Financial Market
Introduction
Market

Summary

- Financial Market Definition
- Financial Return
- Price Determination
- No Arbitrage and Risk Neutral Measure
- Fixed Income and Interest Rate Market
- Currency or FX Market
- Equity Market
- Historical Volatility vs Implied Volatility
A financial market is a market where people trade financial products.

Types of financial markets:
- Fixed income and interest rate market
- Currency market
- Equity market
- Commodity market
- Credit market

There are the spot market and the derivative market within each market above.
Financial return

- Financial return is the measurement of profit and loss on an investment or an asset.
- Return is more important than value itself.
- Return types
  - Absolute return: \( R_A = V_t - V_{t-1} \)
  - Relative return: \( R_R = \frac{V_t}{V_{t-1}} - 1 \)
  - Log return: \( R_L = \ln\left(\frac{V_t}{V_{t-1}}\right) \)
Financial return (Cont)

Return attributes

- Log return is similar to continuously compounding.
- Log return is additive, i.e., $R_{02} = R_{01} + R_{12}$.
- For a short horizon, $R_R \approx R_L$
- Returns are nearly independent and similar to a random walk.
- Returns in future are unpredictable.
Price Determination

- Actual market price determination
  - Determined by supply and demand.
  - Gauged in the real-world measure.
  - Supply side determination factors:
    - Transaction costs
    - Liquidity
    - Risk/reward preferences of suppliers
    - Capital availability
    - Tax rules
    - Differential information
Price Determination (Cont)

- Demand side determination factors:
  - Transaction costs
  - Liquidity
  - Accounting
  - Tax rules

- Model price determination
  - Determined by model and calibration.
  - Gauged in the risk neutral measure.
  - If a trade has the market price, then
    - Model is mainly used to compute risk, such as sensitivities.
    - The model price should be calibrated to the market price.
  - If a trade doesn’t have a market price, then
    - Model price is used for transaction.
    - Model should be calibrated to Vanilla products.
No Arbitrage and Risk Neutral Measure

- **No arbitrage**
  - The law of one price: The same cash flow should have the same price.
  - It is impossible to invest 0 today and receive positive tomorrow.
  - Two portfolios having the same payoff at a given future date must have the same price today.

- **Risk neutral probability measure or simply risk neutral measure**
  - Risk neutral probability measure is no arbitrage.
  - The Arrow security prices are so-called risk neutral probabilities.
  - A risk-neutral probability is not a real mathematical probability.
  - These prices are called probabilities as they fulfill the criteria of probabilities so that the probability theory can be used.
  - In finance, Martingale measure is equivalent to risk neutral measure
Fixed Income and Interest Rate Market

- Fixed income and interest rate market mainly consists of bonds, notes, debentures, certificates, mortgages, money market funds and interest rate derivatives.
- Central to any interest rate related topics is to calculate accrued interest.
- One needs two factors to compute accrued interest: compounding and day count.
- Commonly used compoundings:
  - Annual compounding: the accrual interest is given by
    \[ A(0, t) = (1 + r)^t \]
    where \( r \) is annual compounded interest rate and \( t \) is the accrual period in years.
N-time compounding per year, such as semi-annually (n=2), quarterly (n=4), monthly (n=12), etc.; the accrual interest can be expressed as

\[ A(0, t) = \left(1 + \frac{r}{n}\right)^{nt} \]

Continuously compounding: the accrual interest can be represented as

\[ A(0, t) = \exp(rt) \]

Simply compounding: the accrual interest is given by

\[ A(0, t) = rt \]
Fixed Income and Interest Rate Market (Cont)

- Day count convention or day count fraction
  - Day count convention is used to determine accrual period.
  - Commonly used day count conventions are 30/360, Act/Act, Act/365, Act/360.
  - For example, the accrual period of 30/360 convention between $t_1$ and $t_2$ is
    \[ t_{12} = \frac{360 \ast (Y_2 - Y_1) + 30 \ast (M_2 - M_1) + (D_2 - D_2)}{360} \]

- Interest rate curve:
  - Yield curve or zero-coupon curve is the term structure of interest rates.
  - Zero bond curve is the term structure of discount factors.
  - Bond curve is the term structure of bond yields.
  - Swap curve is the term structure of liquid instruments, such as futures and swap rates.
Currency or FX Market

Currency market convention is one of the biggest sources of confusion for those new to the market.

FX quotation
- The quotation 1.25 EUR/USD means that one Euro is exchanged for 1.25 USD.
- In this case, EUR (nominator) is the base currency and USD (denominator) is the quoted currency.

Spot date
- The spot date or value date is the day in which the two parties actually exchange the two currencies.
- A currency pair requires a specification of the number of days between trade date and spot date, typically 2 business days.
Equity Market

- Equity price is quoted by Exchanges.

- Dividend convention
  - Record date or cut-off date is the date of dividend payment eligibility. The shareholders of record as of the record date will be entitled to receive the dividend.
  - Ex-dividend date is set exactly 2 business days before the record date. On and after the ex-dividend date, a buyer of the stock will not receive the dividend.
  - The stock price usually drops at the ex-dividend date.

- Dividend types:
  - Discrete dividend.
  - Dividend yield or continuous dividend.
Historical Volatility vs Implied Volatility

- **Historical volatility**
  - It is the standard deviation of the time series of an asset return.
  - It is calculated under the real world measure.

- **Implied volatility**
  - It is a model parameter used to back up the market price.
  - It is derived under the risk neutral measure.
  - Implied volatilities could be bigger or smaller than historical volatilities.
Thanks!

You can find more details at
https://finpricing.com/lib/EqRainbow.html