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# Financial Markets (selected topics)

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# Disclaimer

- This is a specially selected compilation from the reading recommended for APRM preparation.
- M. Crouhy, D. Galai, R. Mark “Essentials of Risk Management”, McGraw-Hill, 2006.
- Reading on the PRMIA web site.

# Financial Markets

- Trading of financial securities, derivatives, and other financial contracts takes place in two settings: formal financial exchanges and more loosely organized over-the-counter (OTC) markets.
- Rights to trade are limited to members.
- Exchanges also collect and disseminate pricing information and facilitate post-trade risk management and final trade settlement.
- OTC refers to any financial market transaction that does not take place on a formal exchange.
- Most equity trading takes place through exchanges.
- Most derivative trading is OTC.

# Services of Exchanges

- Financial exchanges offer their members a bundle of related services:
  - Setting standards for traded financial products
  - Providing price information
  - Protecting against the risk of an agreement not being fulfilled (counterparty risk)
  - Facilitating the matching of buyers with sellers at agreed prices : most exchanges are electronic nowadays.
  - Sometimes acting as central counterparty.
- As a consequence, exchanges greatly increase liquidity of traded instruments.

# Liquidity

- Informal: a market is liquid if transactions can take place rapidly, with low transaction costs and with little impact on price.
- Market liquidity should not be confused with cash liquidity, which is a separate notion to be discussed elsewhere.

# Post-Trade

- After a trade is 'executed' further steps are required to complete the transaction.
- Comparison and confirmation.
- Netting.
- Settlement.
- These steps take place sequentially. Usually:
  - Matching & Netting: T+1
  - Preparation for settlement: T+2
  - Settlement: T+3
  - Delivery vs Payment (DVP)

# Marginal Trading and Short Selling

- Trading on margin: take a loan and buy more.
- Leverage = Portfolio Value / Own capital.
- Short selling: borrow a security and sell it.
- Margin:
  - Initial
  - Variation
  - Maintenance
  - Margin Call.

# Stock Market

- Stocks (shares, equities) represent ownership of companies or corporations.
- May exist in paper form or as entries in a register.
- Initial Public Offering (IPO) is a common way of raising capital.
- Access to stock market is usually regulated (including information disclosure), so a company applying for an IPO must comply.
- Usually a company is listed on one exchange, but some very large companies are exceptions.



# Main Participants

- Institutional investors
  - Investment banks
  - Mutual funds
  - Hedge funds
  - Insurance companies
  - Companies
- Retail investors

# Stocks

- A stock represents a right to claim a part of a company's residual assets after all other claims have been payed. Equity holders are the last in the queue if a company is liquidated.
- Equity holders' liability is limited by the price paid.

# Rights and Dividends

- Voting rights: proportional.
- Corporate government.
- Dividends. Decided by the board. Ex-dividend date.
- Equity valuation: capital value (uncertain) + dividends (uncertain).
- Preference shares:
  - Senior to ordinary equity.
  - Dividends may be fixed.
  - Limited or no voting rights.
  - Less.

# Market Portfolio

- All traded assets weighted by their market values.
- For a stock, market value is known as the capitalization (or cap) of a firm.
- $\text{Cap} = \text{Price} * \text{Amt}$
- The return of the market portfolio is considered to be the “market return”.
- Proxies: market indices: S&P 500

# Market & Risk-Free Return

- Risk-free: “no” risk
- Market: risk
- Investors are risk-averse, so they demand additional premium for a risky investment
- One quantification of this statement is called Capital Asset Pricing Model (CAPM)

# CAPM

- The model was introduced by Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) independently, building on the earlier work of Harry Markowitz (1952, 1959) on diversification and modern portfolio theory.
- The main assumptions underlying the model are:

# CAPM Assumptions I

- The market is ideal:
  - The players are many.
  - The players are price-takers.
  - No taxation or transaction costs.
  - The instruments are infinitely divisible.
  - All market information, including expected returns and volatilities, is fully known to all participants, and they agree on it.
  - One can freely invest into the market portfolio, and its return and volatility are also readily available.

# CAPM Assumptions II

- Investors:
  - Are rational and risk-averse.
  - Plan to invest for the same one horizon.
  - Can lend/borrow at the same risk-free rate infinitely.
  - Care only about return (seek) and its volatility (avoid).
  - Measure return using its expected value and volatility using variance.



# CAPM In a Nutshell I

- Under these assumptions the risk of an asset may be decomposed into two parts:
  - Risk that can be neutralized through diversification (diversifiable or specific risk).
  - Risk that cannot be neutralized through diversification (systematic risk).
- The market portfolio can be shown to bear only systematic risk.

Market risk premium = Return of the Market Portfolio – Risk-Free Rate.

# CAPM In a Nutshell II

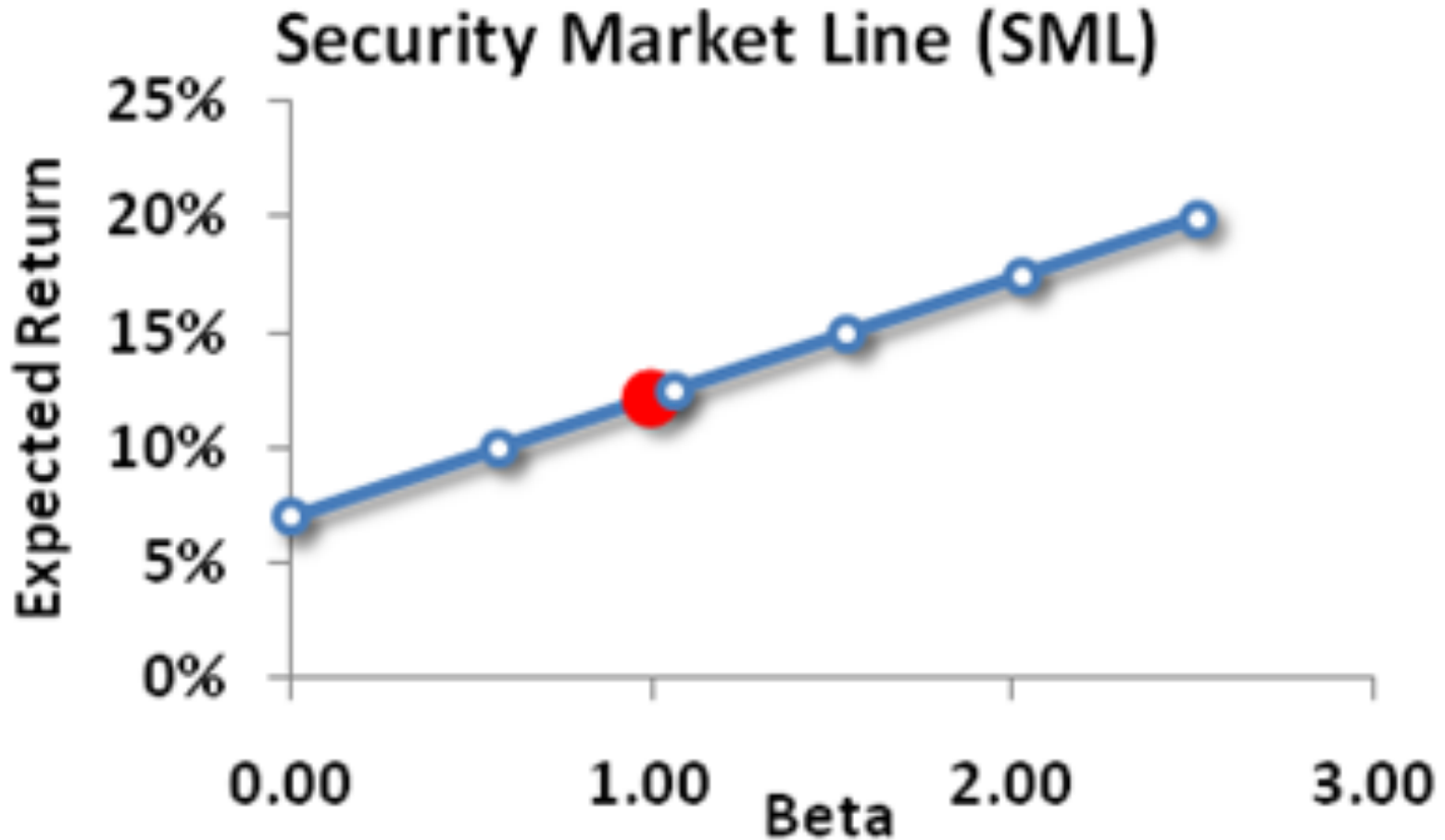
- If the market is in equilibrium, all returns will correspond to the relative amount  $\beta$  of systematic risk in an asset:

Return = Risk-Free Return +  $\beta$  (Return on the Market Portfolio – Risk-Free Rate).

- The amount of systematic risk  $\beta$  is measured by the covariance between its return and the market return:

$$\beta = \text{Cov} (\text{Asset Return}, \text{Market Return}) / \text{Var} (\text{Market Return})$$

# Security Market Line



# Beta

- $\beta < 0$  : Opposite the index: Gold.
- $\beta = 0$  : Uncorrelated with the index: Fixed-yield.
- $0 < \beta < 1$  : With the index, but less: Stable stock.
- $\beta = 1$  : Exactly as the index: Representative stock.
- $\beta > 1$  : More than the index: Volatile stock.

# Bond Markets

- Serves governments, corporations and banks.
- Borrowers, investors and intermediaries.
- Banks: retail and investment.
- Investment banks originate (issue) bonds on behalf of corporations.
- Institutional investors.
  - Banks, building societies, fund managers, central banks, some corporate treasury desks.
  - Insurance companies, corporations.
  - Pension funds, life assurance companies.

# Bonds

- Public:
  - Sovereign bonds.
  - Agency bonds.
  - Municipal bonds.
- Private:
  - Corporate bonds.
  - Bank bonds.

Domestic & Eurobonds.

# Credit Risk

- Bonds bear the default risk of the issuer.
- Rates payed by bonds depend on this risk.
- Rating agencies assign ratings to issuers and to individual bond issues.

# Money Markets

- The market for deposits&loans and money market securities.
- A repo (repurchase agreement) consists in selling a security with a legal obligation to repurchase it in specified time at higher price. It is effectively a kind of a short-term loan with a collateral.
  - Repo rate.



# LIBOR

- London InterBank Offering Rate.
- Top banks are surveyed and the reported interbank rates are averaged (with outliers removed).
- It is a universally accepted benchmark for the “prevailing market interest rate” in USD.
- Its quality has been seriously debated recently.

# Money Market Instruments

- Treasury Bills (T-Bills). Effectively discount bonds, but sometimes with different market conventions.
- Commercial Papers and Promissory Notes. Corporate. Usually backed up by a credit line.
- Bankers' Acceptance.
- Certificates of Deposit.

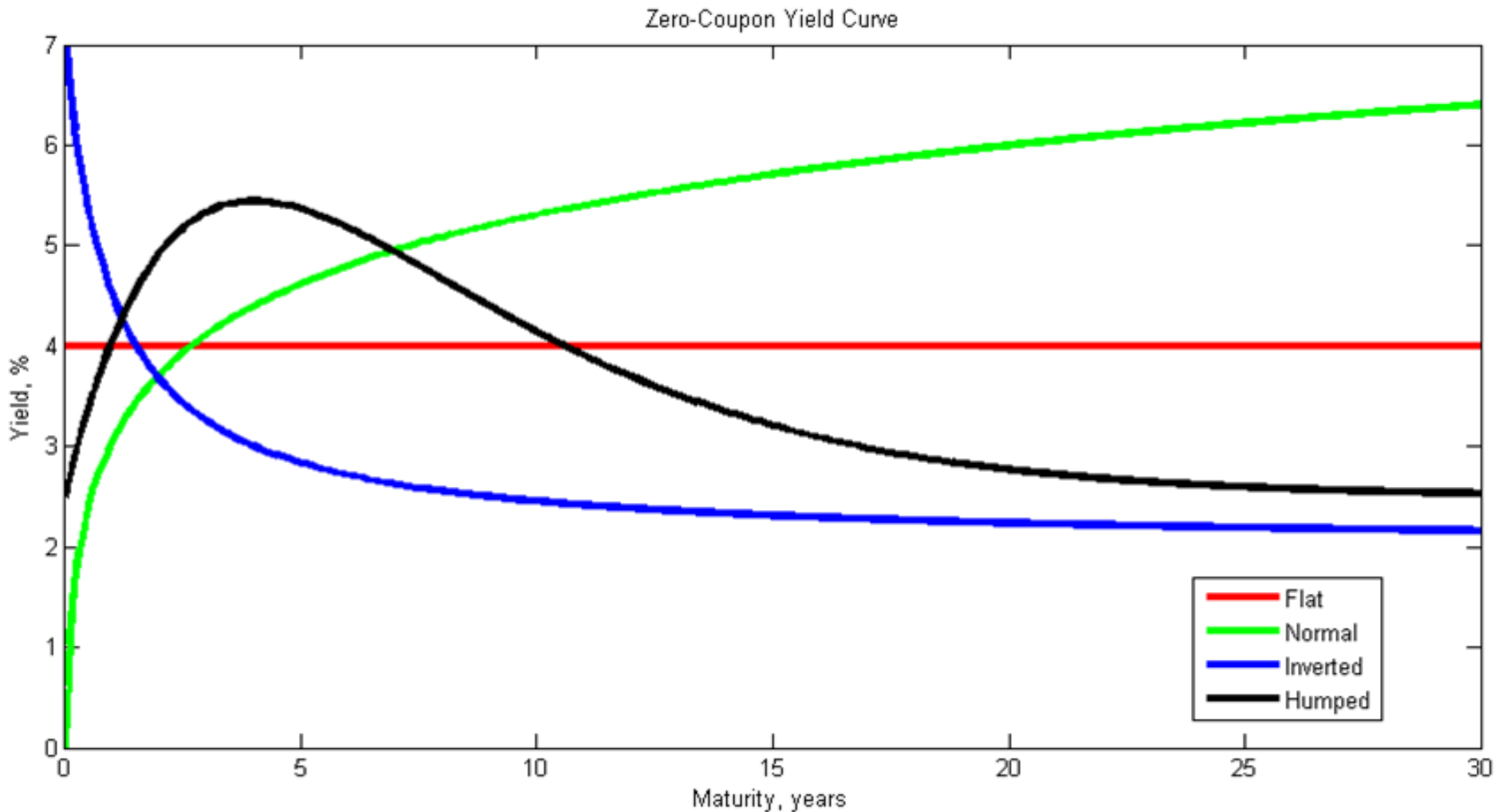
# Interest Rate Risk

- Simplified setting.
- A specific kind of market risk.
  - The possibility of a portfolio reducing in value due to changes in interest rates.
- The simplest asset sensitive to interest rates is a bond.

# Bond Prices and Interest Rates

- Bond prices generally fall when interest rates rise.
- Interest rates are many: for every term.
- Yield Curve (Term Structure of Interest Rates):
  - The relationship between the discount rates and the time to maturity.

# Yield Curve



# Curve & Basis Risks

- Curve risk arises when a portfolio is hedged against uniform rises of interest rates, but is vulnerable to changes in its shape (non-parallel shifts).
- Basis risk arises when a hedge is not entirely similar to the instrument or is imperfectly correlated, e.g. when hedging a 3-month LIBOR exposition with a 3-month bond. They all use “3-month” rates, but are different. Moreover, the spread varies causing the basis risk.

# Bond Pricing

- Bonds are priced using the concept of discounting: future income is less valuable, so we count it with a discount.
- Which rate to use for discounting?
  - Interest rates prevailing for the term in question.
  - Risk of the bond:
    - Credit risk: credit quality of the issuer.
    - Liquidity risk: chance of not getting the fair price when selling due to the lack of demand.
    - Repo eligibility, etc...

# Yield to Maturity

- A coupon bond may be viewed as a portfolio of individual payments (zero-coupon bonds).
- It may also be priced accordingly: every single payment should be discounted using its own discounting rate (called zero-coupon rates).
- In practice we don't observe zero-coupon rates, and estimating them is a separate branch of financial mathematics.
- But we may also discount every payment with the same rate. The rate needed to get the right answer is the bond's Yield to Maturity (YTM).
- Bonds are sometimes quoted in terms of YTM and not price.



# Yield Curve Gambling

- Consider a usual upward-sloping yield curve: short-term investments/borrowings pay less than long-term.
- Buy a 2-year bond (yielding 3 % a year) and finance by selling a 1-year bond (paying 2% a year).
- When the 1-year bond expires, finance it by selling another 1-year bond (again paying 2% a year).
- You have received 1% for a very moderate investment (you only had to deposit margin).
- Profit.
- Repeat until all your money is deposited as a margin.

# Yield Curve Gambling II

- Realize that the bonds in your portfolio are eligible for being a collateral, so you can short-sell more.
- Repeat the previous strategy for all bonds in portfolio (including ones bought during the strategy implementation).
- See your profit multiplied.
- Where is the problem?

# Orange County Case

- A similar strategy was indeed implemented by Robert Citron, the Treasurer of Orange County, California, USA in early 1990s.
- More info at [www.prmia.org/pdf/Case\\_Studies/Orange\\_County.pdf](http://www.prmia.org/pdf/Case_Studies/Orange_County.pdf)
- He used repo's to create leveraged positions and he used reverse floater bonds instead of ordinary ones.

# Floating Rate Bonds (Floaters)

- Some bonds pay fixed coupon. These bonds lose value when interest rates rise and gain it when rates fall.
- For some bonds coupon size may be indexed to account for interest rate changes: floating rate. Example: coupon size =  $\text{LIBOR} + 1\%$ . These bonds retain value when interest rates change.
- For other bonds coupon size may be inversely linked to interest rates: inverse floaters. Example: coupon size =  $\max(0, 10\% - \text{LIBOR})$ . These bonds create even higher exposition to interest rate risk.

# Duration

- “Average” time to maturity of a bond.
- Individual payments’ times are weighted according to relative importance (contribution to the overall bond price).
- For a zero-coupon bond duration equals time to maturity.
- For a short-term coupon bond duration is slightly less than time to maturity.
- For a long-term coupon bond duration may be less than half of time to maturity.

# Duration as a Measure of Sensitivity

- Bond duration also measures relative sensitivity of bond price to small parallel shifts in interest rates.
- Details are quite complex, but when interest rates change by 0.01% (1 bp), bond prices change by approximately 1 bp for each year of duration.
- The duration of a portfolio is a price-weighted average of individual durations (negative if short).

# Managing Interest Rate Risk

- Interest rate risk is managed holding appropriate portfolios.
- Derivative instruments are widely used for hedging interest rate risk.

# OTC Market

- Is not a single institution. Several competing dealers provide quotes openly or upon request.
- Customization.
  - Master agreements.
- Counterparty risk.
  - Collateral.
- Vast amount of derivative instruments are traded OTC.



# Derivative Instruments

- Instruments with payoffs depending on some other quantity, usually a price (underlying).
- Futures and Forwards
- Options
- Swaps
- ...

# Forwards

- A deal in future with conditions (incl. price) specified today.
- Buy/Sell. Interest Rate.
- Delivery vs. Non-Delivery.
- An OTC contract, customizable terms, set upon entering a contract.
- No fee is payed upon entering a forward.
- Usually forward prices are higher than spot: contango.
- $\text{Forward} < \text{Spot}$ : Backwardation.

# Futures

- Exchange-traded equivalent of a forward.
- Brazilian straddle.
- Variational margin.
- Futures are free to enter and exit at any time.
- Usually non-delivery or closed before expiration.



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# Thank you for your attention!

To be continued...