

## Glossary of Financial Derivatives\*

Paul D. Koch  
University of Kansas  
Lawrence, KS 66045

pkoch@ku.edu  
785-864-7503

\*This document draws heavily from several sources:

- (a) Website of Don Chance, [www.fbox.vt.edu/filebox/business/finance/dmc/DRU](http://www.fbox.vt.edu/filebox/business/finance/dmc/DRU);
- (b) Hull, J.C., *Fundamentals of Futures & Options Markets*, 8th Edition, Prentice-Hall, Inc.: New York, NY, 2014;

### I. Background.

Yield Curve – relation among interest rates paid on securities alike in every respect except maturity. (How interest rates change from short term to long term securities.)

Eurodollar - dollar-denominated deposits outside the jurisdiction of the U.S. regulatory authorities.

Financial Derivative - financial claim whose value is contingent upon movements in some underlying variable such as a stock or stock index, interest rates, exchange rates, or commodity prices; includes forwards, futures, options, SWAPs, asset-backed securities, structured notes (hybrid debt), & other combinations of these instruments.

LIBOR - London Interbank Offer Rate; rate charged on short term Eurodollar deposits; benchmark floating rate for international borrowing/lending in \$.

Margin - good faith 'collateral' deposit, specified as a percentage of the value of the financial instrument in question; ensures integrity of market.

Organized Exchange - centralized location where organized trading is conducted in certain financial instruments under a specific set of rules. The exchange clearinghouse is the counter-party to every transaction; members of the exchange share the responsibility of fulfilling commitments. The exchange: (i) sets standardized terms for all contracts traded, and (ii) often places restrictions on trading (e.g. margin requirements, limits on daily price changes, limits on size of individual positions, ...). Standardization of contracts and other rules make clearing easier, reduce uncertainty about counterparty default risk, and help ensure an orderly market.

Over-the-Counter (OTC) Market - any market where a transaction takes place other than an organized exchange; e.g. through a financial institution or broker.

Arbitrage Portfolio – (i) uses none of your own money; (ii) has no risk.

## II. Basic Building Blocks.

Debt Instrument, Bond - Prior, fixed claim against earnings and assets of firm.

Equity Instrument, Stock - residual ownership claim against earnings and assets.

Forward Contract - commitment by two parties to exchange a particular good for a specific price (F) at a specified future time (Expiration, Maturity);  
no cash exchanges hands initially; at expiration cash is exchanged for the consideration specified in the contract;  
traded OTC; customer typically required to post margin.

Futures Contract - same as Forward except that profits/losses are computed and settled (marked-to-market) on a daily basis rather than only at maturity;  
typically traded on organized exchange.

Financial Futures - futures contract in which the good to be delivered is a financial instrument.

Option Contract - entitles holder to *buy/sell* a certain asset *at or before* a **certain time** at a **specified price**.

Note that this gives holder the right (not the obligation) to do something.

Call - ... *buy* ...

Put - ... *sell* ...

European Option - ... *at* a certain time (not before) ...

American Option - ... *at or before* a certain time ...

Expiration/Maturity - the **certain time**.

Exercise Price/Strike Price - the **specified price**.

A Call is: in-the-money (itm) if current price  $>$  exercise price;  
at-the-money (atm) if current price = exercise price;  
out-of-the-money (otm) if current price  $<$  exercise price.

Warrant - option issued by parent corporation or financial institution, rather than by another investor, to achieve some objective.

III. Option Valuation and Option Sensitivities. Before discussing innovations in derivative markets, it is prudent to briefly discuss the behavior of options.

A. Characteristics of an Option that give it value.

$$1. \quad \text{Value of a Call} = f(S, X, T, r_f, \sigma_s).$$

A Call Option is more valuable if:

- (i) the underlying stock price (S) increases;
- (ii) you have the right to buy at a lower strike price (X decreases);
- (iii) the time to maturity (T) increases;
- (iv) the riskfree interest rate ( $r_f$ ) increases;
- (v) the underlying stock price is more volatile ( $\sigma_s$  increases).

B. Option Pricing Models - different models specify different assumptions about the behavior of the stock price (S) over time, and yield different functional forms or means for solving the equation above.

1. Black/Scholes Model - assumptions:

- (i) Stock pays no dividends;
- (ii) No taxes or transactions costs;
- (iii) Interest rates ( $r_f$ ) are constant;
- (iv) No penalties for short sales;
- (v) Market operates continuously and share price is continuous.
- (vi) Distribution of (continuous) returns on S is lognormal;

2. Generalizations of Black/Scholes Model:

- (i) Merton (1973) relaxes assumption (i);
- (ii) Ingersoll (1976) relaxes assumption (ii);
- (iii) Merton (1973) relaxes assumption (iii);
- (iv) Thorpe (1973) relaxes assumption (iv);
- (v) Merton (1976), Cox & Ross (1976) relax assumption (v);
- (vi) Jarrow & Rudd (1982) relax assumption (vi).

3. Extensions of Black/Scholes Model, for valuing:

- (i) options on futures (Black, 1976);
- (ii) options on currencies (Garman & Kohlhagen 1983);
- (iii) options on options; then  $\sigma_s$  is not constant (Geske 1979);
- (iv) path-dependent options (Goldman, et.al. 1979);
- (v) American options (Roll 1977; Geske 1979; Whaley 1981).

4. Numerical Methods for valuing options.
  - (i) Binomial Models assume  $S$  follows discrete binomial distribution. Then use iterative approach to solve for the option value.
  - (ii) Finite Difference Methodology (Schwartz '77; Courtadon '82) Finds a numerical solution to the differential equation that option valuation must satisfy; this differential equation is converted to a set of difference equations & solved iteratively.
  - (iii) Monte Carlo Simulations - Use the fact that the distribution of asset values at option *expiration* is determined by the process that generates *future* movements in  $S$ . If this process can be specified, it can be simulated on a computer. Each time this simulation is done, a terminal asset value is generated. If this simulation process is repeated several thousand times, the result is a distribution of terminal asset values from which one can directly extract the expected asset value at option expiration.

### C. Option Sensitivities.

Reflect the nature and extent of changes in the value of an option, given changes in the behavior of the underlying asset over time. These sensitivities are critical in determining appropriate hedging strategies.

1. Delta - sensitivity of option value to changes in  $S$  ( $\partial C/\partial S$ ); change in option value, given a 1% change in  $S$ .
2. Gamma -  $\partial(\partial C/\partial S)/\partial S = \partial^2 C/\partial S^2$ ; acceleration (deceleration) in option value, given a 1% change in  $S$ .
3. Theta - sensitivity of option value to changes in term to maturity ( $\partial C/\partial T$ ); change in option value, given a 1% decline in time remaining to mat.
4. Vega - sensitivity of option value to changes in volatility of  $S$  ( $\partial C/\partial \sigma_s$ ); change in option value, given a 1% change in volatility of  $S$ .
5. Rho - sensitivity of option value to changes in interest rates ( $\partial C/\partial r_f$ ); change in option value, given a 1% change in the riskfree rate.

#### IV. SWAPs.

- A. Definition - contract in which party A promises to make a payment to party B, while party B simultaneously agrees to make a payment to party A, with both payments occurring on a set of scheduled dates, and the two sets of payments determined according to different formulas.

\*A SWAP is a collection of futures contracts with different expirations.

\*SWAPs are traded OTC, and are thus susceptible to default risk since they are not guaranteed by any clearinghouse. Parties are sometimes required to post margin or mark-to-market periodically, like in futures markets.

1. Interest Rate SWAP - involves the exchange of interest payments on a given face value, called the *notional principal*, while the notional principle itself is never exchanged;

usually involves the exchange of a set of floating interest payments for a set of fixed interest payments;

in this case the floating rate is usually tied to LIBOR (6 mo earlier) while the fixed rate is set at some agreed-upon rate;

some interest rate SWAPs have both sets of payments tied to different floating rates;

at each payment date the party who owes more to the other makes a net payment so only one party in fact makes a payment.

2. Currency SWAP - involves one party making payments in one currency and another making payments in another currency.
3. Commodity SWAP - one set of payments is based on the price of a commodity, such as oil, while the other can be fixed or based on some other floating rate or price, such as LIBOR.
4. Equity SWAP - involves one party promising to pay the other a rate based on the rate of return on an equity index like the S&P 500 or the DJIA; the other party makes a payment based on something else like a fixed rate, LIBOR, or another equity index. This type of arrangement makes it easy and inexpensive to reallocate one's portfolio, to eliminate exposure or to shift exposure to a different equity sector.

## B. Combining SWAPs with other derivatives.

1. Forward SWAP or Delayed Start SWAP - a forward contract on a SWAP.  
Useful for treasurer who expects to issue floating rate debt in future and wants to lock in existing fixed rates.
2. SWAPtion - option to enter an interest rate SWAP.  
Payer SWAPtion - holder of the SWAP will pay fixed;  
Receiver SWAPtion - holder of the SWAP will receive fixed.
3. Collapsible SWAPs or Cancelable SWAPs - embed a SWAPtion in a SWAP.  
Your firm enters an interest rate SWAP, but has the right to cancel.  
Consider a SWAP in which your firm receives LIBOR. If rates decline, you'd like to cancel the SWAP; this instrument gives you that option.  
Here changes in interest rates change the *nature* of interest payments; if interest rates fall, the treasurer has the right to switch from paying fixed to paying the lower floating rate.  
Treasurer pays for the embedded SWAPtion by paying a fixed rate on the SWAP that is higher than prevailing fixed rates.
4. Indexed Principal SWAP (IPS) - notional principal on an interest rate SWAP is tied to the level of interest rates.  
Consider a SWAP in which your firm receives LIBOR. If rates decline, you have right (option) to amortize the notional principal downward; this would reduce the term or duration of the SWAP.  
Treasurer pays for the embedded option by paying a fixed rate on the SWAP that is higher than prevailing fixed rates. Two advantages:
  - (i) Can be used to express a view on future path of interest rates; e.g. if you expect little volatility, could enter an IPS as the fixed rate receiver, locking in a higher-than-market fixed rate.
  - (ii) The fixed-rate-pay side of IPS exhibits *positive convexity*; If rates decline, duration of fixed rate payments declines.  
This can be used to mitigate the *negative convexity* of a pool of mortgages characterized by high prepayments when rates decline.

## V. Exotic Options & Other Non-Standard Products (see Hull, Chapters 22-24).

### A. Nonstandard American Options.

1. In a standard exchange-traded American option, exercise can take place at anytime, and the exercise price stays the same throughout its life.  
American options traded OTC do not always have these standard features.
2. Bermuda Option –has a *limited* early exercise feature.  
(Bermuda is somewhere between America and Europe...)
  - a. Can only be exercised at specific dates, on or prior to expiration; or it exercises automatically when something happens.  
More opportunities to exercise than European, fewer than American; thus, the price is between price of European and American option.
  - b. These are embedded in callable or puttable corporate bonds. See Hybrid Debt.
  - c. Cap Option - money spread that automatically pays off the difference between the two strikes when the S&P closes at the upper strike.  
Thus, could exercise early, but not at the discretion of the holder.  
[Not the same as a Capton, discussed in Hybrid Debt, later.]  
Traded on CBOE for awhile; didn't survive. Variations available OTC.
3. Early exercise may be allowed during only part of the life of the option.
4. The Strike Price may change during the life.  
For example, warrants issued by the parent corporation often have these features.  
e.g., in a 7-year warrant, exercise might be allowed on certain dates during years 3-7, with  $K = \$30$  during years 3 & 4,  $K = \$35$  during years 5 & 6, and  $K = \$40$  in year 7.
5. Nonstandard options can be valued using Binomial Trees, that account for these features.

### B. Forward Start Options.

1. Will 'start' sometime in future.
2. Example: Executive stock options plan often promises to grant ATM options to execs at certain times in the future.
3. Can be valued using Black/Scholes, if underlying asset provides no income ( $I$  or  $q$ ).  
e.g., an ATM forward start option that will start in 3 years & then go for 2 more years is worth the same as a 2-year option starting now.

### C. Options on Options, or Compound Options.

1. Give holder right to buy a specified option at some time in the future for a premium today. Cheaper than the specified option itself.
2. e.g., A construction firm bids on a foreign project; while waiting to see if it gets the bid, it is exposed to exchange rate risk.
3. Buying an option on a foreign currency option is cheaper 'insurance.' Other examples are options on interest rate Caps and Floors. These are called Captions and Floortions (see Hybrid Debt, later).

### D. Chooser Options (sometimes called, "As You Like It" Options).

1. After a specified period, the holder can choose whether option is call or put.
2. Value of Chooser Option =  $\max(c, p)$ , where  $c$  = value of call, &  $p$  = value of put.
3. If underlying put & call have same maturity ( $T$ ) & strike ( $K$ ), then put-call parity can be used to value.

### E. Path-Dependent Options.

Terminal value of European option depends only on price of asset at expiration; it doesn't matter how the price gets there during the life of the option.

In contrast, the value of a path-dependent option depends on the path that the price of the underlying asset follows during the life of the option.

1. Asian option - payoff is not based on the price of an asset at expiration, but on the average price of an asset over the life of the option.  
["S" = avg exchange rate ( $e_{ij}$ ); not European, not American, ...]
  - a. This average price is less volatile than actual price; option cheaper.
  - b. (i) To hedge a stream of foreign cash flows when the hedger is more concerned about hedging the average exchange rate over the life;  
(ii) To operate in markets that are highly concentrated and, thus, are susceptible to manipulation or temporarily distorted prices.  
[Common in oil markets.]
  - c. Average Strike Option - variation in which the final payoff is based on the difference between the asset price at expiration and the average price over the life of the option.  
The average thus serves as the exercise price ["X" = avg  $e_{ij}$ ].



2. Lookback option - allows holder to exercise the option against the most favorable price of underlying asset that occurred over option's life.  
e.g. A lookback call on S&P 500 has a value at expiration equal to the difference between the strike price and the highest price achieved during its life. Will cost more than a standard option.
3. Barrier option (Knockout or Knockin) - In addition to strike price & maturity, the user of a barrier option also specifies a 'trigger price.'
  - a. When the spot price of the underlying asset hits this 'trigger price,' the option will disappear (be knocked out).
  - b. If trigger price  $>$  spot price at origination, option is 'up & out.'  
If trigger price  $<$  spot price at origination, option is 'down & out.'  
Payoff is identical to standard option unless spot price hits trigger.
  - c. Advantages of knockout options:  
Because knockout options may die, early expiration is more likely, and the *price* of a knockout is usually *less* than a standard option.
    - (i) Thus, knockout options can be written on high-volatility assets where a standard option price would be prohibitive.
    - (ii) Up and out options are popular for hedging currency risk.  
They offer less expensive protection of downside risk;  
if the exchange rate moves enough in your favor, you don't need downside protection; you are willing to forego the hedge.
  - d. Alternatively, down and *in* options would become effective (knocked *in*) when a trigger price is reached.  
e.g., a down and in S&P 500 option can be constructed to become effective if the S&P drops 10 points. This would protect your portfolio if declines go beyond the trigger.
  - e. There are relations between the prices of Barrier Options & European Options.  
e.g., The price of down-and-out call plus the price of down-and-in call must equal the price of a regular European call (all else equal). Same!
  - f. Have quite different properties from regular options.  
e.g., Vega may be negative! Consider up-and-out call when  $S$  is close to barrier.  
As volatility increases,  $P(S \text{ will hit barrier})$  increases, so price may decrease!
  - g. Delta hedging barrier options can mean huge needs to buy or sell underlying asset.  
e.g., Consider up-and-out call when  $S$  is close to barrier.  
While call is alive, must be short  $\delta$  shares to hedge.  
As  $S \rightarrow$  Barrier, suddenly will not need hedge, & must unload position in  $S$ .

4. Contingent option or Contingent Premium option.

- a. Option premium (price) is set at origination,  
but is paid only if the contract finishes in-the-money.

If option expires out-of-the-money, seller receives nothing.  
Since there will be cases in which the seller receives nothing,  
contingent premium is substantially higher than a standard option.

[Contingent premium is approximated by the standard option premium  
divided by its 'delta'.]

Attractive for hedgers who fear a big price change;  
there is no outlay for 'insurance' unless the hedge is needed.  
Have been used as 'disaster insurance' in periods of high uncertainty.

5. Shout option.

- a. European option where holder can “shout” to the writer once during its life.

At the end of its life, the option holder receives either the usual payoff -  
the intrinsic value from a European option (based on  $S_T$  at maturity) - or  
the intrinsic value at the time of the shout, whichever is greater.

- b. Example: Suppose  $K = \$50$ , and holder of a call shouts when  $S = \$60$ .  
If final asset price ( $S_T$ )  $< \$60$ , holder gets  $\$10 = \$60 - \$50$ .  
If final asset price ( $S_T$ )  $> \$60$ , holder gets more ( $S_T - \$50$ ).
- c. Shout option has some of same features as lookback option, but is cheaper.  
Don't get BEST possible payoff during life,  
but the payoff from  $S_T$  at the time you shout, or at maturity.
- d. Can be valued using Binomial Trees, that map out the shout value of  $S_T$ .

F. Multi-factor options.

The value of derivatives discussed so far depends on the behavior of one price ( $S_T$ ); the value of a multi-factor derivative is determined by the behavior of 2 or more prices. This involves a new form of risk -- correlation risk.

1. Rainbow option - value is determined by relative performance of 2 or more underlying assets [if  $n$  assets; called an  $n$ -color rainbow].
  - a. 'Better-of' option - pays off on the basis of the better performance of 2 or more assets. Used in equity, interest rate, & currency mkts.
  - b. May involve assets from the same class. e.g. equities; investor may buy '2-color rainbow' option that would pay off the better of a German equity index (DAX) and a U.K. equity index (FTSE). If DAX increases 6% while FTSE increases 9%, holder gets 9%.
  - c. May involve assets from different classes. e.g. debt and equities; investor may buy '2-color rainbow' option that would pay off the better of an equity index and a bond market index.
  - d. May involve different payoff structures, besides 'better-of'. Can also depend on the sum or difference between two asset prices. e.g. rainbow *spread* option pays holder difference between two prices. [If you are holding the DAX, but wish to change your exposure to FTSE, can simply buy a rainbow spread.]
2. Quanto option - eliminates the exchange rate risk inherent when you purchase an asset denominated in a foreign currency.
  - a. e.g. buy a European call option on a Euro-denominated asset (say, DAX). At maturity the US\$ value of this asset depends on two things:
    - (i) what happens to the value of the Euro-denominated asset (DAX);
    - (ii) what happens to the Euro/US\$ exchange rate.
 A Quanto option will pay (i) only, by converting that payoff back to US\$ at the initial exchange rate. The investor's payoff only depends upon the performance of the DAX. The investor is not exposed to the risk that the Euro will weaken; nor will the investor benefit if the Euro strengthens against the US\$.
  - b. This involves additional risk for Quanto dealer - correlation risk; The seller is exposed to the possibility that the exchange rate and the value of this foreign asset may move together to some extent. The dealer must make some assumptions about this correlation, and hedge against potential changes in this correlation.

3. Basket option - payoff depends on the aggregate value of a 'basket' of financial assets, rather than on the value of the individual assets.
  - a. As long as the financial prices of the assets in the basket are not perfectly positively correlated, the *average price* of all assets will be less volatile than the individual prices.
  - b. Thus an option on the basket will be less expensive than buying individual options on each of the assets.
  - c. Suppose your firm has revenues in several foreign currencies; your firm is exposed to risk associated with several exchange rates. You can hedge your total foreign exchange risk more cheaply with a basket option on all these currencies.

#### G. Asset-Backed Security (ABS) –

Instrument constructed by packaging a group of securities and then issuing a security whose purchaser has a claim against the cash flows generated by the original package. Called 'securitization.'

Most ABSs contain additional features that can make them complex and give them option-like qualities (e.g. the *prepayment feature* of a mortgage).

1. Mortgage-pass-through or Mortgage-Backed Security (MBS) - Firm puts together portfolio of mortgages and then sells claims against that portfolio.
2. Often the firm secures credit insurance on the package by paying a fee (or CDS), or limits its portfolio to Federally insured FNMA or GNMA mortgages (or used to, before FNMA & GNMA ceased to exist).
3. An individual investor could thus purchase a piece of a credit risk-free mortgage portfolio; receive a monthly check for interest and principal.
  - a. Problem: homeowners (mortgage owners) often have a *prepayment option*.  
When interest rates fall, mortgage issuers receive principal repayments earlier than planned, which *must be* reinvested at lower rates;  
When interest rates rise, mortgage issuers do not receive the principal early, that *could have been* reinvested at higher rates.  
This option adds value to the mortgage owner's position; and makes the mortgage issuer's position more volatile & risky.

4. Collateralized Mortgage Obligation (CMO) - like a mortgage-pass-through; the portfolio's cash flows are split up and sold as separate claims.

Some of these tranches receive interest only (IO); Some receive principal only (PO);

Some receive principal and interest and, when fully repaid, others then step in line to receive principal and interest;

Some have a limited degree of protection against principal repayments;

Some have a claim on any residual value after all other tranches are paid off. (These are affectionately called 'toxic waste.')

Example: Consider a CMO with 3 classes of investors:

All principal repayments (both those scheduled & those prepaid) are given to class A investors until these have been completely paid off.

Then principal repayments are channeled to class B investors until they are completely paid off.

Finally, principal repayments are channeled to class C investors.

Here class A investors bear the most prepayment risk.

Class A securities are expected to last less long than class B or C securities.

Class C securities bear little prepayment risk if there are more A still out.

Class C securities bear more prepayment risk if there are fewer A & B out.

- a. These tranches offer widely divergent risk-return profiles. They bear different types of both interest rate and prepayment risk.
  - b. Their values may be volatile in differing ways to changes in interest rates.
  - c. Offer investors a wide range of risk-return possibilities.
  - d. May be more attractive to institutional investors than simpler MBS-pass-throughs.
5. More on Stripped MBS, IOs, & Pos.
- a. Both IOs & POs are risky.
  - b. In a PO, a fixed amount of principal is returned to investor, but timing is uncertain. A high rate of prepayments on the MBS pool means PO is paid back earlier, which is good news for PO holder.
  - c. In an IO, the total of the cash flows received by the investor is uncertain. If prepayments on the pool are higher, less interest will be paid (or received).
  - d. As prepayment rates ↑, POs become more valuable & IOs become less valuable.
  - e. OF COURSE, all these Asset-Backed Securities have **default risk!**  
 FNMA & GNMA were thought to be default-risk free --- implicit gov't guarantee.  
 Sub-Prime MBS have more risk --- led to bloodbath in Fall, 2008.

## H. Structured Notes or "Hybrid Debt" -

Intermediate or long term debt security whose interest payments are determined by some (occasionally complex) formula.

Recently, issuers of structured notes have made the formulas more complex to meet the needs of users who want to take more specific positions against interest rates, exchange rates, or commodity prices.

1. Floating Rate Note - "FRN" or "floater;" a pure floating rate security whose interest payment is tied to LIBOR; been around since 1970s.
2. Debt plus Forward Contract.
  - a. Dual Currency Bond - FRN combined with forwards on foreign currency; result is bond whose *coupon payments* are made in foreign currency while the principal is repaid in US\$.
  - b. An alternative is the Principal Exchange Rate Linked Security (PERLS), a bond whose *principal* is linked to exchange rates.
  - c. Petrobonds - bond combined with forward contract on oil prices; e.g. bonds issued by PEMEX in 1973 had principal payments linked to oil prices.
3. Debt plus SWAP.
  - a. Inverse Floater - FRN combined with a specific interest rate SWAP; FRN whose interest rate moves inversely with market rates; if interest rates rise, the coupon payment falls; effective hedge for a pure floater.
  - b. Adjustable Rate Convertible Note - convertible FRN combined with an interest rate SWAP in which the bondholder pays the Floating rate & receives a rate tied to the dividend rate on the firm's stock. Acts exactly like equity. Issued in 1982; a bald attempt to issue 'tax-deductible equity' and thus avoid taxes. Disappeared when IRS ruled these are equity for tax purposes.

4. Debt plus option.
  - a. Bond with Warrant - warrant may or may not be detachable;  
e.g. warrants on equity, commodity prices, or foreign exchange.  
Warrants' existence and exercise do not affect existence of debt.
  - b. Bond with Indexed Principle - zero coupon bond with an option that entitles holder to receive either the value of the bond or the option.
    - (i) Indexed to Commodity Prices - option to exchange bond for oil  
(Standard Oil: Oil-Indexed Note, early 1980's);
    - (ii) Indexed to Exchange Rates - option to exchange bond for currency  
(First Boston: Indexed Currency Option Note (ICON));
    - (iii) Indexed to Interest Rates - option to exchange for another bond  
(Extendable Bond: exchange for a bond of longer maturity);
    - (iv) Indexed to Equity Index - indexed to S&P 500, NYSE, NIKKEI, ...  
(Salomon Bro's: S&P500 Index Subordinated Notes - SPINs)  
(Goldman Sachs: Stock Index Growth Notes, SIGNs [on S&P500])
  - c. Bond with Indexed Coupons - debt plus series of options  
with many maturities matched to the dates of the coupon payments.  
These options change the nature of the coupon payments.
    - (i) Interest Rate Cap - floating rate loan in which you are guaranteed  
that the maximum floating rate you will have to pay is some cap.  
Loan with a series of interest rate options over loan's maturity.  
Other variations are Floors and Collars.
    - (ii) Commodity Interest-Indexed Bonds - coupon payments indexed to  
commodity prices: copper, natural gas, aluminum, oil, ...
    - (iii) Floored Floating-Rate Bonds - FRN plus series of options on LIBOR  
results in FRN that has a minimum interest rate.  
A variation replaces European options with Asian options;  
instead of paying off if the interest falls below some rate,  
the average rate options would pay off if the interest rate  
falls below the average rate over some time period.  
Resulting security has a floor, but the level of the floor  
depends on the path interest rates have followed (Cheaper).
    - (iv) Inflation-Rate Interest-Indexed Bonds -  
(Franklin S&L, 1988: offered 'Real Yield Securities' (REALS);  
notes with interest payments equal to [3% + inflation rate]).

- (v) Range Note - pays interest at an above-market rate if LIBOR stays within a specific range; this range may change according to some schedule. If LIBOR moves outside the range, these notes may revert to a lower interest rate or no interest at all.
- (vi) Other types of Structured Notes pay a promised rate plus additional payments based on movement of a commodity price or stock index:
  - A 5-year note that pays 2% interest plus the % change in the S&P 500 over the 5-year period if the S&P 500 goes **up**. [Like a T.Bill at a below-market rate plus a call option.]
  - A 5-year note that pays 2% interest plus the % change in the S&P 500 over the 5-year period if the S&P 500 goes **down**. [Like a T.Bill at a below-market rate plus a put option.]
  - An oil company with a poor credit rating may borrow by issuing a Structured Note with coupons tied to price of oil (natural hedge)

5. Debt plus option on Issuer's Creditworthiness, or on Manager's Behavior.

a. Puttable, Callable, Extendable Debt -

Puttable: bondholder has the right to sell back the bond to issuer;  
 Callable: bond issuer has the right to buy back the bond from holder;  
 Extendable: bondholder has the right to trade for a longer term bond.  
 All are essentially debt with interest rate options.

b. Convertible Debt - holder has option to convert to equity;

If shareholders act opportunistically, can become a shareholder.  
 [Different from 4.a.; if holder of convertible debt converts the equity option, then this bond ceases to exist.]

c. LYONs - Liquid Yield Option Note, introduced by Merrill Lynch, 1986;

A puttable, callable, convertible, zero-coupon bond;  
 The puttable and convertibility features effectively deal with potential for opportunistic behavior by shareholders. However, the callability feature adds value to the issuer; holders of these instruments lost value recently when interest rates declined and issuers called them back.

d. Explicit Options on the Issuer's Creditworthiness -

In 1988, Manufacturers Hanover issued FRNs in which they agreed to pay a spread above LIBOR that varied with their senior debt rating. For every step that Mannie Hannie's credit rating declined, investors would receive an additional 1/16th in yield.



e. Hybrids composed of Equity and Derivatives -

- (i) Equity plus SWAP - 'Adjustable Rate Preferred Stock';  
ties quarterly dividend payments to some floating rate;  
can be viewed as equity plus a SWAP in which the holder  
pays the firm's dividend rate and receives a floating rate.
- (ii) Equity plus Option - Morgan Stanley, 1991, issued PERCS on GM  
(Preference Equity Redemption Cumulative Stocks).  
Shares of the underlying stock are held in trust,  
and the PERCS are sold from the trust.

In return for an above-market dividend,  
the investor gives the issuer (Morgan Stanley)  
the right to call the equity at some predetermined price.  
Thus the investor is effectively long in the equity and  
short a call option on the equity.

- (iii) Option on Managerial Behavior - 'Puttable stock.'  
Arley Merchandise Corp., in 1984, issued stock with a right  
that entitles the holder to claim *more stock*  
if the market price of the stock declines  
below some specified price before some specified date.  
If the share price stays above this level, nothing happens;  
if the share price falls below this level, the holder is  
*issued new shares* to make up the difference.  
This is effectively stock with a put warrant that is settled  
by issuing more stock, rather than in cash.

6. Economic Rationale for Issuing a Hybrid Security.

1. Structured Notes provide investors with an opportunity to take advantage of views not only about the direction of interest rates, but the volatility, the range, the shape of the term structure, and the direction of commodity and equity prices.
2. Structured notes may have a leverage factor in which the rate adjusts by a multiple (such as 1.5) times LIBOR -- This practice extends the leverage.
3. These also may allow firms to take advantage of favorable tax and accounting treatments of certain forms of payments, and to enable firms to get around regulatory impediments.
  - a. To Provide Investors with a 'Play':
    - (i) on interest rates - anticipating a twist in the yield curve;
    - (ii) on exchange rates - anticipating a change in exchange rates;
    - (iii) on commodity prices - anticipating a change in oil prices.

- b. To 'Arbitrage' Tax and/or Regulatory Authorities; to take advantage of asymmetries in:
  - (i) tax treatment across national boundaries;
  - (ii) regulations in different markets.

- c. To obtain Accrual (Hedge) Accounting Treatment for Risk Management of *net income* or *economic exposure*.

If a U.S. firm uses a derivative to hedge a *specific transaction*, it is simple to obtain accrual accounting treatment for the hedge.

However, if the firm wishes to use a forward, futures, SWAP or option to hedge *net income* or an *economic exposure*, current GAAP accounting requires that the hedge position must be marked-to-market. Some firms hesitate to use risk management because this accounting treatment will make their accounting statement income more volatile.

However, if the risk management instrument is embedded in a debt security, the firm can obtain accrual accounting treatment for the entire package. Accountants can make an analogy to convertible debt, and use accepted accounting principles for convertible debt to account for the hybrid on an integrated basis using historical cost, thereby achieving hedge accounting treatment. Note: this is subject to change!

- d. To Align Interests of Shareholders and Bondholders.

Debtholders are concerned that shareholders may promote actions that might hurt the value of their debt claims.

If the bond is puttable bondholders have the right to cash in the bond when shareholders might attempt to dilute the bond's value.

If the bond is convertible, bondholders can become shareholders.

Hybrids can also be structured to reduce the volatility in the firm's underlying net income, thereby reducing the probability of default.

## I. Credit Derivatives.

Derivatives that are tied to the failure of some firm or security to perform.

### 1. Default Put Option –

Buyer pays a premium for an option that pays some amount if an event occurs – typically contingent on the default of some party specified in the agreement.

Seller receives premium up front,  
and is obliged to pay the amount if the default occurs.

Emerging market credit derivatives account for the largest share.

This is because credit derivatives provide an easy tool  
to obtain or hedge credit exposure in emerging markets.

Buyers are often banks wishing to hedge specific elements of a foreign loan,  
such as sovereign risk of default and currency convertibility.

Sellers are investors who want access to exposure that otherwise might not be available.

### 2. Credit-Linked Note

A bank may issue (sell) a credit-linked note tied to some corporate loan on their books.

The buyer then receives a yield associated with the loan return to the bank;  
the buyer therefore acquires exposure to the bank's loan.

If the loan goes bad, the buyer of this credit-linked note suffers the loss.

The bank therefore is able to pass on the credit risk associated with part of its loan portfolio  
to investors who want that exposure.

Motivation: Banks are in an advantageous position to extend commercial credit

In markets that are often concentrated in geographic areas or specific industries.

However, banks do not want a loan portfolio that is too concentrated.

Bank needs the ability to diversify across geographical economic exposures.

Bank needs a vehicle to pass on this exposure to investors who might want it,  
such as hedge funds or insurance companies.

Investors can thus acquire exposure to these markets  
without the cost of establishing the ability to extend credit.

### 3. Credit Default SWAP (CDS)

A bank funds a (typically high risk, high yield) commercial loan,  
and swaps the credit risk to an investor via a default put option.

The bank is then exposed to the much reduced risk of simultaneous default  
of both the loan and the hedge fund.

Thus the bank can commit less of its own capital to support the loan.

As a result the bank's use of capital becomes more efficient and its return on capital rises.

Similarly, the investor's use of capital also becomes more efficient  
since it is using the bank's advantageous position for loan origination.

## J. Value-at-Risk (VaR).

A technique for assessing a corporation's potential loss from market movements over a given period. VaR measures the maximum unfavorable change in portfolio value that can be expected over a specific time period and confidence interval, due to the movements of economic variables such as interest rates, exchange rates, commodity prices, equity prices, etc.

An example of the outcome from a VaR analysis might be:  
“There is a 5% probability that the bank's loan portfolio will lose 15% of its market value in the next quarter.”

VaR analysis can be decomposed into four steps:

1. A set of market variables is determined that will influence the value of a company's holdings (e.g. interest rates, exchange rates, commodity prices, equity prices, etc.)
2. A given type of behavior for these market variables is assumed and modeled through a stochastic process, typically a normal distribution.
3. The portfolio of the firm's holdings is then modeled as a function of the market variables; i.e., the change in the portfolio's value is computed as a function of the market variables.
4. The VaR can then be computed for the portfolio using various techniques, including statistical simulations, historical simulations, or covariance analysis.

It should be noted that VaR techniques have weaknesses that must be considered when they are implemented.