Simple Assumptions of Finance

1. Investors prefer more to less
2. Money paid in the future is worth less than same amount today
3. Investors are risk-averse
4. Financial Markets are competitive

Discount Rate (r)

- The discount rate (r) is the number such that you're indifferent between

$ today & $(1+r) next period

Present Value

$$PV(CF_T) = \frac{CF_T}{(1+r)^t}$$

Net Present Value (NPV)

- To value a stream of cash flows → sum over all Present Values

$$\boxed{NPV = \sum \frac{CF_t}{(1+r)^t}}$$

Properties of NPV

1. NPV scales under Multiplication
   ↳ $NPV(a \cdot CF_1, \ldots a \cdot CF_T) = a * NPV(\ldots)$
2. NPV is additive
   ↳ $NPV(X_T + Y_T) = NPV(X_T) + NPV(Y_T)$

Conditions to use NPV

- Cash flows are known
  ↳ (in amount & time)
- Discount rate is known & constant

When r uncertain or unknown

- Use average rate of return for similar asset
  ↳ R_f + Risk premium

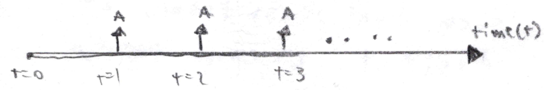
Future Value

$$FV_T = CF_0 * (1+r)^T$$

15.401 Exam #1

Present Value of Perpetuity

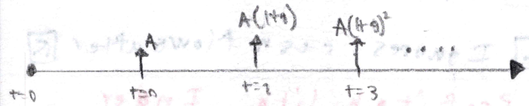
- Value of same cash flow, every period, forever.



$$PV(\text{Perpetuity}) = \frac{A}{r}$$

Perpetuity w/ constant growth

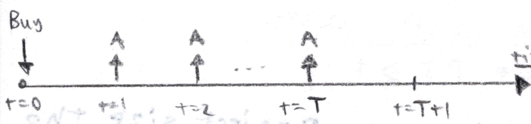
- value of a sequence of cash flows that grow at constant rate



$$PV\left(\begin{matrix}\text{Perpetuity}\\ \text{w/ growth}\end{matrix}\right) = \frac{A}{r-g}$$

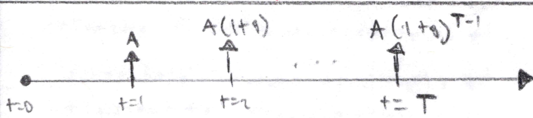
Present Value of Annuity

- A constant cash flow for T periods



$$PV(\text{annuity}) = \frac{A}{r}\left(1 - \frac{1}{(1+r)^T}\right)$$

Annuity w/ growth



$$PV\left(\begin{matrix}\text{Annuity}\\ \text{w/ Growth}\end{matrix}\right) = \frac{A}{r-g}\left(1 - \frac{(1+g)^T}{(1+r)^T}\right)$$

Compounding

- Interest may be charged more frequent than annually
- Interest Rates quoted as Annual Percentage Rate (APR)

$$APR = \left(\begin{matrix}\text{Per Period}\\ \text{interest rate}\end{matrix}\right) * \left(\begin{matrix}\text{\# of Periods}\\ \text{in year}\end{matrix}\right)$$

APR vs. EAR

- For per-period rate (r)
  ↳ $\boxed{N = \text{\# of periods per year}}$
- $APR = N * r$
- $(1 + EAR) = (1+r)^n$
  ↳ EAR = Effective annual rate or Annual Percentage Yield (APY)

* Conversion Formulas *

$$EAR = \left(1 + \frac{APR}{N}\right)^N - 1$$

$$APR = N \cdot \left[(1+EAR)^{1/N} - 1\right]$$

Compounding for 1 year

$$(1+r_{daily})^{365}$$
$$\Uparrow$$
$$e^{r_{cont}} \Leftarrow 1 + EAR \Rightarrow (1+r_{months})^{12}$$
$$\Downarrow$$
$$(1+r_{semi})^2$$

$$\left(1+\frac{APR}{365}\right)^{365}$$
$$\Uparrow$$
$$e^{APR} \Leftarrow 1 + EAR \Rightarrow \left(1+\frac{APR}{12}\right)^{12}$$
$$\Downarrow$$
$$\left(1+\frac{APR}{2}\right)^2$$

Real vs Nominal Returns

$$r_{real} = \frac{1 + r_{nominal}}{1 + i} - 1$$

↳ (For small i) $\boxed{r_{real} = r_{nominal} - i}$

Inflation & NPV

- Discount Nominal Cash Flow by Nominal rates
- Discount Real Cash Flow by Real rates

Capital Budgeting: NPV

* Companies should only take projects w/ positive NPV

1. Use cash flows
2. Use After-Tax Cash Flows
3. Use cash flows attributable to project
   ↳ i. Ignore sunk costs!
   ↳ ii. Include investment in working capital & capital expenditure
   ↳ iii. Include opportunity cost for existing facilities

Cash Flow Estimation

↳ Must undo effects of accounting

1. Cash Flows

$$CF = \left(\begin{matrix}\text{Operating}\\\text{Revenues}\end{matrix}\right) - \left(\begin{matrix}\text{Non-capital}\\\text{costs}\end{matrix}\right) - \left(\begin{matrix}\text{Capital}\\\text{Expenditure}\end{matrix}\right) - \left(\begin{matrix}\text{Income}\\\text{Taxes}\end{matrix}\right)$$

↳ Non-capital costs: COGS + OPEX

2. Operating Profit

$$\text{Operating Profit} = \left(\begin{matrix}\text{operating}\\\text{Rev}\end{matrix}\right) - \left(\begin{matrix}\text{Non-capital}\\\text{cost}\end{matrix}\right) - \text{Dep}$$

3. Income Taxes

$$\text{Income Taxes} = T(\text{Operating Profit})$$

4. working capital

a. Inventory

b. Accounts receivable

c. Accounts Payable

$$\text{working capital} = \text{Inv} + \text{AR} - \text{AP}$$

* PUTTING IT ALL TOGETHER *

$$CF = (1-T)(\text{Operating Profit}) - \text{CAPEX} + \text{Depreciation} - \text{change in working capital}$$

Internal Rate of Return

↳ in words, IRR is the discount rate that makes project's NPV = 0

Accept Project:

1. Project's IRR > Fixed IRR

Shortcomings of IRR

1. IRR sometimes doesn't exist
2. Multiple IRR's can exist
3. IRR ignores Project Magnitude
4. IRR ignores difference in time patterns

Pay back Period

- Minimum value of periods $\boxed{K}$ such that cash flows of project become positive

accept Project:

- If payback period less than some threshold value

Shortcoming of Payback Period

1. Ignores Time Value of Money
2. Ignores cash flows after $\boxed{K}$

Profitability Index

- Ratio of future NPV of Project to initial cost

$$PI = \frac{NPV}{I_0}$$

Accept:

- if $PI > 1$

* ignores project size tho

Stock Markets

1. common stock

↳ ownership positions in companies

↳ rights to cash dividend, stock dividend, share repurchase

Legal characteristics:

1. Residual claim
2. Limited Liability
3. Voting rights

Discounted Dividend Model

↳ Price of Stock

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r_t)^t}$$

P_t = price of stock @ time t

D_t = expected cash Dividend

r_t = discount rate

Special Case: Gordon Growth Model

- Dividends expected to grow @ rate g

$$P_0 = \frac{D_1}{r-g}$$

implied cost of capital:

$$\text{cost of capital} = \left(\frac{D_1}{P_0}\right) + g$$

Forecasting Dividends: Key Variables

1. Earnings or EPS

↳ Total Profit or $\frac{\text{Total Profit}}{\text{\# of shares}}$

2. Payout Ratio

$$\frac{\text{Dividends}}{\text{Earnings}} = \frac{DPS}{EPS}$$

3. Retained Earnings

$$RE = \text{Earnings} - \text{Dividends}$$

4. Plowback Ratio

↳ retained Earnings / Earnings

5. Book Value

↳ cumulative RE

6. Return on Equity

↳ Total Earnings / Book Value

Mini-Case: World Granary

Data

- Company gets 18% ROE
- Book value = $150 mil
- Expands at 12% growth rate
- cost of capital = 18%

SEE Packet

But

$$\text{Dividends} = \varphi * ROE * BV$$

* b/c φ & ROE are constant

- Dividends & Book Value must grow at same rate

Constant Growth Formula

- w/ constant ROE & constant g

$$EPS_1 = ROE * BV_0$$

$$RES_1 = g * BV_0$$

$$\text{Dividend per Share}: D_1 = (ROE - g) * BV_0$$

$$\text{Stock Price}: P_0 = \frac{(ROE - g) * BV_0}{r - g}$$

Growth Opportunities

- Investment opportunities w/ (ROE > r)

indicators:

- Stock w/ EPS growing slower than cost of capital
- Stock w/ BPS growing slower than cost of capital

Two components of Stock Price

- Stock Price has 2 components

[1.] Present value of earnings under No-Growth Policy

[2.] Present Value of Growth (PVGO)

$$P_0 = \frac{EPS_1}{r} + PVGO$$

Cash Flow of a Bond

- Cash Flow Depends on

[1.] Maturity of Bond

[2.] Principal (Full value of Bond to be paid)

[3.] Coupons

Discount Bonds

- Discount bond w/ maturity date $\boxed{t}$ pays \$1 at time t only

Spot Interest Rates

- Prices of Discount Bonds offer information about spot rates of different horizons

$$B_t = \frac{1.00}{(1+r_t)^t}$$

↳ B_t → price of Bond Maturing at time $\boxed{t}$

Coupon Bonds

- Pays stream of Regular Payments $\boxed{\&}$ Principal at maturity

→ Price by treating as a portfolio of Discount Bonds

Can Price Coupon bond knowing

[1.] Discount Bond Prices

[2.] Spot rates of all relevant periods

Yield to Maturity (YTM)

- YTM (y) → rate that replace all spot rates & result in same bond Price

Time Value of Money Across Horizons

- Market's implied time value of money described by Spot-Rates

Term Structure of interest Rate

- Spot interest rate $\boxed{r_t}$ is annualized interest rate for horizon of t periods
- A set of spot rates for different maturities is called a term structure (Also Yield Curve)

Expectations Hypothesis

↳ states Long-term interest rates are determined fully by expectations of one period r until maturity

$$(1+r_{t,2\text{-}yr})^2 = (1+r_{t,1yr})(1+E_t(r_{t+1,1}))$$

So for $\boxed{m}$ maturity $\boxed{t}$ date

$$(1+r_{t,m})^m = (1+r_{t,1})(1+E[r_{t+1,1}])\cdots(1+E[r_{t+m-1,1}])$$

↳ Doesn't hold in data

Liquidity Preference Hypothesis

- Same as above but add a Risk Premium Term
- Investors view long-term bonds as riskier

$$(1+r_{t,2})^2 = (1+r_{t,1})(1+f_{t+1,1}) + \text{Risk Premium}$$

Implications:

- Term structure reflects Future one Period Rates $\boxed{\&}$ Risk premium demanded by investors

Interest Rate risk

- Change in interest rate could effect real value of your payment in future

* Duration *

↳ Measure of interest-rate risk exposure

- consider a bond w/ YTM $\boxed{y}$ & cash flows from coupons & Principal

Duration → Weighted Average time to Maturity

$$D = \frac{1}{B}\sum_{t=1}^{T}\frac{CF_T}{(1+y)^t} * t$$

↳ B = Bond Price

Modified Duration

↳ Relative Price change w/ respect to a unit change in yield

$$MD = \frac{D}{1+y}$$

Duration of Perpetuity

$$(1+y)/y$$

Using MD to calculate Bond Price Change

$$MD \times (-\Delta y) = \frac{\Delta B}{B}$$

Duration Matching for a firm

- Duration matching makes duration of assets & liabilities equal

$$D^{assets} P^{assets} = D^{Liab} P^{Liab}$$

- sensitivity to interest rate changes are as follows

$$\Delta P = -\frac{D^{Liab}}{1+y} P^{assets}(\Delta y) + \frac{D^{Liab}}{1+y} P^{Liab}(\Delta y) = 0$$

Dangers of Duration Mismatch

- When interest rates fall value of Bonds increase
  - ↳ But Liabilities increase more!

Example:

$B_1 \cdot x + B_{30} \cdot Z$ = Portfolio Value

$\boxed{B}$

$\frac{1}{B}\left((B_1 \cdot x \cdot 1) + (B_{30} \cdot Z \cdot 30)\right) =$ Maturity of 15

Inflation Risk

- Real return of nominal payout will depend on inflation rate

Default Risk

- Corporate bonds risk defaulting on their payouts, or making payments as promised.

How does a Firm Finance Projects

- Internal Funds
- Equity
- Debt

↳ which of these to use is the job of the CFO

How firm is structured determines cash flow rights

Important characteristics of Liabs

1. Payoff structure
2. Priority
3. Maturity
4. Voting rights
5. Options

Book Value vs Market Value

Book Value → what accountant says asset is worth

Market Value → what you could sell asset for

$$\text{Book Leverage} = \frac{\text{Debt}}{(\text{Book Equity} + \text{Debt})}$$

$$\text{Market Leverage} = \frac{\text{Debt}}{\text{Market Equity} + \text{Debt}}$$

Modigliani-Miller Theorem

- How should a firm finance itself
  - ↳ M&M says it's irrelevant!

Assumptions:

1. Markets are complete
2. Markets are efficient
3. No taxes
4. Investment Decisions Fixed

Intuition:

- Firm's cash flows don't matter on how it was financed
- Firm is a collection of projects, it's value shouldn't matter on how its financed

M&M Value of firm

$$V = E + D$$

V = value of firm
E = Equity
D = Debt

Main result: two identical companies financed differently, worth the same

- Doesn't strictly hold true, but a good benchmark

Debt Financing

- Key advantage of Debt: interest is tax-Deductible

$$CF_T = (1-\tau)EBITDA + \tau\left(\text{Dep} + \text{Interest}\right) - CAPEX - \Delta WC$$

- Define CF_t^* to be cash flows under no debt

$$\boxed{V = V^* + \tau D}$$

Weighted Average cost of Capital (WACC)

$\boxed{\lambda}$ = Leverage Ratio = $\frac{\text{Debt}}{\text{Debt} + \text{Equity}}$

- $\lambda V = D$ — firm will make its value proportional to leverage ratio
- let $\boxed{r_d}$ be interest rate on debt

rate of return on firm (r_v)

$$\boxed{r_v = \lambda r_d + (1-\lambda) r_e}$$

Weighted Average Cost of Capital (WACC)

- $$r_{WACC} = (1-\tau) r_d \left(\frac{D}{D+E}\right) + r_e \left(\frac{E}{D+E}\right)$$

↳ Takes into account tax advantages of debt

- Compute $\boxed{E = V - D}$

* If Market Leverage Ratio is constant

$$V_0 = \sum_{t=1}^{T} \frac{CF_t}{(1+r_{WACC})^t}$$

Randomness of Asset Returns

- Most Asset Returns are random
  - ↳ $\boxed{P_0}$ Price today
  - ↳ $\boxed{\tilde{D}_1}$ Dividend next Period
  - ↳ $\boxed{\tilde{P}_1}$ Price next Period

Return	Expected Return
$\tilde{r}_1 = \frac{\tilde{D}_1 + \tilde{P}_1}{P_0} - 1$	$E[\tilde{r}_1]$
Excess Return	**Risk premium**
$\tilde{r}_1 - r_f$	$E[\tilde{r}_1] - r_f$

Simple Metrics for risk+return

1. Mean { $\bar{r} = E[\tilde{r}]$
2. Variance { $Var(\tilde{r}) = E[(\tilde{r} - \bar{r})^2]$
3. Standard Deviation { $\sigma = \sqrt{var(\tilde{r})}$

More Metrics to Analyze

Median : 50th percentile

Covariance & Beta

1. Covariance

$$\sigma_{ij} = E[(\tilde{r}_i - \bar{r}_i)(\tilde{r}_j - \bar{r}_j)]$$

2. Correlation

$$\rho_{ij} = Cov(\tilde{r}_i, \tilde{r}_j)/\sigma_i \sigma_j$$

3. Beta

$$\beta_{ij} = Cov(\tilde{r}_i, \tilde{r}_j)/\sigma_j^2$$

Portfolios & weights

- A combination of Different Assets

$$Value_p = \sum_1^n N_i P_i$$

Portfolio weights

- (+) long Positions
- (−) Short Positions

$$w_i = \frac{N_i P_i}{N_1 P_1 + N_2 P_2 + \dots N_n P_n}$$

$$w_1 + w_2 + \dots w_n = 1$$

Portfolios vs. Assets

- Portfolios provide Diversification
  - ↳ allows balance of Risk / Reward

15.401 Part 2 Notes

What is "best" portfolio:

- Highest reward
- lowest Risk

Micro Econ: Indifference Curve

- All combinations of two items that deliver same level of utility

→ In Finance: Risk-Reward Tradeoff

Mean - Variance Investors

Mean-Variance Utility

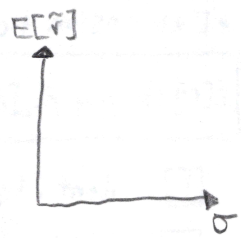
$$U(\tilde{r}) = E[\tilde{r}] - \frac{1}{2} A * Var(\tilde{r})$$

→ $\boxed{A}$ is Risk-Aversion

→ U = "certainty Rate of Return"

Selecting Desirable Portfolio

1. Investors like more to less
2. Investors dislike Volatility
3. Investors care about performance of overall Portfolio



Portfolio properties

Expected Portfolio Return { $E[\tilde{r}_p] = w_1 E[\tilde{r}_1] + \dots w_n E[\tilde{r}_n]$

Variance of Portfolio Returns { $\sigma_p^2 = \sum_{i=1}^{n} w_i^2 \sigma_i^2 + \sum_{i=1}^{n} \sum_{i \neq j} w_i w_j \sigma_{ij}$

Why Diversification Works

- Returns contain independent sources of risk, when ~~un~~coupled, cancel eachother out

Takeaways:

1. Diversification Benefit has limit
2. Remaining Risk is Systematic

(2) constrained optimization Problem

Highest Return	Lowest - Risk
Max $E[r_p] = \sum w_i r_i$	Min $\sigma_p^2 = \sum\sum w_i w_j \sigma_{ij}$
s.t	s.t
(1) $\sum_{i=1}^{n} w_i = 1$	(1) $\sum w_i = 1$

Effect of Short-selling

- * shorting allows positions past 100% in one asset
- * adding more equities generally improves mean-variance frontier

Tools to Select "best" portfolio

Tools:	Best Portfolio
• Risky Asset or combination of risky assets	• Max Return
• Risk-free asset	• Min Risk

* Best Portfolio is a combination of Risk-Free Asset & Tangent Portfolio

Sharpe Ratio

Sharpe Ratio Formula : $\frac{E[r_p] - r_f}{\sigma_p}$

- Tangency Portfolio has highest Possible sharpe Ratio
- Only portfolios along the capital Market Line can be someone's best choice

Tangent Portfolio is Market Portfolio

1. Efficient CML portfolios are combos of market Portfolio & Risk-free Asset
2. Expected return on asset must satisfy

$$E[r_i] = r_f + \beta_i (E[r_m] - r_f)$$

↳ $\beta_i = Cov(r_i, r_m)/Var(r_m)$

3. gives us Benchmark CAPM Pricing Model

CAPM & Implementation

For any arbitrary portfolio of stocks

$$E[r_p] = r_f + \beta_p \times (E[r_m] - r_f)$$

Gives expression to calculate

1. required rate of return
2. Opportunity cost of capital
3. Risk-Adjusted Discount Rate

Decomposing Asset to get CAPM

Return of asset i

Regression: $r_{i,t+1} - r_{f,t} = \alpha_i + \beta_i(r_{m,t} - r_{f,t}) + \epsilon_i$

- $\boxed{\beta_i}$ is regression coefficient
  - → $E[\epsilon_i] = 0$
  - → $Cov[\epsilon_i, r_{m,t+1}] = 0$

β_{im} → measures i's exposure to systematic Risk

$SD(\epsilon_i)$ → measures i's idiosyncratic risk

α_i → measures i's return beyond its reward for risk

investors respect reward for systematic risk

$$SD[r_{i,t+1}] = \beta * SD[R_{m,t+1}] + SD[\epsilon_{i,t+1}]$$

Security Market Line can compare Asset Performance

CAPM & Cost of Capital

- CAPM based cost-of-capital for a firm's assets, need weighted average of Debt & Equity Betas

$$\beta_A = \frac{D}{D+E}\beta_D + \frac{E}{D+E}\beta_E$$

- When Debt Beta is zero

$$\beta_E = \left(\frac{Assets}{Equity}\right)\beta_A$$

* Capital structure matters for equity Betas

How to Implement CAPM in Practice

Option 1

- use T-Bill rates for r_f
- Estimate $\boxed{\beta}$ in linear regression
- Decide which index to use as proxy for market return

→ use long time horizon & daily frequency

Option 2 Estimate Beta

$$\beta = \frac{Cov[r_i - r_f, r_m - r_f]}{Var(r_m - r_f)}$$

Fama & French 3-factor Model

$$E(r_i) - r_f = \beta_{im}[E(r_m) - r_f] + \beta_{is}(r_s) + \beta_{in}(r_{nmw})$$

Arbitrage Pricing Theory (APT)

- Extension to CAPM Model

$$E[r_i] - r_f = \alpha_i + \beta_{im}[E[r_m] - r_f] + \sum \beta_k (r_k - r_f) + \epsilon_i$$

1. identify the factors
2. Estimate factor loadings of assets
3. Estimate factor premiums

Options

- Gives owner the right to buy or sell an underlying asset at a pre-specified price, on or before specific date

Characterizing Option

1. Option type

Call → Right to Buy an asset for a given Price

Put → Right to Sell an asset for a given price

2. Exercise Style

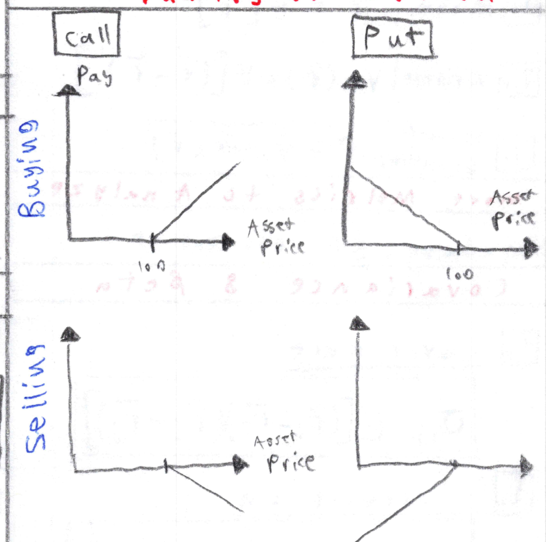
European → option can only be executed on expiration date

American → can exercise at any time

Cash flow of call

$$CF_T(Call) = \max(S_T - 100)$$

Duality of Option



Net Payoff of Options

Net Payoff =

$$\max(S_T - K) - Cost(1+r)^T$$

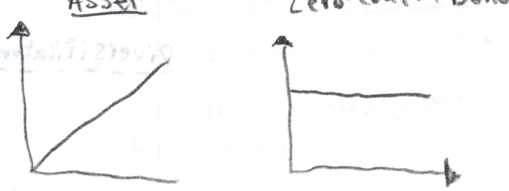
Hence, Break even is S_T such that Net payoff = 0

CALL	S < K	S = K	S > K
Payoff	0	0	S − K
Profit	$-C(1+r)^T$	$-C(1+r)^T$	$S-K-C(1+r)^T$
PUT	S < K	S = K	S > K
Payoff	K − S	0	0
Profit	$K-S-C(1+r)^T$	$-C(1+r)^T$	$-C(1+r)^T$

Basic Option strategies

2 Building Blocks:

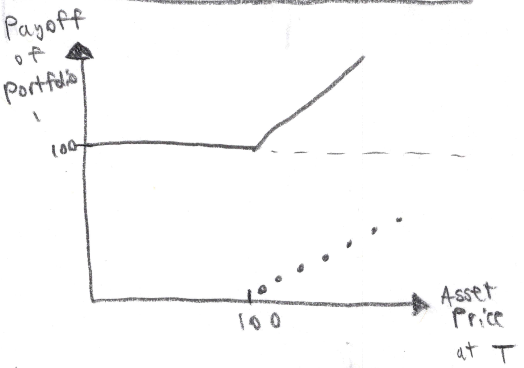
Asset   Zero-Coupon Bond



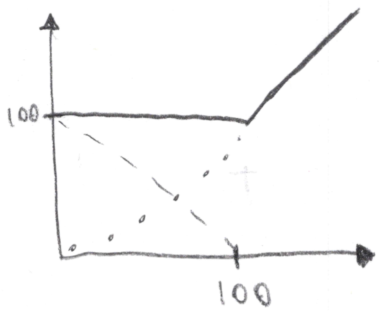
Put-Call Parity

- 2 ways one can have a protective put

Recipe 1: \$100 strike call + Bond w/ par \$100



Recipe 2: \$100 put + asset



Key Takeaway: Payoffs are Identical

→ must be same price

$$C + K/(1+r)^T = P + S$$

Binomial Pricing Model

- Value of a Call Depends on future Asset Price

	$t=0$	$t=1$
Asset Price	S_0	S_T
Bond Price	$B_0 = 1$	$B_T = 1 * (1+r)^T$
Call Price	C_0 ←	$C_T = \max(S_T - K, 0)$

Starting Assumptions:

1. Prices follow "no-arbitrage"
2. *Price follows a binomial Process (two possible values for price at current date)

Five Key determinents of option price

1. Current Asset Price
2. Volatility of underlying asset
3. Time to Maturity
4. Spot interest rate
5. Strike Price

Example: European Call on Stock

- Current stock Price = \$50
- One period till Maturity
- Stock price either will go up or down (75 or 20)
- Call price (50)

	$t=0$	$t=1$
Asset Price	$S_0 = \$50$	S_1: $S_u = \$75$, $S_d = \$25$
Bond Price	$B_0 = 1$	B_1 = \$1.1, \$1.1
Call Price	$C_0 = ?$	C_1: \$25, \$0

Key Tool: Portfolio Replication

Want to Know: Price of Option

We know: Price of Bond & stock

$$a S_u + b B_u = C_u$$
$$a S_D + b B_D = C_d$$

$$\text{Price of Option} = a S_0 + b B_0$$

→ For Multi-Period Problems Work Backwards

↳ can plug result into put-call parity to get results

Black-Scholes Formula

Motivations

1. Time isn't discrete
2. Price can take more than 2 possible values

$$\underbrace{C(S,K,T,\sigma)}_{1} = \underbrace{S \cdot N(x)}_{2} - \underbrace{K \cdot (1+r)^{-T}}_{3} \cdot \underbrace{N(x - \sigma\sqrt{T})}_{4}$$

$$\boxed{x} = \frac{\ln\left(\frac{S}{K(1+r)^{-T}}\right)}{\sigma\sqrt{T}} + \frac{1}{2}\sigma\sqrt{T}$$

$\boxed{T}$ = option maturity in years

$\boxed{r}$ = risk-free interest rate annualized

$\boxed{\sigma}$ = volatility of annual returns of underlying asset

$\boxed{N()}$ → Standard Normal CDF

interpretation:

1 → Call

2 → amount invested in replicating stock of replicating portfolio

3 + 4 → dollar amount borrowed in replicating portfolio

Black-Scholes Take away

- Volatility determines price of a call

First Term:

$S \cdot N(x)$ is discounted expected value of stock at strike time

Second Term:

$K \cdot (1+r)^{-T}$ → Discounted Strike Price

$N(x - \sigma\sqrt{T})$ → probability of exercising option

Black-Scholes: volatility increases Value

↑ w/ stock Price $\boxed{S}$

↓ w/ Exercise "Strike" Price

↑ Increases w/ Maturity

↑ Increases w/ Volatility

Equity & Debt as Options

- 2 firms, identical Assets, Differt capital structures

Firm A

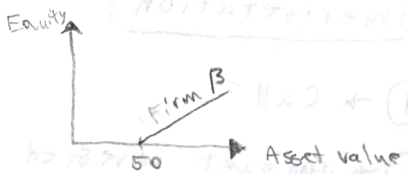
\$60 (A) { \$0 (Bond), \$60 (Equity)

Firm B

\$60 (A) { \$50 (Bond), \$10 (E)

Value of Firm B's stock mirrors call on its assets

Asset Value	Firm B stock Value	Value of Call
\$40	\$0	\$0
\$60	\$10	\$10



Replicating payoffs with options

1. Start w/ RF bond or asset
2. add puts or calls to get desired pay structure

Options in Everday life

- In capital investment decisions, we face strategic options

→ option to wait

→ option to make follow-on investments

→ option to abandon projects

Options Example