Fixed Income & Derivatives Crash Course

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What is a Fixed Income Security?

An investment that provides a return in the form of fixed periodic interest payments and the eventual return of principal at maturity.

Fixed Income

Continued

- Debt instruments that pay a fixed amount of interest in the form of coupon payments
  - Typically semiannually
  - Principal returns at maturity
- Investment product issued by corporations and governments to raise funds to finance projects and fund operations

Benefits of Fixed Income

Diversification from Stock Market Risk	Capital Preservation	Income Generation	Total Return
Assets are less sensitive to macroeconomic risks Carries lower risk than stocks	Protecting the absolute value of the investment Assets have a stated objective of return of principal	Generates a steady source of income Several kinds, such as municipal bonds, are exempt from taxes	Like stocks, some fixed income assets offer the potential for attractive returns (albeit carries more risk)

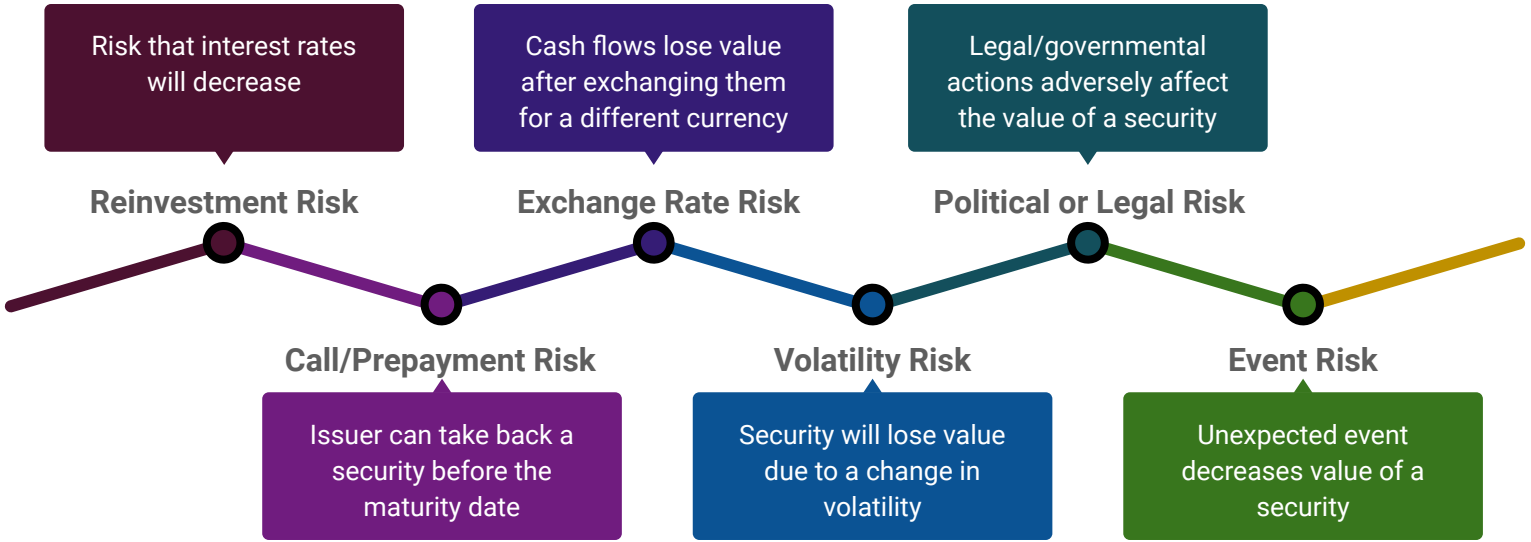
Major Risks of Fixed Income

01	**Interest Rate Risk**	• As interest rates rise, bond prices fall • Based on the yield curve (which generally has an inverse relationship)
02	**Inflation Risk**	• If rate of inflation outpaces the fixed amount of income, investors lose purchasing power
03	**Credit Risk**	• Possibility that the counterparty defaults on its obligations • Also known as default risk
04	**Liquidity Risk**	• Unable to sell because there is no buyer • Can be defined as the size of the spread between the bid and ask price

Aside: Credit Ratings

STANDARD & POOR'S RATINGS SERVICES	FitchRatings	MOODY'S	Rating Grade Description	
AAA	AAA	Aaa	Investment Grade	Highest Grade Credit
AA+	AA+	Aa1	Investment Grade	Very High Grade Credit
AA	AA	Aa2	Investment Grade	Very High Grade Credit
AA-	AA-	Aa3	Investment Grade	Very High Grade Credit
A+	A+	A1	Investment Grade	High Grade Credit
A	A	A2	Investment Grade	High Grade Credit
A-	A-	A3	Investment Grade	High Grade Credit
BBB+	BBB+	Baa1	Investment Grade	Good Credit Grade
BBB	BBB	Baa2	Investment Grade	Good Credit Grade
BBB-	BBB-	Baa3	Investment Grade	Good Credit Grade
BB+	BB+	Ba1	Speculative Grade	Speculative Grade Credit
BB	BB	Ba2	Speculative Grade	Speculative Grade Credit
BB-	BB-	Ba3	Speculative Grade	Speculative Grade Credit
B+	B+	B1	Speculative Grade	Very Speculative Credit
B	B	B2	Speculative Grade	Very Speculative Credit
B-	B-	B3	Speculative Grade	Very Speculative Credit
CCC+	CCC+	Caa1	Speculative Grade	Substantial Risks - In Default
CCC	CCC	Caa2	Speculative Grade	Substantial Risks - In Default
CCC-	CCC-	Caa3	Speculative Grade	Substantial Risks - In Default
CC	CC	Ca	Speculative Grade	Substantial Risks - In Default
C	C		Speculative Grade	Substantial Risks - In Default
SD	DDD	C	Speculative Grade	Substantial Risks - In Default
D	DD		Speculative Grade	Substantial Risks - In Default
	D		Speculative Grade	Substantial Risks - In Default

Additional Risks of Fixed Income



Types of Fixed Income

1 Treasuries
-Issued by the U.S. Federal Government
-Include Treasury Bills, Notes, and Bonds

2 Corporate Bonds
-Issued by companies
-Typically offer a higher rate and are riskier

3 Municipal Bonds
-Government bond issued by states, cities, counties
-Interest earned is tax-exempt

4 Certificate of Deposit (CD)
-Bank pays interest to account holder in return for depositing money for a predetermined period

5 Mortgage-Backed Securities (MBS)
-Investors receive monthly income consisting of a blend of principal and interest payments

Data as of Jan. 1, 2020. Source: S&P Global Ratings Research.

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Additional Types of Fixed Income

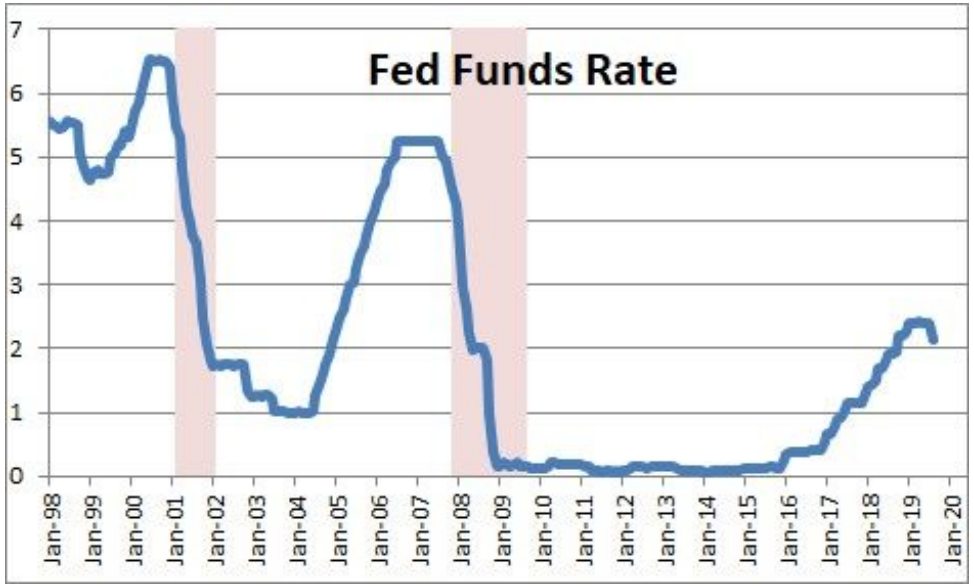
6 **Savings Account**
-Bank pays fixed rate of interest
-Based on the fed funds rate

7 **Money Market Account**
-Slightly higher fixed rate of interest
-More restrictions

8 **Preferred Stocks**
-Pay a regular dividend based on a predetermined rate at a predetermined schedule

9 **Money Market Funds**
-Mutual funds that invest in short-term investments
-Paid a fixed rate based on short-term securities

10 **Bond Mutual Funds**
-Mutual funds that own many bonds
-Get paid dividends



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Review Part 1

1. What is the lowest grade of investment grade debt?
   a. BBB
   b. BBB-
   c. BB
   d. BB+
2. Which is **not** a type of Treasury issued by the US federal government?
   a. Bills
   b. Notes
   c. Munis
   d. Bonds

Review Part 1

3. For a given maturity, which should have the highest yield on average?
   a. Treasury
   b. CD
   c. Corporate Bond
   d. Muni Bond
4. In the United States, when are coupons on a Treasury Bill paid?
   a. Never
   b. Semi-Annually
   c. Annually
   d. At maturity

A Closer Look At Bonds: Terminology

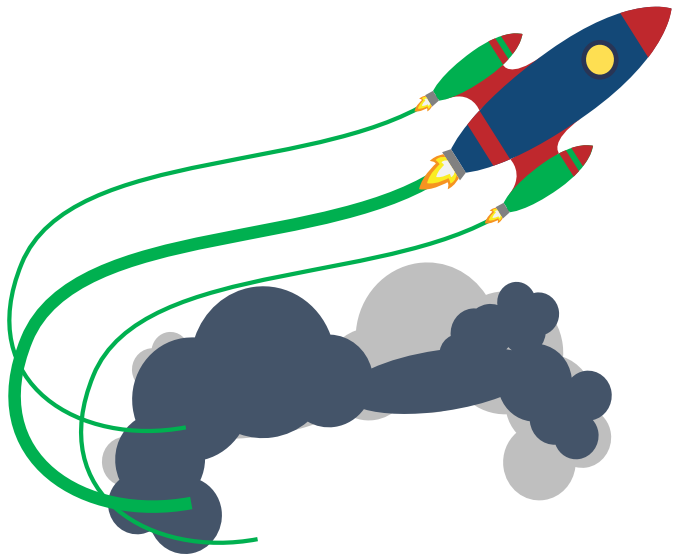
1. **Par Value (Face Value)**
   How much a bond is issued for and can be redeemed at maturity
   Generally valued at $1000

2. **Coupon Rate**
   Interest rate paid by a bond issuer on a bond's face value
   Taken an a % annually

3. **Coupon Payment**
   Annual interest payment on a bond when it's issued to when it matures

4. **Maturity Date**
   Date when the principal must be paid back on a fixed income instrument

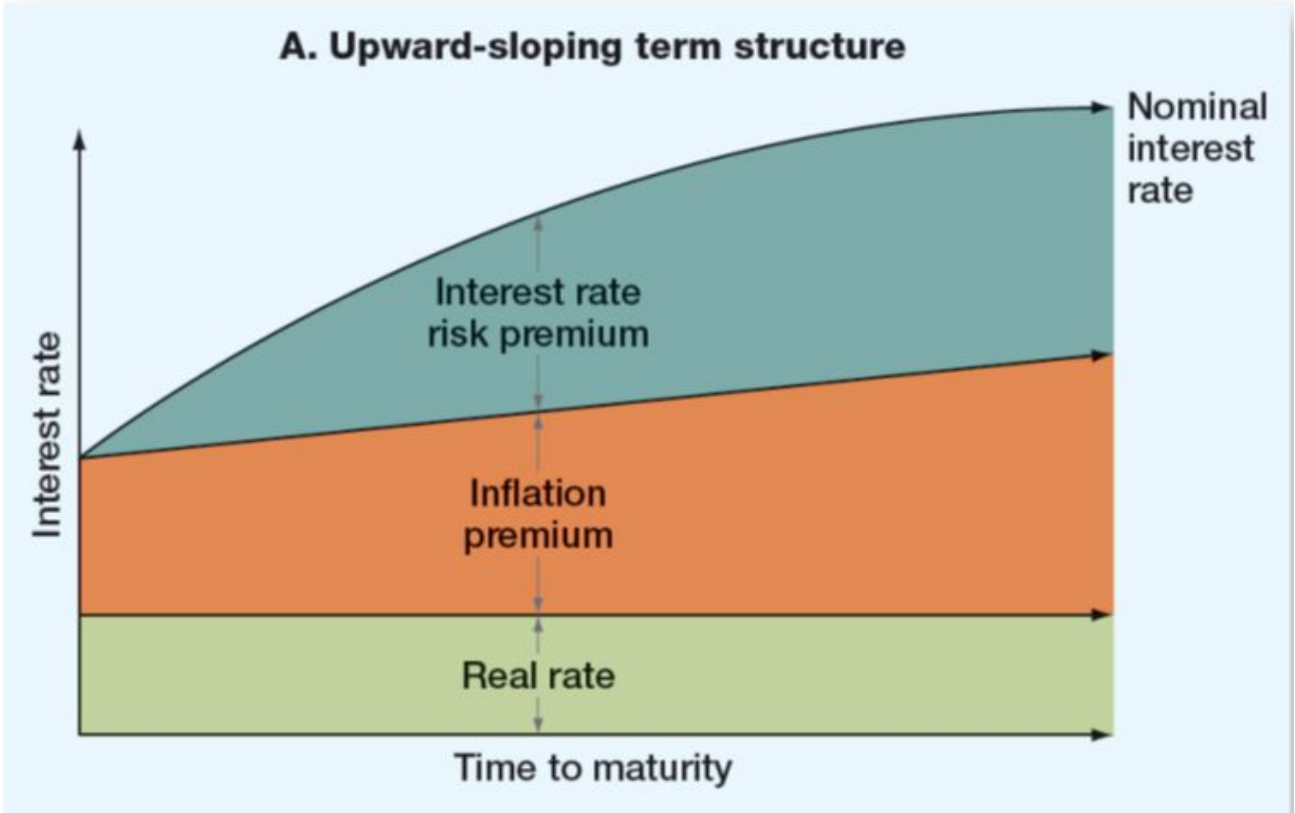
5. **Yield/Yield to Maturity**
   Internal rate of return required for all PV of future CFs of the bond to equal the current bond price if held until maturity



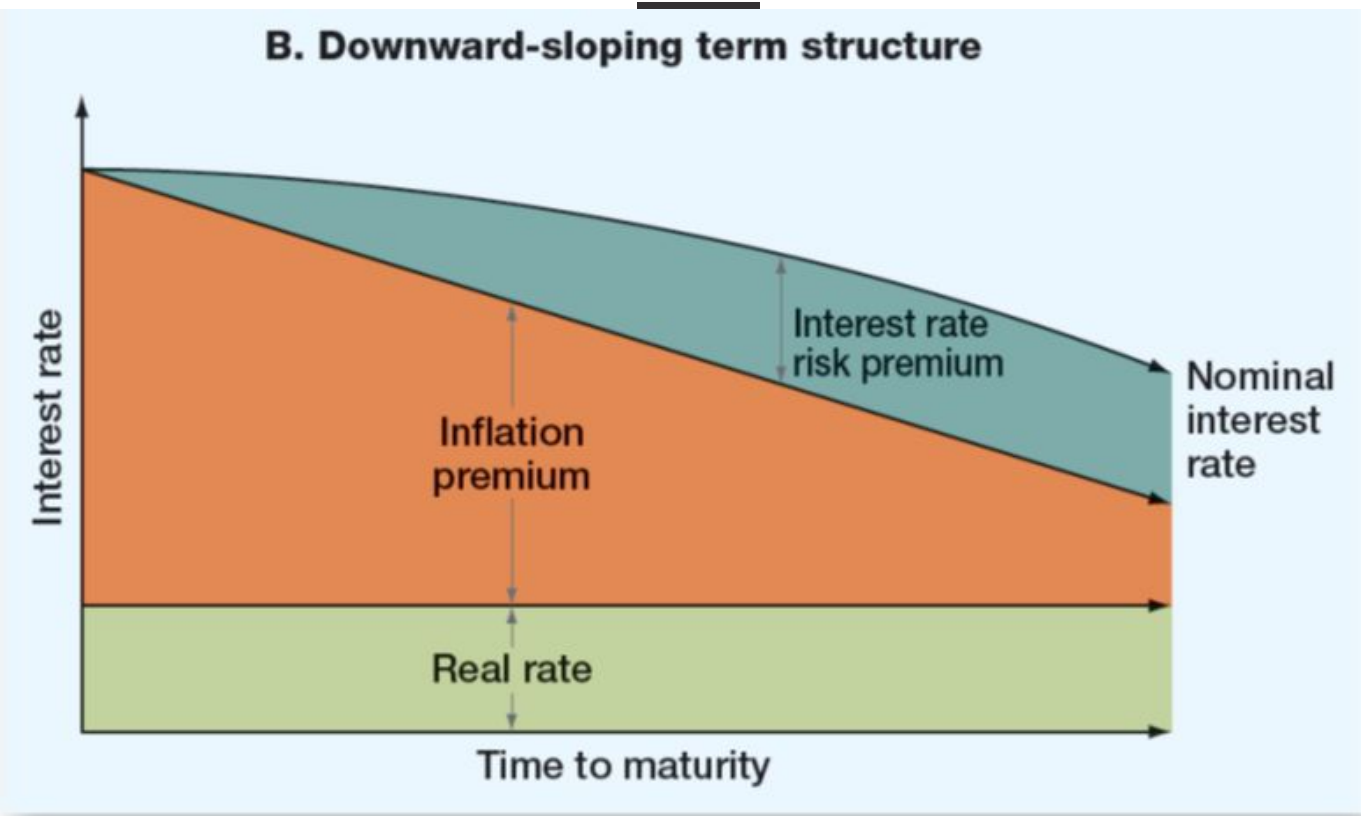
A Closer Look At Bonds: Features

- Zero-Coupon Bond
  - Ex: Treasury STRIPS
- Coupon Bond
  - Fixed vs Floating-Rate
- Callable Bond
  - Embedded call option for issuer
  - Callable Bond Price = Noncallable Bond Price - Call Option Price

Yield Curve: Upward Sloping



Yield Curve: Downward Sloping



The Fisher Effect

The Fisher Effect defines the relationship between real rates, nominal rates, and inflation

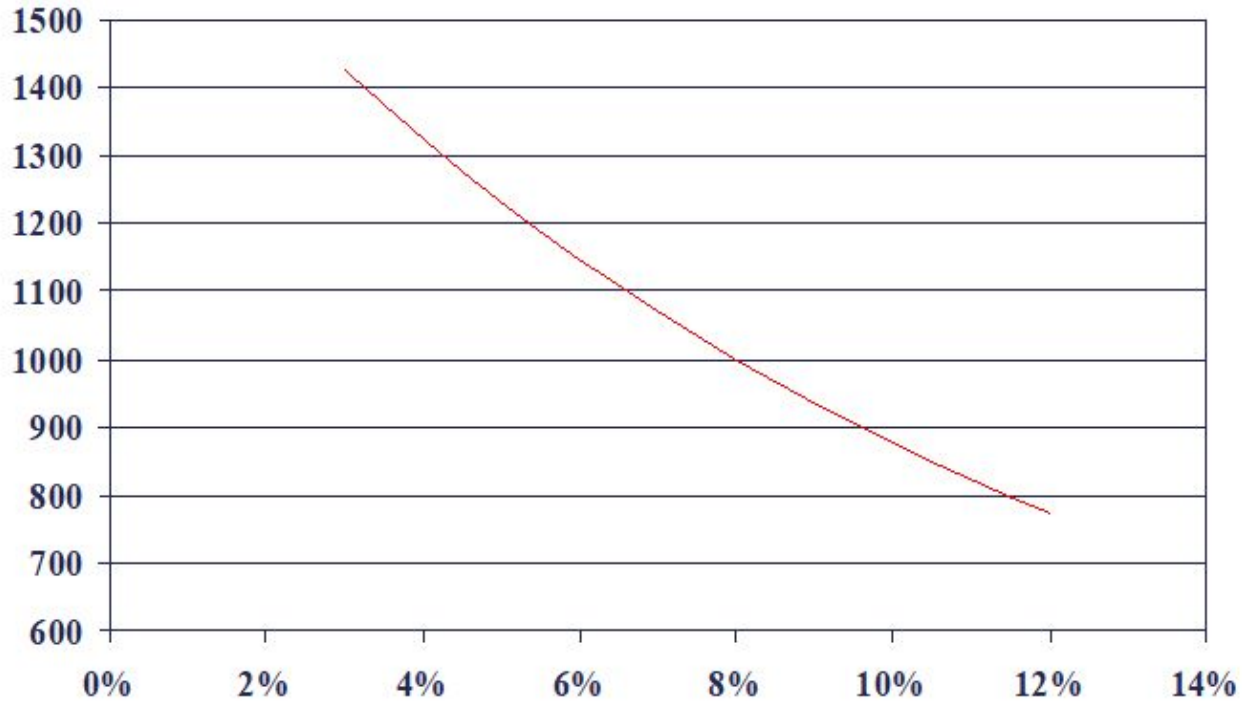
- Real Rate of Interest: rate earned on constant purchasing power
- Nominal Rate of Interest: quoted interest rate on and actual $ amount
- Fisher Effect:

$$(1 + i) = (1 + r) \times (1 + \pi)$$

Factors Affecting Bond Yields

- Real rate of interest
- Expected future inflation premium
- Interest rate risk premium
- Default risk premium
- Taxability premium
- Liquidity premium

Relationship Between Price and YTM



Duration & Bond Price Volatility

Bond Price Volatility is determined by Coupon and Term to Maturity

- Ceteris paribus, lower coupon rates = higher price vol
- Ceteris paribus, longer term to maturity = higher price vol

Bond Price Vol measured by Duration

- Macaulay Duration: weighted average time until cash flows are received
- Modified Duration: measures approx change in price for given change in yield

$$MacD = \sum_{i=1}^{n} t_i \frac{CF_i \cdot e^{-y \cdot t_i}}{V} \qquad ModD = \frac{MacD}{(1 + y_k/k)}$$

Review Part 2

1. TIPS is what type of bond?
   a. Fixed-Rate
   b. Floating-Rate
   c. Zero-Coupon
   d. Catastrophe
2. What kind of relationship do Price and Yield have?
   a. Inverse
   b. Proportional
   c. Father-Son
   d. Exponential

Review Part 2

3. What is generally the most important risk premium?
    a. Inflation risk premium
    b. Credit risk premium
    c. Liquidity premium
    d. Interest rate risk premium
    e. Taxability premium
4. What are we solving for in the Fisher Equation?
    a. Real interest rate
    b. Nominal interest rate
    c. Inflation

What are Derivatives?

This isn't Calc 1

A derivative is a financial contract whose value depends on some underlying asset.

Yes, while it is a broad definition, keep this idea in mind as we proceed through this crash course.

The Purposes

Hedger

- Uses Risk management to compensate for unforeseen events
- Locks in profits or cash flows for the future
- Mitigates forex risk, interest-rate risk, commodity hedge, etc.

Speculator

- Multiplies returns by taking on more risk
- Speculates and occasionally takes a gamble
- Uses educated guesses about direction of the market or price of underlying

Some Specialties

One can control more of an asset without investing more, i.e. leverage

One can profit off of different scenarios (not just the value of the asset increasing)

Allows two parties to find more favorable interest rates or manage risk

Customizable products based on risk tolerance and chance of profitability

Hedging vs. Diversification

Hedging	Strategy of taking up an offsetting position to protect one from unexpected market moves, thereby mitigating risk
Diversification	Strategy of spreading your chips to limit risk in each investment

Common Derivatives

1

Options

Contracts that gives the *right*, **but not the obligation**, to buy or sell an asset

2

Futures

Contract to buy or sell an asset on a future date at a specified price (occuring in a regulated exchange)

3

Forwards

Contract between any two parties to exchange an asset on a future date at a specified price

4

Swaps

Contract that allows two parties to swap cash flows on or before a specified date (interest rates and currencies)

Others

Swaptions, Options on Futures, Warrants, Convertible Bonds, CDO, CDS, etc.

Key Differentiators

Lock

- Include swaps, futures, and forwards
- Obligates agreeing parties to follow through on contract

Option

- Vanilla options, binary options, etc.
- Provides the participant the right, but **not the obligation**, to follow through on the contract

OTC and Exchange-Traded Derivatives

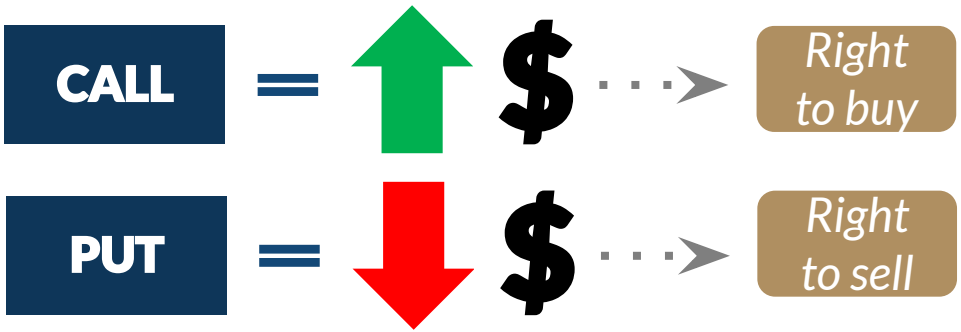
1 Exchange Traded

- Traded on exchanges specially dedicated to derivatives
- Contracts are standardized and highly regulated
- Examples include the CME Group, Eurex, and the Korea Exchange

2 Over-the-Counter

- No exchange or middle man is involved in the transaction
- Less regulated than a conventional exchange
- Often involved private deals between large institutions
- Much larger market than those on regulated exchanges

1 Options: No Strings Attached



Moneyness	Result
In-the-money	Gain
At-the-money	Break Even
Out-of-the-money	Loss

Long
Contract Buyer
Short
Contract Seller/Writer

Strike Price

Describes the price at which the option will exercise at.

Premium

Price paid for the contract itself.

Expiration Date

Date at which contract expires, and can no longer be used after.

Intrinsic Value: Value of the option if exercised immediately; ITM option must be worth its intrinsic value!

Identify the Option!

Identify *Long* or *Short* & *Call* or *Put*

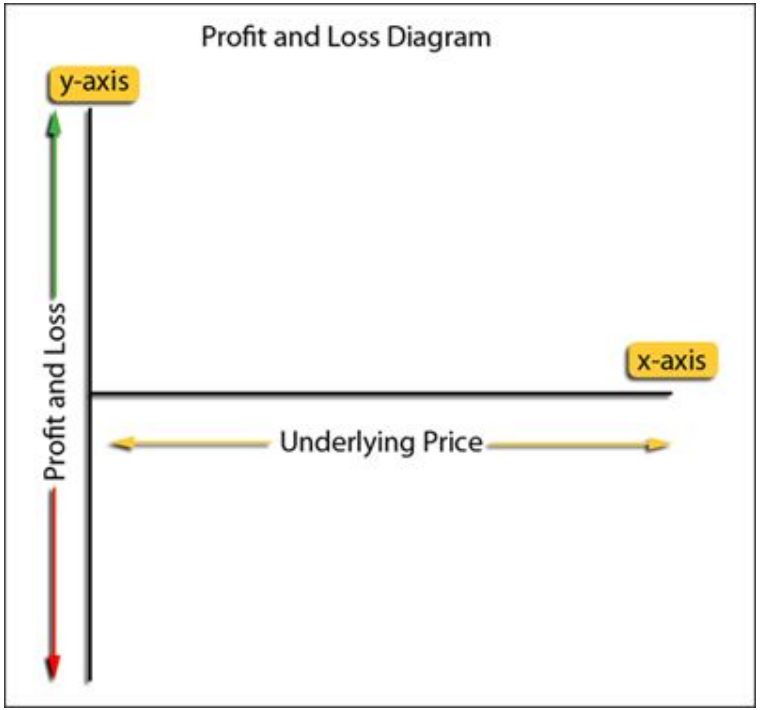
Buying the right to buy an underlying asset at the strike price

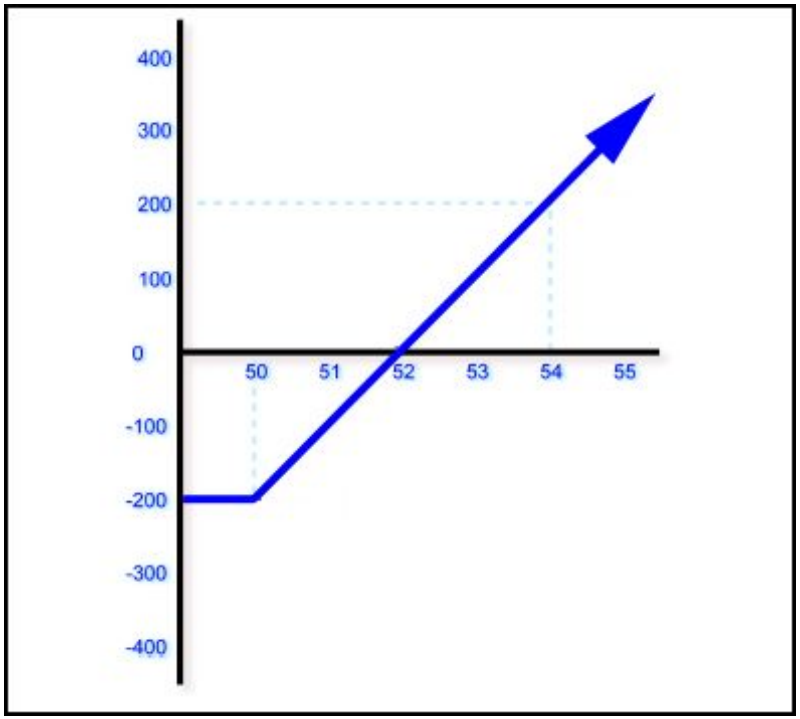
Buying the right to sell an underlying asset at the strike price

Selling the right to buy an underlying asset at the strike price

Selling the right to sell an underlying asset at the strike price

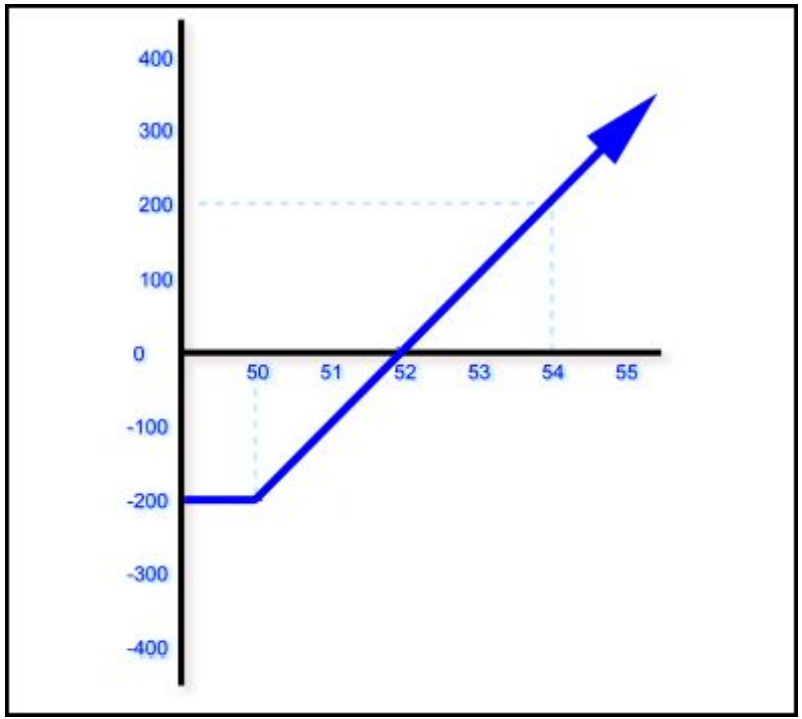
Profit-Loss


Profit and Loss Diagram
y-axis
Profit and Loss
x-axis
Underlying Price


400
300
200
100
0
-100
-200
-300
-400
50
51
52
53
54
55

Long Call

Identify the Strike Price, Contract, Breakeven!



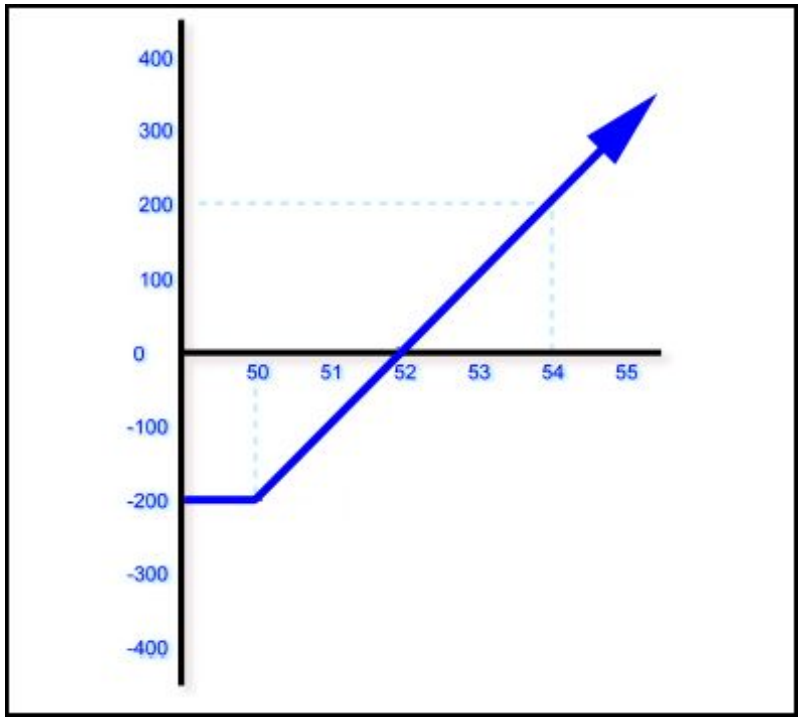
Long Call

Identify the Strike Price, Contract, Breakeven!

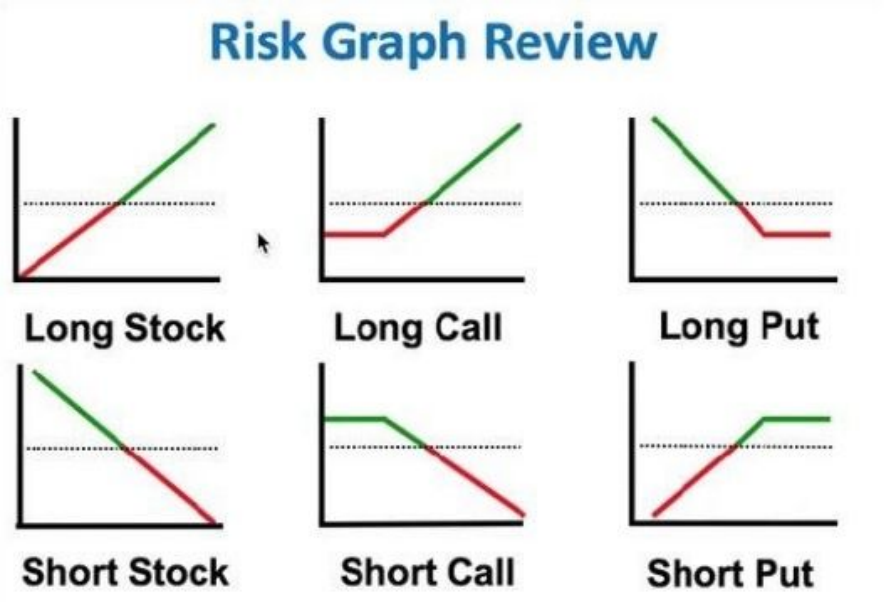
Strike - $50

Contract - $200

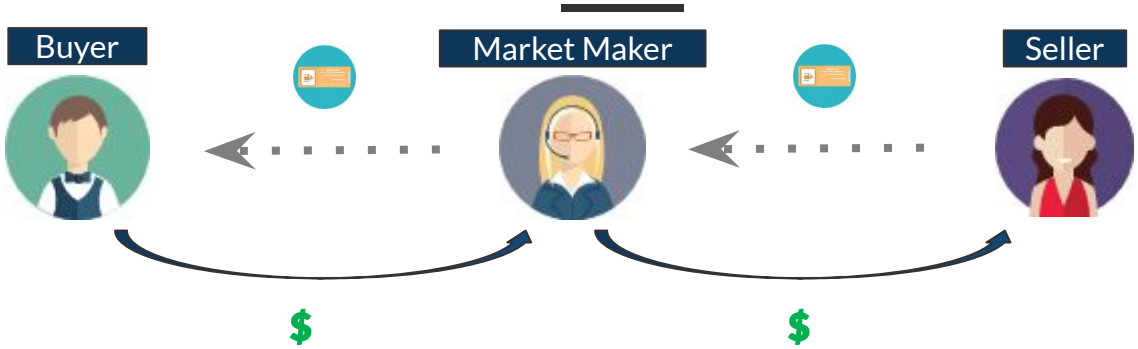
Breakeven - $52



Other Options



Mechanics of an Option



Volume	Number of contracts that have been exchanged in the day
Open Interest	Number of contracts held by market participants which have not been closed out, expired, or exercised

2

Futures: Many Strings Attached

Example of Mechanics[1]

Day	Trade/EOD Price	Daily Change	Cumulative Change	Margin Account balance
0	$1250/ounce	-	-	$6000[2]
1	1241	-$900	-$900	5100
2	1238	-300	-1200	4800
3	1231	-700	-1900	4100
4	1255	+2400	+500	$6500

[2]One contract concerns 100 ounces and costs $6000

Key Points:
- Futures are regulated and traded on an exchange
- Generally used for commodities such as crude oil, gold, etc.

Different from Options because...

- More Leverage...More Risk
- You're obligated in the end!
- Initial margin instead of premium
- Long and Short (Not Calls/Puts)
- Can lose more than initial cost

[1]Example derived from page 28 of Options, Futures, and other Derivatives 8th Edition by Hull

3

Forwards: Some Strings Attached

Forwards are *very* similar to futures in terms of mechanics. The differences are below:

Forwards

- Not standardized on an exchange and can occur privately between two parties
- Agreed for settlement either in the form of delivery or cash settlement
- Involves more credit risk as it is easier for one of the parties to not fulfill their side of the agreement
- Generally one settlement date between two parties

Futures

- Traded on exchanges such as the Chicago Mercantile Exchange (CME), the Minneapolis Grain Exchange (MGEX), and Euronext.
- Settled at the end of every day and traded for the value of the contract
- Different delivery dates, similar to options and no credit risk since there is full regulation

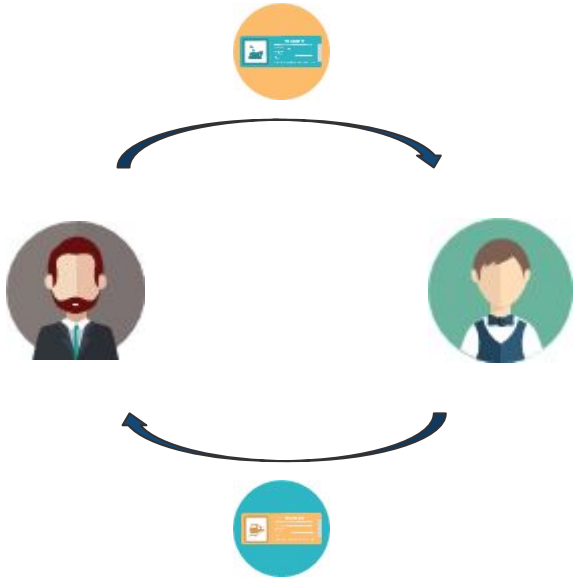
Swaps: A Different Type of Thing

Swaps represent a large number of derivatives that involve the exchange of financial products (*generally cash flows)* between two parties.

Examples include but are not limited to:

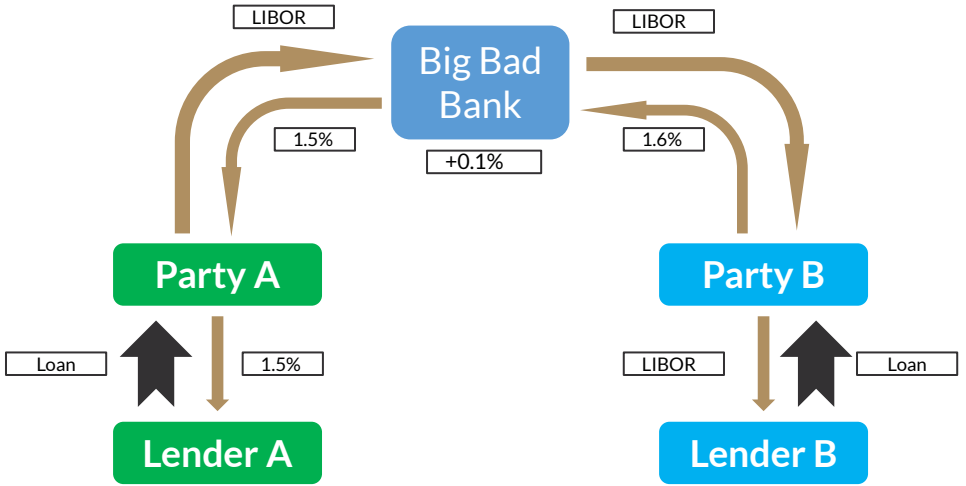
- Interest rates swaps
- Commodity swaps
- Currency swap
- Debt-equity swaps

The list goes on.



Interest Rate Swaps

- OTC Agreements between two parties to exchange interest rate-related cash flows
- Often more convenient to borrow at one rate even if a party prefers another
  - Can be later exchanged
    - Fixed for fixed
    - Fixed for floating (vice versa)
    - Float for float
- Different motivations for each swap
- Bank serves as intermediary



Initial
$100 loan from lender
Interest: 1.5%

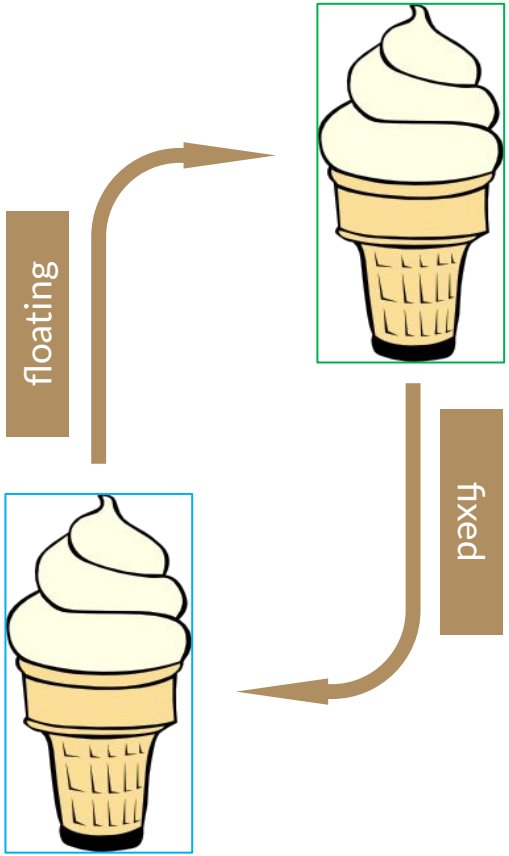
Final
Interest: LIBOR

Initial
$100 loan from lender
Interest: LIBOR

Final
Interest paid: 1.6%

Vanilla Swaps

- Fixed-for-floating or vice versa are known as **vanilla swaps**
- Floating rates are based on LIBOR
  - Stands for London Inter-Bank Offered Rate, Not Little Investment Bankers of Rutgers
  - “Risk-free” lending rate between banks
- Market makers are investment and commercial banks
- Cornerstone of risk management but can be used to speculate
- Involves credit risk and interest rate risk



Other Swaps

Currency Swaps

- Agreement between two parties for the exchange of either principal or the interest rates on the principal
- Latter is akin to an interest rate swap, while former is simply an exchange of a sum of currency

Commodity Swaps

- Agreement between two parties where a floating (market) price for some commodity is traded for a fixed price
- Very common with oil, natural gas, metals, grains, and livestock
- Market dominated by large financial institutions

Credit Derivatives

- Include credit default swaps, credit spread options, and credit spread forwards
- Credit risk includes default, credit spread, and downgrade risk
- Can be forwards, swaps or options that involve credit risk

Discussion: Did credit derivatives worsen the Global Financial Crisis nearly a decade ago?[1]

There are many products that are designed to mitigate or transfer credit risk. These products also helped facilitate the Great Recession in the late 2000s.

[1]Discussion derived from "https://www.sciencedirect.com/science/article/pii/S1877042813052233"

And Finally, Remember This!

A derivative is a financial contract whose value depends on some underlying asset.

Think about this in relation to all of the different derivatives we went over today.

Source: Investopedia

Final Review

1. Which is a OTC contract between any two parties to exchange an asset on a future date at a specified price?
    a. Option
    b. Forward
    c. Future
    d. Swap
2. Which of these do you definitely lose money from if the stock goes up?
    a. Long Stock
    b. Short Call
    c. Short Put
    d. Long Put

Final Review

3. Which of the following is traded on a regulated exchange?
   a. Interest Rate Swap
   b. Future
   c. Forward
   d. Binary Option
4. What kind of relationship do Price and Yield have?
   a. Inverse
   b. Proportional
   c. Father-Son
   d. Exponential

Thank you!