$P(2) = \frac{V_{Pre}(2)}{S(1)}$	$S(2)$	$S(1) + S(2)$	$V_{Pre}(2)$	$A(2) = P(2)S(2)$	$V_{Post}(2) = V_{Pre}(2) + A(2)$
3	$P(3) = \frac{V_{Pre}(3)}{S(1)+S(2)}$	$S(3)$	$S(1) + S(2) + S(3)$	$V_{Pre}(3)$	$A(3) = P(3)S(3)$	$V_{Post}(3) = V_{Pre}(3) + A(3)$
...	...	...	...	...	...	...
n	$P(n) = \frac{V_{Pre}(n)}{S_T(n-1)}$	$S(n)$	$S_T(n) = S(1) + ... + S(n)$	$V_{Pre}(n)$	$A(n) = P(n)S(n)$	$V_{Post}(n) = V_{Pre}(n) + A(n)$

Venture Capital Financing Terms

Venture capitalists typically hold convertible preferred stock, which differs from common stock due to:

- Liquidity preference = Multiplier × Initial Investment
- Participation rights, Seniority, Anti-dilution protection, Board membership

There are two ways to exit from a private company: Acquisition & Public offering

1.2 Equity Financing

Initial Public Offering

An IPO is the first time a company sells its stock to the public.

Advantages of IPO	Disadvantages of IPO
Greater liquidity	Dispersed equity holdings
Better access to capital	Compliance is costly / time-consuming

There are two major types of offerings:

- **Primary offerings**: new shares sold to raise new capital
- **Secondary offerings**: Existing shares sold by current shareholders

The company and underwriter decide on the best mechanism to sell shares:

- **Best-efforts**: Shares sold at the best possible price. Used in smaller IPOs
- **Firm commitment**: All share guaranteed to be sold at offer price. Most common
- **Auction IPOs**: Shares sold at auction directly to public

Standard steps to launching a typical IPO:

1. Underwriters manage IPO: market the IPO, Assist in required filings, ensure stock's liquidity after IPO
2. Companies file *registration statement*: Preliminary prospectus (red herring), final prospectus
3. Fair valuation performed by underwriter via road show and book building
4. Company pays fees and underwriting spread. After IPO underwriters can protect themselves against loss by exercising *over-allotment allocation* (greenshoe provision)

1.3 Equity Financing

IPO puzzles

1. The average IPO seems priced too low
2. New issues appear cyclical
3. Transaction costs of an IPO are high
4. Long-run performance after an IPO is poor on average

2.1 Debt Financing

Corporate Debt: Public Debt

Public debt trades on public exchanges. The bond agreement takes the form of an *indenture*, which is a legal agreement between the bond issuer and a trust company.

Four common types of corporate debt:

1. Notes - unsecured
2. Debentures - unsecured
3. Mortgage bonds - secured
4. Asset-backed bonds - secured

subordinated debenture - New debt with lower seniority than existing debt.

International bonds are classified into four broad categories:

- Domestic bonds - issued by local, bought by foreign
- Foreign bonds - issued by foreign, bought by local
- Eurobonds - issued by local or foreign
- Global bonds

Private Debt

Private debt is negotiated directly with a bank or a small group of investors. It is cheaper to issue due to the absence of registration cost.
Two main types of private debt:

- Term loan
- Private placement

2.2 Debt Financing

Other types of Debt

Sovereign debt / Municipal bonds are issued by the national / local government. In the U.S., sovereign debt issued as bonds are "Treasury securities". There are four types of treasury securities:

- Treasury bills - zero coupon bond with maturity less than one year
- Treasury notes - semiannual coupons with maturity 1-10 years
- Treasury bonds - semiannual coupons with maturity greater than 10 years
- Treasury inflation protected securities (TIPS) - semiannual coupon bonds where principal is adjusted for inflation. Coupon rate is fixed, coupon payment adjusted for inflation

2.2 Debt Financing Cont.

Municipal bond is issued by the state and local governments.

There are several types of municipal bonds based on the source of funds backing them:

- Revenue bonds
- General obligation bonds

Asset-Backed Securities

An asset-backed security (ABS) is a security whose cash flows are backed by the cash flows of its underlying securities. Include:

- Mortgage-backed securities (MBS) - largest sector of ABS,
  - *prepayment risk*
  - Ginnie Mae - govt. backed, Fannie Mae, Freddie Mac
- Credit-card receivables and auto loans
- Collateralized debt obligation (CDO) - private ABS

3.1 Short and Medium-Term Financing

Liquidity Management

liquidity - ability to meet short-term obligations with short-term assets

Primary sources of liquidity:

- Cash balances - bank accounts, investment income
- Short-term funds - bank line of credit, short-term investments
- Cash flow management (decentralization leads to cash tied up in system i.e. not readily available

Secondary sources of liquidity:

- Negotiating debt contracts
- Liquidating assets
- Filing for bankruptcy protection

drag on liquidity - uncollectable receivables, obsolete inventory, tight credit
*pull on liquidity* - early payments, reduced credit limits, low liquidity positions

3.1 Short and Medium-Term Financing Cont.

Measuring Liquidity

Liquidity Ratios:

- Current ratio $= \frac{\text{Current assets}}{\text{Current liabilities}}$
- Quick ratio $= \frac{\text{Quick assets}}{\text{Current liabilities}} = \frac{\text{Cash+Short-term investments+Receivables}}{\text{Current liabilities}}$ = Acid test
- Accounts receivable turnover $= \frac{\text{Credit sales}}{\text{Average receivables}}$
- Inventory turnover $= \frac{\text{Cost of goods sold}}{\text{Average inventory}}$
- Number of days receivables $= \frac{\text{Accounts receivable}}{\text{Average day's sales on credt}}$
- Number of days inventory $= \frac{\text{Inventory}}{\text{Average day's cost of goods sold}}$
- Number of days payables $= \frac{\text{Accounts payable}}{\text{Average day's purchases}}$
- Operating cycle = Number of days inventory + Number of days receivables (time to convert raw material to cash)
- Net operating cycle = Operating cycle − Number of days payables (accounts for lag of payments to suppliers)
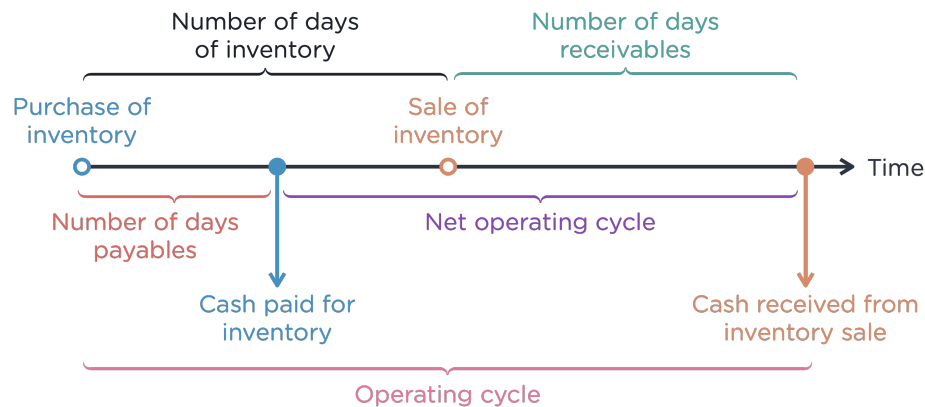
3.2 Short and Medium-Term Financing

Forecasting Short-Term Cash Flows

- Companies maintain a minimum cash balance
- Cash flow projections easier for companies with established history
- Inflows - operational receipts, maturing investments, tax refunds
- Short range forecasts generally more accurate

Monitoring Cash Use and Level

Cash flows monitored daily while keeping target balance for each bank account. Impacted by acquisitions and expenditures, can have seasonality.

3.2 Short and Medium-Term Financing Cont.

Short-Term Investment Instruments

Includes Treasury bills, bank CDs, banker's acceptances, repurchase agreements, commercial paper and mutual funds.

- nominal rate - based on face value
- yield - based on price

Money market yield $= \left(\frac{\text{Face value−Purchase price}}{\text{Purchase price}} \right) \left(\frac{360}{\text{Number of days to maturity}} \right)$

Bond equivalent yield $= \left(\frac{\text{Face value−Purchase price}}{\text{Purchase price}} \right) \left(\frac{365}{\text{Number of days to maturity}} \right)$

Discount basis yield $= \left(\frac{\text{Face value−Purchase value}}{\text{Face value}} \right) \left(\frac{360}{\text{Number of days to maturity}} \right)$

Strategies:

- Active - matching (more conservative) or mismatching
- Passive - less aggressive and focus on safety / liquidity

3.3 Short and Medium-Term Financing

Managing Accounts Receivable

Activities (captive finance subsidiary or outsourced):

1. Grant credit and process transactions
2. Monitor credit balances
3. Measure performance of credit function
4. Asset-backed bonds - secured

Goals:

1. Efficient processing and keeping accurate, updated records
2. Proper controls over records
3. Collection of accounts
4. Prepare performance reports

Trade Credit Granting

1. Open book - most common
2. Documentary - cross-border transactions
3. Installment credit - regular timed payments
4. Revolving credit

3.3 Short and Medium-Term Financing

Types of credit terms:

1. Ordinary - 1/10 net 30: 1% discount if paid within 10 days, paid in full by 30 days
2. Cash before delivery (CBD) - checks clear before shipment made
3. Bill-to-bill: prior bill paid before a new shipment
4. Monthly billing

Managing Customer Receipts

The *float factor* represents the amount of money in transit from customer to company. It tells the average number of days it takes checks to clear.

$$\text{Float factor} = \frac{\text{Average daily float}}{\text{Average daily deposit}}$$

Accounts receivables measured by how effectively they can be turned into cash. Aging schedule puts receivables into categories of days outstanding.

Managing Inventory

Motives for holding inventory (drag on earnings until sold)

1. Transaction motive - production-sales cycle
2. Precautionary motive - avoid running out of stock (lost sales)
3. Speculative motive - ensure availability and price

Approaches to Managing Inventory

1. Economic order quantity - predict demand and lead time. Common for smaller items with low unit costs.
2. Just in time - minimize in-process inventory. Materials ordered based on manufacturing resource planning systems.

Inventory Costs

1. Ordering - fixed / variable. Include: freight, labor and paperwork
2. Carrying - cost of storage, capital and insurance
3. Stock-out - cost of lost sales, back-orders and substitution
4. Policy - cost of gathering data

Evaluation Inventory Management

$$\text{Number of days of inventory} = \frac{365}{\text{Inventory turnover}}$$

3.4 Short and Medium-Term Financing

Managing Accounts Payable

Accounts Payable Management guidelines:

1. Financial organization's centralization
2. Number, size and location of vendors
3. Trade credit and cost of borrowing or alternative cost
4. Control of disbursement float (time between check issuance / clearing)
5. Inventory management
6. E-commerce and electronic data interchange

Trade Discount Economics

$$\text{Cost of trade credit} = \left(1 + \frac{\text{Discount}}{1 - \text{Discount}}\right)^{\frac{365}{\text{days past discount period}}} - 1$$

$$1 + APR = 1 + \frac{d}{1-d} \cdot T$$

$$1 + EAR = \left(1 + \frac{d}{1-d}\right)^{T}$$

The company should never pay before the end of a discount period.

$$\text{Number of days payables} = \frac{\text{Accounts payable}}{\text{Average day's purchases}} \quad \text{(comparable to credit terms)}$$

3.5 Short and Medium-Term Financing

Sources of Short-Term Financing

- Money Markets
- Banks
  - committed line of credit - upfront fee (e.g. 0.5% of full / unused amount)
  - uncommitted lines of credit (e.g.unsecured at LIBOR plus spread)
  - revolving credit limits - strongest: multiple years for large accounts

Short-Term Borrowing

- Ensure capacity can handle peak cash needs
- Sufficient credit sources for ongoing cash needs
- Cost-effective rates
- Consider size, credit-worthiness, diversification of lenders, borrowing options

Asset-Based Loans

Secured by assets:

- Receivables - collateral for loan
- Inventory - blanket lien, trust / warehouse receipt arrangement

3.5 Short and Medium-Term Financing Cont.

Cost of Borrowing

$$\text{Cost} = \frac{\text{Interest+Commitment Fee+Commission+Backup costs}}{\text{Loan amount}}$$

If all-inclusive loan on discount basis (amount borrowed includes interest)

$$\text{Cost} = \frac{\text{Interest+Commitment Fee+Commission+Backup costs}}{\text{Loan amount}-\text{Interest}}$$
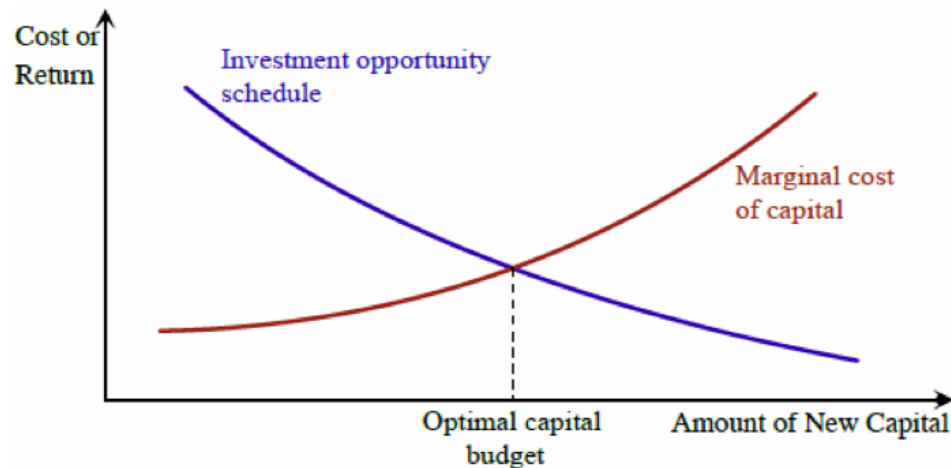
4.1 Cost of Capital

Weighted Average Cost of Capital

Required return to firm's investors accounting for Equity E, Preferred stock P, debt D and the interest tax shield τ:

$$r_{WACC} = w_E \cdot r_E + w_P \cdot r_P + w_D \cdot r_D(1 - \tau)$$

Capital Budgeting and Security Valuation

The optimal capital budget occurs at the intersection of MMC and IOS.

Use NPV to calculate Cost of Capital when the project:

1. has same risk as the average-risk project at the company

2. has a fixed capital structure throughout its life

The weighted average cost of capital (r_{WACC}) should be adjusted up or down if the project risk is above or below the average risk at the company.

4.2 Cost of Capital

Cost of Debt

Before-tax cost of debt can be estimated by:

- Yield to maturity - PV of cash flows assuming semiannual interest payments
- Debt rating - use yield on comparably rated bonds. Possible issues:
  - Cost of floating rate depends on current and future yields
  - Yields affected by embedded options (call / conversion features)
  - Company doesn't have rated bonds. Estimate by financial ratios
  - Leases should not be included in cost of capital

Cost of Preferred Stock

Cost of preferred stock is preferred dividend / price of preferred shares:

$$r_P = \frac{D_P}{S_P}$$

Cost of Common Equity

Approaches:

- Capital Asset Pricing Model (CAPM):
  - Single factor- $E[R_i] = r_f + \beta_i(E[R_{Mkt} - r_f)$
  - Multi factor - $E[R_i] = r_f + \sum_k \beta_{i,k}\text{Factor}_k$
  - Estimate risk premium by:
    1. Historical equity risk premium
    2. Gordon growth model - $S_0 = \frac{D_1}{r_E - g} \implies r_E = \frac{D_1}{S_0} + g$
    3. Survey financial experts

- Dividend Discount model with sustainable growth rate $r_E = \frac{D_1}{S_0} + g$

  - growth g = retention rate $\times$ return on equity

  $$= \left(1 - \frac{D}{\text{EPS}}\right)(\text{ROE})$$

- Bond Yield plus Risk Premium

  - Riskier cash flows have higher cost of capital
  - $r_E = r_D + \text{Risk premium}$
  - Risk premium is forward looking (often estimated from historical)

5.0 Capital Budgeting

The process used to make decisions for capital projects (mergers, acquisitions etc)

Capital budgeting steps:

1. Generate investment ideas
2. Analyze individual proposals
3. Plan capital budget, consider overall strategy and timing
4. Monitor and audit results

Project Categories:

1. Replacement projects
2. Expansion projects
3. New products and services
4. Regulatory, safety and environmental project
5. Other: pet projects and moonshots

5.1 Capital Budgeting

Budget Assumptions:

- Decisions base on cash flows and not intangible cost / benefits
- Timing of cash flows are important
- Cash flows based on opportunity costs. The incremental cash flow required by the investment.
- Financing costs not including among cash flows. Only operating cash flows are considered and financing costs are reflected in the discount rate.
- Cash flows do not equal accounting or economic income

Budgeting Concepts:

- Decisions today should not be affected by past decisions - sunk cost fallacy
- Opportunity cost is resource worth in next-best use
- Incremental cash flows are extra cash flows from a particular decision
- Investment externalities - cannibalization: investment takes sales away from another part of the company
- Non-conventional cash flows have outflows that occur at more than just time zero. Requires multi-period investments

Challenges to Analysis:

- Mutually exclusive projects limit choice
- Some projects must be completed sequentially
- Companies have limited funds - capital rationing required

5.2 Capital Budgeting

Net Present Value

$$\text{NPV} = -\text{Outlay} + \sum_{t=0}^{t=n} \frac{CF_t}{(1+r)^t} > 0 \implies \text{Invest}$$

Internal Rate of Return

$$NPV = \sum_{t=0}^{t=n} \frac{CF_t}{(1+\text{IRR})^t} = 0 \text{ Invest if IRR} > \text{required return}$$

(Discounted) Payback Period

The amount of time until cumulative (discounted) cash flows are positive. I.e. amount of time needed to recover the original investment.
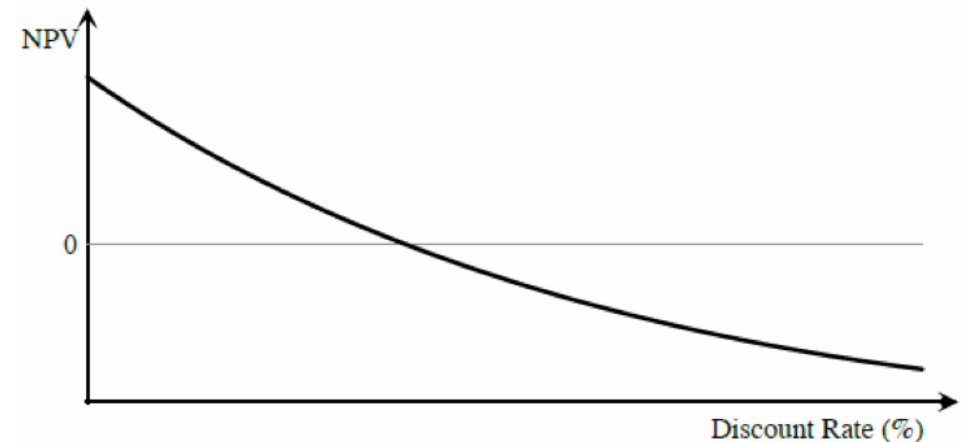
Average Accounting Rate of Return

Based on accounting numbers rather than cash flows. Doesn't consider TVM.

$$\text{AAR} = \frac{\text{Average net income}}{\text{Average book value}}$$

Profitability Index

$$PI = \frac{\text{PV of future cash flows}}{\text{Initial Investment}} = 1 + \frac{\text{NPV}}{\text{Initial Investment}} > 1 \implies \text{Invest}$$

NPV Profile

NPV vs. IRR:

- Will agree on investment decision (yes/no) for independent projects
- Rankings might be different. In that case choose project with higher NPV
- Project may have no IRR or multiple IRRs depending on cash flows
- Large companies prefer NPV and IRR

Cash Flow Projections

Cash flow types:

- Investment outlays (Outlay)
- After-tax operating cash flow over project life (CF)
- Terminal year after-tax non-operating cash flows (TNCOF)

Variables:

- FCInv : Investment in new fixed capital
- NWCInv : Investment in net working capital
- Sal_t : Cash proceeds (salvage value) from sale of fixed capital
- B_t : Book value of fixed capital
- S : Sales
- C : Cash operating expenses
- D : Depreciation charge
- τ : Tax rate

Expansion Project:

- Initial investment: $\text{Outlay} = \text{FCInv} + \text{NWCInv}$
- After-tax cash flows: $CF = (S - C)(1 - \tau) + D \cdot \tau$
- Terminal year cash flows: $\text{TNOCF} = \text{NWCInv} + \text{Sal}_t - \tau(\text{Sal}_t - B_t)$

Replacement Project:

- Initial investment: $\text{Outlay} = \text{FCInv} + \text{NWCInv} - \text{Sal}_0 + \tau(\text{Sal}_0 - B_0)$
- After-tax cash flows: $CF = (\Delta S - \Delta C)(1 - \tau) + \Delta D \cdot \tau$
- Terminal year cash flows: $\text{TNOCF} = \text{NWCInv} + \Delta\text{Sal}_t - \tau(\Delta\text{Sal}_t - \Delta B_t)$

See 5.3 Cash Flow Projections spreadsheet for examples:

Year	Sales	Expenses	Book Value	Depreciation	Salvage Value	Cash Flows	Cash Flows (TVM)	Terminal Yr Non-Op CFs	Terminal Yr Non-Op CFs (TVM)	NPV
0	0.00	0.00	25000.00	0.00	0.00	0.00	0.00	0.00	0.00	-30000.00
1	3429.00	1500.00	20000.00	5000.00	0.00	2850.30	2544.91	0.00	0.00	-27455.09
2	3429.00	1500.00	15000.00	5000.00	0.00	2850.30	2272.24	0.00	0.00	-25182.85
3	3429.00	1500.00	10000.00	5000.00	0.00	2850.30	2028.79	0.00	0.00	-23154.06
4	3429.00	1500.00	5000.00	5000.00	0.00	2850.30	1811.42	0.00	0.00	-21342.64
5	3429.00	1500.00	0.00	5000.00	0.00	2850.30	1617.34	0.00	0.00	-19725.31
6	3429.00	1500.00	0.00	0.00	0.00	1350.30	684.10	0.00	0.00	-19041.20
7	3429.00	1500.00	0.00	0.00	0.00	1350.30	610.81	0.00	0.00	-18430.40
8	3429.00	1500.00	0.00	0.00	0.00	1350.30	545.36	0.00	0.00	-17885.03
9	3429.00	1500.00	0.00	0.00	0.00	1350.30	486.93	0.00	0.00	-17398.10
10	3429.00	1500.00	0.00	0.00	1000.00	1350.30	434.76	5700.00	1835.25	-15128.09

Fixed Capital Investment	25000.00
Net Working Capital Investment	5000.00
Initial Investment / Outlay	30000.00

EXAMPLE: EXPANSION PROJECT

Nico, Inc. is considering purchasing a new machine. The machine costs $25,000. The machine also requires an initial $5,000 investment in net working capital. The machine's

Cost of Capital	12.00%
Tax Rate	30.00%

Project Analysis and Evaluation

Replacement Chain / Least Common Multiple of Lives
Extend the time horizon of each project to the least common multiple of all projects:

Given project A and B with interest rate i and lives n and m respectively. Let $l = \text{lcm}(m, n)$, R be the replacement cost and CF the after tax cash flows. Then:

$$\text{NPV}_A(l) = -R_A \frac{a_{\overline{l}|i}}{a_{\overline{m}|i}} + CF_A \cdot a_{\overline{l}|i}$$

$$\text{NPV}_B(l) = -R_B \frac{a_{\overline{l}|i}}{a_{\overline{m}|i}} + CF_B \cdot a_{\overline{l}|i}$$

And we simply choose the one with largest NPV.

Equivalent Annual Annuity (EAA)
Convert NPV to annuity then solve for PMT using TVM keys on the BA-II

$$\boxed{N} = n$$
$$\boxed{I/Y} = i$$
$$\boxed{PV} = -\text{NPV}_A$$
$$\boxed{FV} = 0$$
$$\boxed{CPT}\ \boxed{PMT} = \frac{1}{a_{\overline{m}|i}} \cdot \text{NPV}_A = \text{EAA}(A)$$

Then choose project with the largest EAA.

Capital Rationing

Allocate a finite amount of capital among available projects to maximize total NPV. Projects with a negative NPV should never be chosen. Capital rationing limits market efficiency.

Order projects from highest to lowest profitability index and select projects until your capital budget is reached (greedy approach):

Project	Outlay	NPV
A	1800	420
B	900	290
C	600	250
D	500	230
E	300	190

$$\rightarrow 1 + \frac{\text{NPV}}{\text{Outlay}} \rightarrow$$

Project	Outlay	PI
E	300	1.63
D	500	1.46
C	600	1.42
B	900	1.32
A	1800	1.23

* In general this is a 0/1 Knapsack problem