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# 1 Reading 9: Correlation and Regressions

## 1.1 Sample covar and sample correlation coefficients

Sample covariance:  $cov_{x,y} = \sum_i \frac{(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$

Sample correlation coeff:  $r_{x,y} = \frac{cov_{x,y}}{s_x s_y}$ , where  $s_x$  is the sample dev of X.

## 1.2 Limitations to correlations analysis

Outliers: The results will be affected by extreme data points.(outliers)

Spurious correlation: There might be some non-zero correlation coeff, but actually they have no correlation at all.

Nonlinear relationships: Correlation only describe the linear relations.

## 1.3 Hypothesis: determine if the population correlation coefficient is zero

Two-tailed hypothesis test:

$$H_0 : \rho = 0, H_a : \rho \neq 0$$

Assume that the two populations are **normally** distributed, then we can use t-test:

$$t = \frac{r\sqrt{n-2}}{1-r^2}$$

: Reject  $H_0$  if  $t > +t_{critical}$  or  $t < -t_{critical}$ . Here,  $r$  is the sample correlation. Remember, you need to check t-table to find the t-value.

## 1.4 Determine dependent/independent variables in a linear regression

**Simple linear regression:** Explain the variation in a dependent variable in terms of the variation in a single independent variable. **Independent variables** are called explanatory variable, the exogenous variable, or the predicting variable. **Dependent variable** is also called the explained variable, the endogenous variable, or the predicted variable.

## 1.5 Assumptions in linear regression and interpret regression coeff.

1. Assumptions of linear regression:

- (a) Linear relationship must exist.
- (b) The independent variable is uncorrelated with residuals.
- (c) Expected Residual term is value.  $E(\epsilon) = 0$
- (d) variance of the residual term is const.  $E(\epsilon_i^2) = \sigma_\epsilon^2$ . Otherwise, it will be "heteroskedastic"
- (e) The residual term is independently distributed. otherwise - "auto correlation"  $E(\epsilon_i \epsilon_j) = 0$
- (f) The residual term is normally distributed.

2. Simple Linear Regression Model

- (a) Model:  $Y_i = b_0 + b_1 X_i + \epsilon_i$ , where  $i = 1 \dots n$ , and  $Y_i$  is the actual observed data.
- (b) The fitted line, the line of best fit :  $\hat{Y} = \hat{b}_0 + \hat{b}_1 X_i$ . Where  $\hat{b}_0$  is the estimated parameter of the model.

- (c) How to choose the best fitted line? **Sum of squared errors** is minimum.

$$\hat{b}_1 = \frac{cov_{x,y}}{sigma_x^2}$$

where  $X$  is the independent variable.  $\hat{b}_1$  is "regression coefficient".

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}$$

where  $\bar{X}, \bar{Y}$  are the mean.

3. Interpreting a regression coefficient: Similar to basic ideas of "slope". Keep in mind: any conclusion regarding this parameter needs the statistical significance of the slope coefficient.

### 1.6 Standard error of estimate, the coeff. of determination and a confidence interval for a regression coefficient.

1. Standard error of estimate (SEE): Standard deviation between  $Y_{estimate}$  and  $Y_{actual}$ . - Smaller: better
2. Coefficient of Determination ( $R^2$ ) The percentage of the total variance in the dependent variable that is predictable from the independent variable. - One independent variable:  $R^2 = r^2$ , where  $r^2$  is the square of correlation coefficient.
3. Regression Coefficient confidence interval

(a) Hypothesis:  $H_0 : b_1 = 0 \Leftrightarrow H_a : b_1 \neq 0$

(b) Confidence interval:  $\hat{b}_1 - (t_c s_{\hat{b}_1}) < b_1 < \hat{b}_1 + (t_c s_{\hat{b}_1})$   $s_{\hat{b}_1}$  is the standard error of the regression coeffi.

### 1.7 Hypothesis: Determine if $\hat{b}_1 = b_1$

1. t-test statistic:  $t_{b_1} = \frac{\hat{b}_1 - b_1}{s_{\hat{b}_1}}$
2. Reject: if  $t > +t_{critical}$  or  $t < -t_{critical}$

### 1.8 Calculate the predicted value for the dependent variable

If an estimated regression model is known,  $\hat{Y} = \hat{b}_0 + \hat{b}_1 X_p$

### 1.9 Calculate and interpret a confidence interval for the predicted value of the dependent variable

1. Eq:  $\hat{Y} \pm (t_c s_f)$ , where  $s_f$  is the **std error of the forecast**.
2.  $s_f^2 = SEE^2 \left[ 1 + \frac{1}{n} + \frac{(X - \bar{X})^2}{(n-1)s_x^2} \right]$ 
  - (a)  $SEE^2$  = variance of the residuals
  - (b)  $s_x^2$  = variance of the independent variable
  - (c)  $X$  = value of the independent variable where the forecast was made.

### 1.10 ANOVA in regression. Interpret results, and calculate F-statistic

- Analysis of variance (ANOVA) is used to analyze the total variability of the dependent variable.
  - Total sum of squares(SST):  $SST = \sum_{i=1}^n (Y_i - \bar{Y})^2$   
SST is the total variation in the dependent variable.  $Variance = SST/(n - 1)$
  - Regression sum of squares(RSS):  $RSS = \sum_{i=1}^n (\hat{Y}_i - \bar{Y})^2$   
RSS is the explained variation.
  - Sum of squared errors(SSE):  $SSE = \sum_{i=1}^n (Y_i - \hat{Y}_i)^2$   
SSE is the unexplained variation.
  - $SST = RSS + SSE$  I cannot get this equation yet You need to know how to use these squares.
  - Degree of freedom: i) Regression(Explained):  $k = 1$ , since we only estimate one parameters. ii) Error(Unexplained)  $df = n - k - 1 = n - 2$  iii) Total variation  $df = n - 1$
- Calculating  $R^2$  and **SEE**
  - $R^2 = explainedvariation/totalvarn = RSS/SST$
  - SEE** =  $\sqrt{\frac{SSE}{n-2}}$  **SEE** is the std deviation of the regression error terms.
- The F-Statistic: used to explain whether *at least one* independent parameter can significantly explain the dependent parameter.
  - F-statistic eq:  $F = \frac{MSR}{MSE} = \frac{RSS/k}{SSE/(n-k-1)}$  where  $MSR$  = mean regression sum of squares.  $MSE$  = mean squared errors. Note: **One tailed test!**
- F-statistic with one independent variable.
  - Hypothesis:  $H_0 : b_1 = 0 \Leftrightarrow H_a : b_1 \neq 0$
  - degree of freedom:  $df_{rss} = k = 1, df_{sse} = n - k - 1$
  - Decision rule: reject  $H_0$  if  $F > F_c$

### 1.11 Limitations of regression analysis

- Parameter instability: the estimation eq may not be useful for other times.
- Limited usefulness: other participants may also use the same eq.
- Assumptions does not hold: i) Heteroskedastic, i.e., non-const variance of the error terms. ii) autocorrelation, i.e., error terms are not independent.

## 2 Reading 10: Multiple Regression and Issues in Regression Analysis

Some basic ides

- Model:  $Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + \dots + b_kX_{ki} + \epsilon_i$
- Multiple regression methodology estimates the intercept and slope coefficients so that  $\sum_i^n \epsilon_i^2$  is minimized.

### 2.1 Interpret estimated regression coefficients and their p-values.

They are just simple linear functions with multiple parameters. Ignore.

## 2.2 Formulate a null/alternative hypothesis, do corresponding calculations

1. Hypothesis Testing of Regression coefficient. (Multi-parameters).  
Use t-statistics to determine if one parameter significantly contribute to the model.

$$t = \frac{\hat{b}_j - b_j}{s_{\hat{b}_j}}, df = n - k - 1$$

where  $k$  is the number of regression coefficients, and 1 corresponds to the intercept term, and  $s_{\hat{b}_j}$  is the coefficient standard error of  $b_j$

2. Determining statistical significance.  
“testing statistical significance”  $\Rightarrow H_0 : b_j = 0, H_a : b_j \neq 0$
3. Interpreting p-values.  
(a) Def: p-value is **the smallest level of significance for which the null hypothesis can be rejected**. If the p-value is less than significance level, the null
4. Other Tests of the Regression Coefficients:  $H_0 : a = \text{some value}$

## 2.3 Calculate and Interpret a confidence interval for the population value of a regression coefficient or a predicted value for the dependent variable if an estimated regression model.

1. Confidence intervals for a regress. coeff.:  $\hat{b}_j \pm (t_c \times s_{\hat{b}_j})$
2. predicting the dependent variable:  $\hat{Y}_i = \hat{b}_0 + \hat{b}_1 \hat{X}_{1i} + \dots + \hat{b}_k \hat{X}_{ki}$   
Even if you may conclude that some  $b_i$  are not statistically significantly, you cannot treat them as 0 and keep other parameters unchanged. You should use the original model, or you can throw  $\hat{b}_k$  away and make a new regression model.

## 2.4 Assumptions of a multiple regression model

1. Linear relationships exist.
2. The independent variables are not random, and there is no exact linear relation between independent variables.
3.  $E[\epsilon | X_1, \dots, X_k] = 0$
4. Variance of  $\epsilon = 0$ , i.e.  $E[\epsilon_i] = 0$
5.  $E(\epsilon_i \epsilon_j) = 0$
6.  $\epsilon$  is normally distributed.

## 2.5 Calculate and interpret F-statistic

F-test: whether at least **one** of the independent variables explains a significant portion of the variation of the dependent variable. F test is a one-tail test.

1.  $H_0 : b_1 = b_2 = b_3 = 0$  vs  $H_a : \text{at least one } b_j \neq 0$
2.  $F = \frac{MSR}{MSE} = \frac{RSS/k}{SSE/n-k-1}$
3. Degree of freedom:  $df_{\text{numerator}} = k, df_{\text{denominator}} = n - k - 1$
4. Rules: reject  $H_0$  if  $F(\text{test} - \text{statistic}) > F_c(\text{criticalvalue})$

## 2.6 Distinguish between $R^2$ and adjusted $R^2$

1. coefficient of determination  $R^2$ : used to test if a group of independent variable can explain the dependent variable:

$$R^2 = \frac{\text{total variation} - \text{unexplained variation}}{\text{total variation}} = \frac{SST - SSE}{SST} = \frac{RSS}{SST}$$

$$\text{Multiple } R = \sqrt{R^2}$$

2. Adjusted  $R^2$

- (a) Note:  $R^2$ : **Overestimating**: will increase as variables are added to the model. Even the marginal contribution of new variables are not statistically significant.
- (b) Introduce  $R_a^2$ :  $R_a^2 = 1 - \left[\left(\frac{n-1}{n-k-1}\right)\right] (1 - R^2)$

## 2.7 Evaluate the quality of a regression model by analyzing the output of the equation/ANOVA table

1. ANOVA Tables, some important quantities

- (a)  $R^2 = \frac{RSS}{SST}$

- (b)  $F = \frac{MSR}{MSE}$  with  $k$  and  $n - k - 1$  df

- (c) Standard error of estimate:  $SEE = \sqrt{MSE}$

## 2.8 Formulate a multiple regression with dummy variables to represent qualitative factors

1. Def: Some value is quite qualitative. Using dummy values like 0 or 1 to describe their impacts.
2. Note: Pay attention to # of dummy variables. If  $n$  classes, we must use  $n - 1$  dummy variables.
3. Interpreting the coefficients in a dummy variable regression. We can use F-statistics to test a group of parameters, or use t-test to test the individual slope coefficients.
4. Example of Regression application with dummy variables. See Notes directly.

## 2.9 Why multiple regression isn't as easy as it looks?

Pay attention to the assumptions that have been used. Violations like::

1. Heteroskedasticity
2. Serial correlation (auto-correlation)
3. Multicollinearity

Any violations on the assumptions will impact the estimation of SEE, and finally change the t-statistic and F-statistic, and change the conclusion of the hypothesis test.

## 2.10 Types of Heteroskedasticity, how heteroskedasticity and serial correlation affect inference

1. What is Heteroskedasticity?

**Corresponding assumptions: Variance of the residuals is constant across observations. – Homoskedasticity** Heteroskedasticity means the variance of the residuals is not equal.

- (a) Unconditional heter: Not related to the level of the independent variables. Will not systematically increase with changes in the value of the independent variables. **Usually will not cause major problems.**

- (b) Conditional heter: Related to the level of the independent variables. Eg: Conditional heter exists if the variance of the residuals increase with the value of the independent variables increases. **Will cause big problems.**
2. Effect of Heteroskedasticity on Regression Analysis
- (a) Unreliable standard errors.
  - (b) The coefficient estimates aren't affected.
  - (c) Will change the t-statistic, and will change the conclusion.
  - (d) Unreliable F-test
3. Detect Heteroskedasticity
- (a) Scatter plot
  - (b) Breusch-pagan test:  $BPtest = n \times R_{resid}^2$  with  $df = k$ . where  $n$  = the number of observations,  $R_{resid}^2 = R^2$  from a second regression of the squared residuals from the first regression.  $k$  = the number of independent variables. If  $R^2$  or BP-test are too large, something is wrong.
4. Correcting Heteroskedasticity
- (a) Calculate robust standard errors (White corrected std errors). Use them for t-test.
  - (b) Generalized least squares.
5. What is serial correlations?
- (a) Def: auto-correlation, in which the residual terms are correlated. Common problem with time series data.
    - i. Positive serial correlation: a positive error in one time period will increase the possibility to observe a positive one next time.
    - ii. Negative serial correlation: Just opposite.
  - (b) Effect: positive serial correlation will get small coefficient std errors. Thus, too large t-statistics. therefore, too many Type I errors: reject the null hypothesis  $H_0$  while it's actually true.
  - (c) Detection:
    - i. Residual plots
    - ii. Durbin-Watson statistics:
 
$$DW = \frac{\sum_{t=2}^T (\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2}{\sum_{t=1}^T \hat{\varepsilon}_t^2}$$

For large samples,  $DW \approx 2(1 - r)$ , where  $r$  is the correlation coefficient between residuals from one period and those from the previous period.

Results:

      - A.  $DW = 2 \Rightarrow$  Homoskedastic and not serially correlated.
      - B.  $DW < 2 \Rightarrow$  Positively serially correlated.
      - C.  $DW > 2 \Rightarrow$  Negatively serially correlated.

Formulated hypothesis with DW-table, upper and lower critical values

      - A. Hypothesis:  $H_0$ : the regression has **no** positive serial correlation.
      - B.  $DW < d_l$ : positive serially correlated. Reject null.
      - C.  $d_l < DW < d_u$ : inconclusive results.
      - D.  $DW > d_u$ : **There is no evidence that are positive correlated.**
  - (d) Correcting serial correlation:
    - i. Adjust the coefficient std errors. **recommended.** Using Hansen method.

- A. Serial correlation only: Hansen method.
- B. Heteroskedasticity only: White-corrected stand errors.
- C. Both: Hans methods.
- ii. Imporoe the specification of the model.

## 2.11 Multicollinearity and its cause and effects in regression analysis

Multicollinearity: Independent variables or linear combinations of independent variables are highly correlated.

1. Effect of Multicollinearity on Regression Analysis: Will increase the std errors of the slope coefficients.  
**Type II Error: A variable is significant, while we conclude it's not.**
2. Detecting: Common situation:  $t$  - statistic is not significant while  $F$  - test is significant. This tells us the independent variables are highly correlated.  
A simple rule works if there are 2 independent variables: when the absolute value of the sample correlation betewen any two independent variables in the regression is greater than 0.7.
3. Correcting: omit one or more of the correlated independent variables. The problame is that it's hard to find the variables that result in the multicollinearity.

## 2.12 Model misspecification

1. Defination of **Regression model of specification**: decide which independent variables to be included in the model.
2. Types of misspecification
  - (a) The functional form can be misspecified: important variables are ommitted; variables should be transformed; data is improperly pooled.
  - (b) Explanatory variables are correlated with error term in time series model: A lagged dependent variable is used as an independent variable; a function of the dependent variable is used as an independent variable (forecasting the past); independent variables are measured with error.
  - (c) Other time-series misspecification.

## 2.13 Models with qualitative dependent variables

Include qualitative dependent variables, like default, bankruptcy. Cannot use an ordinary regression model. Should use other models like **probit and logit models** or **discriminant models**.

1. Probit: normal distribution, give probability.
2. Logistic: logistic distribution.
3. Discriminant: result in an overall score or ranking.

# 3 Reading 11: Time-Series Analysis

## 3.1 Calculate/evaluate the predicted trend value for a time series given the estimated trend coefficients

1. Linear Trend Model and Log-linear Trend
  - (a) Definition:  $y_t = b_0 + b_1(t) + \epsilon_t$  Note:  $t$  is just time.
  - (b) Coefficients is determined by OLS. Ordinary least squared regression.  
 $\hat{y} = \hat{b}_0 + \hat{b}_1$
  - (c) Log-linear Trend Models
  - (d) Model:  $y_t = \exp b_0 + b_1(t) \Rightarrow \ln y_t = b_0 + b_1(t)$



### 3.2 Factors that determine whether a linear or a log-linear model trend should be used

1. Factors that determine which model is best: plot data.
2. Limitations of trend models:
  - (a) residuals are uncorrelated with each other. Otherwise, it will cause auto correlation and we should not use the trend model.
  - (b) For log-linear model, it is not suitable for cases with serial correlations (autocorrelation).
  - (c) Detect auto correlation: Durbin Watson statistic.  $DW = 2.0 \Rightarrow$  No auto correlation.

### 3.3 Autoregressive model, requirements for covariance stationary

1. Autoregressive model:
  - (a) Model:  $x_t = b_0 + b_1x_{t-1} + \varepsilon_t$
  - (b) Statistical inferences based on ordinary least squares estimates doesn't apply unless the time series is **covariance stationary**.
  - (c) Conditions for covariance stationary
    - i. Constant and finite expected value.
    - ii. Constant and finite variance.
    - iii. Constant and finite covariance between values at any given lag.

### 3.4 An autoregressive model of order $p$

1. Model(order  $p$ ):  $x_t = b_0 + b_1x_{t-1} + b_2x_{t-2} + \dots + b_px_{t-p} + \varepsilon_t$
2. Forecasting with an autoregressive model:
  - (a) One-period-ahead forecast for  $AR(1)$ :  $\hat{x}_{t+1} = \hat{b}_0 + \hat{b}_1x_t$
  - (b) Two-period-ahead forecast for  $AR(1)$ :  $\hat{x}_{t+2} = \hat{b}_0 + \hat{b}_1\hat{x}_{t+1}$

### 3.5 How the residuals can be used to test the autoregressive model

1. The residual should have no *serial correlation* if an AR model is correct.
2. Steps
  - (a) Estimate: Start with  $AR(1)$
  - (b) Calculate: the autocorrelations of the model residuals
  - (c) Test: whether the autocorrelations are significantly different from 0.  
The standard error is  $\frac{1}{\sqrt{T}}$  for  $T$  observations. The t-test for each observation is  $t = \frac{\rho_{\varepsilon_t, \varepsilon_{t-k}}}{1/\sqrt{T}}$ , with  $T - 2$  df.

### 3.6 Mean reversion and a mean-reverting level

1. Mean reversion: The time series tends to move toward its mean.
2. Mean-reverting level:  $\hat{x}_{t+1} = x_t$ , where  $\hat{x}_t$  is the predicted value.
3. All covariance stationary time series has finite mean-reverting level.

### 3.7 Contrast in-sample and out-of-sample forecasts and the forecasting accuracy of different time-series models based on the root mean squared error criterion.

1. in-sample, out-of-sample: determined by if the predicted data is in the range of the observations.
2. RMSE, root mean squared error: used to compare the accuracy. If the accuracy of out-of-sample is better, you should use it for future applications

### 3.8 Explain the instability of coefficients of time-series models

1. Instability or nonstationarity. Due to the dynamic economic conditions, model coefficients will change a lot from period to period.
2. Shorter time series are more stable, but longer time series are more reliable.

### 3.9 Random walk processes and their comparisons between covariance stationary processes

1. Random walk:  $x_t = x_{t-1} + \varepsilon_t$ 
  - (a)  $E(\varepsilon_t) = 0$ : The expected value of each error is zero.
  - (b)  $E(\varepsilon_t^2) = 0$ : The variance of the error terms is constant.
  - (c)  $E(\varepsilon_i, \varepsilon_j) = 0$ : There is no serial correlation in the error terms.
2. Random walk with a Drift:  $x_t = b_0 + b_1 x_{t-1} + \varepsilon_t$ , where  $b_1 = 0$
3. A random walk or a random walk with a drift have no finite mean-reverting level. Since  $b_1 = 1$ ,  $\frac{b_0}{1-b_1} = \frac{b_0}{0}$ . Therefore, they are not covariance stationary.
4.  $b_1 = 1$ , they exhibit a unit root. Thus, **the least square regression that been used in AR(1) will not work unless we transform the data.**

### 3.10 Things about unit roots: when they will occur, how to test them, how to transform data to apply AR

1. Unit root testing for nonstationarity:
  - (a) run an AR model and check autocorrelations
  - (b) perform Dickey Fuller test.
    - i. Transform:  $x_t = b_0 + b_1 x_{t-1} + \varepsilon \Rightarrow x_t - x_{t-1} = b_0 + (b_1 - 1)x_{t-1} + \varepsilon$
    - ii. Direct test if  $b_1 - 1 = 0$  using a modified t-test.
2. First differencing
  - (a) For a random walk, transform the data  $y_t = x_t - x_{t-1} \Rightarrow y_t = \varepsilon_t$  then start to use an AR model  $y = b_0 + b_1 y_{t-1} + \varepsilon$ , where  $b_0 = b_1 = 0$
  - (b)  $y$  is covariance stationary.

### 3.11 How to test and correct for seasonality in a time-series model, and calculate and interpret a forecasted value using an AR model with a seasonal lag.

1. Detect: special autocorrelation exists for some seasonal lags.
2. Correction: Add an additional seasonal lag term.

### 3.12 Explain autogressive conditional heteroskedasticity (ARCH) and describe how ARCH models can be applied to predict the variance of a time series

1. ARCH: the variance of the residuals in one period is dependent on the variance of the residuals in a previous period.
2. Using ARCH models:  
Example  $ARCH(1)$ :  $\hat{\varepsilon}_t^2 = a_0 + a_1\hat{\varepsilon}_{t-1} + \mu_t$  if  $a_1$  is significantly different from zero.  $\hat{\varepsilon}_t^2$  is the squared residuals.  
Note: Things like generalized least squares should be used to correct heteroskedasticity. otherwise, the std errors of the coefficients will be wrong, leading to invalid conclusions.
3. Predicting the variance of a time series: using ARCH model to predict the variance of future periods:  $\hat{\sigma}_{t+1}^2 = \hat{a}_0 + \hat{a}_1\hat{\varepsilon}_t^2$

### 3.13 Explain How time-series variables should be analyzed for nonstationarity and/or cointegration before use in a linear regression

1. Cointegration:
  - (a) Two time series are economically linked or follow the same trend and that relationship is not expected to change. – Error terms from regressing one on the other is covariance stationary and the t-test are reliable.
  - (b) How to test cointegration: regress  $y_t$  on  $x_t$   $y_t = b_0 + b_1x_t + \varepsilon$ ,  $y_t, x_t$  are two different time series. Then do a unit root test using the Dickey Fuller test with critical t-values calculated by Engle and Granger.  
If "A unit root" is rejected  $\Rightarrow$  covariance stationary, cointegrated.

## 4 Reading 12: Probabilistic Approaches: Scenario Analysis, Decision Trees, and Simulations

### 4.1 Describe steps in a simulation, Explain three ways to define the probability distributions for a simulation's variable, and describe how to treat correlation across variables in a simulation.

1. Steps in simulations:
  - (a) Determine the probabilistic variables
  - (b) Define probability distributions for these variables
    - i. Option 1: Historical data
    - ii. Option 2: Cross-sectional data: estimate the variable from similar companies.
    - iii. Option 3: Pick a distribution and estimate the parameters.
  - (c) Check for correlations among variables: Use historical data to determine whether any systematically related. Strong relations  $\Rightarrow$  1) Allow only one of the variables can be removed. Or 2) Build the rules of correlations into the simulation.
  - (d) Run the simulation.

### 4.2 Describe advantages of using simulations in decision making

1. Advantages: 1) Better input quality 2) Provides a distribution of expected value rather than a point estimate.

### 4.3 Describe some common constraints introduced into simulations

1. Constraints: specific limits imposed by users of simulations.
2. Types of constraints
  - (a) Book value constraints:
    - i. Regulatory capital requirements: minimum capital requirements
    - ii. Negative equity
  - (b) Earnings and cash flow constraints: might be imposed to meet analyst expectations
  - (c) Market value constraints

### 4.4 Describe issues in using simulations in risk assessment

1. Limitations of using simulations
  - (a) Input quality: garbage in, garbage out
  - (b) Inappropriate statistical distributions
  - (c) Non-stationary distributions: parameters will change
  - (d) Dynamic correlations: correlations between input variables will change.
2. Risk-adjusted value: cash flows from simulations are not risk-adjusted. SHOULD NOT be discounted at risk-free rate.

### 4.5 Compare scenario analysis, decision trees, and simulations

1. Scenario analysis: computes the value of an investment under some specific cases. Total probability is less than 1.
2. Decision trees: good when risk is discrete and sequential. Sum of probability is 1

## 5 Reading 13: Currency Exchange Rates: Determination and Forecasting

### 5.1 Calculate and interpret the bid-ask spread

1. Exchange rates
  - (a) Important things: exchange rate, spot exchange rate, forward exchange rate.
  - (b) Bid/offer(ask) rates: //Bid: The price that bank will buy. Offer: The price that bank will sell.
  - (c) Foreign Exchange Spread. Unit: "1 pip" =  $1/10000 = 0.0001$ . Spread depend on:
    - i. Spread in the interbank market. (Currencies, time, market volatility)
    - ii. Size of transaction.
    - iii. Relationship between the dealer and client.

## 5.2 Identify a triangular arbitrage opportunity and calculate its profit

- Example: USD/AUD. USD is the price currency, and AUD is the base currency.
  - Buy the base currency at the ask  $\Rightarrow$  Sell the price currency at the ask
  - Sell the base currency at the bid  $\Rightarrow$  Buy the price currency at the bid
- For investors, Rule: *up-the-bid-and-multiply, down-the-ask-and-divide*
  - Convert USD into AUD: going down the quote – from USD on top to AUD on bottom. Use the ask price for the quote.
  - Convert AUD into USD: similar. But from bottom to top.
- Cross Rate: The exchange rate between two currencies with the help by a common third currency.
- Cross Rate with bid-ask spreads.
  - Rule 1:
 
$$\left(\frac{A}{C}\right)_{bid} = \left(\frac{A}{B}\right)_{bid} \times \left(\frac{B}{C}\right)_{bid}; \left(\frac{A}{C}\right)_{offer} = \left(\frac{A}{B}\right)_{offer} \times \left(\frac{B}{C}\right)_{offer}$$
  - Rule 2:
 
$$\left(\frac{B}{C}\right)_{bid} = \frac{1}{\left(\frac{C}{B}\right)_{offer}}; \left(\frac{B}{C}\right)_{offer} = \frac{1}{\left(\frac{C}{B}\right)_{bid}}$$
- Triangular Arbitrage: If the dealer's quote is different from the cross rate, arbitrage opportunities may exist. Check it with Notes.

## 5.3 Distinguish between spot and forward rates and calculate the forward premium/discount for a given currency

- Forward premium relative to a second currency: Forward price > Spot price. Forward premium =  $F - S_0$
- Calculate the market-to-market value of a forward contract

$$V_T = (FP_T - FP)(contractsize)$$

where:

- $V_T$  = value of the forward contract at time  $T$ , denominated in price currency
  - $T$  = maturity of the forward contract
  - $FP$  = forward price locked in at inception to buy base currency
  - $FP_T$  = forward price to **sell** the same currency at time  $T$
- Value prior to expiration.

$$V_t = \frac{(FP_t - FP)contractsize}{1 + R\left(\frac{days}{360}\right)}$$

where

- $V_t$  is the value of the forward price
- $FP_t$ : forward price at time  $t$
- $days$  number of days remaining
- $R$  interest rate

## 5.4 Explaining international parity relations (covered and uncovered interest rate parity, purchasing power parity, and the international Fisher effect)

1. Covered interest rate parity: “Covered” means bound by arbitrage. Investor should earn the same return using either currency.

$$F = \frac{1 + R_A(\frac{days}{360})}{1 + R_B(\frac{days}{360})} S_0$$

2. Uncovered interest rate parity: Forward currency contract is unavailable, which makes the interest rate not bound by arbitrage. For a quote A/B, the base currency is expected to appreciate

$$E(\% \Delta_S)_{(A/B)} = R_A - R_B$$

Uncovered interest rate parity can only **forecast** the future spot exchange rate.

3. Comparing covered and uncovered interest parity:

- (a) Covered interest parity  $\Leftrightarrow$  No-arbitrage forward rate
- (b) Uncovered interest parity  $\Rightarrow$  **Expected** future spot rate

4. International Fisher Relation

- (a)  $R_{nominal} = R_{real} + E(inflation)$
- (b) Under real interest rate parity, the real interest rate are assumed to converge across different markets.

$$R_{nominalA} - R_{nominalB} = E(inflation_A) - E(inflation_B)$$

5. Purchasing Power Parity: Assumed by one price law.

- (a) Absolute purchasing power parity: The average price of a basket of consumption goods.

$$S(A/B) = CPI(A)/CPI(B)$$

May not hold due to different weights of consumptions.

- (b) Relative Purchasing Power Parity: Changes in exchange rates should exactly offset the price effects of any inflation differential between the two countries.

$$\% \Delta S(A/B) = Inflation_A - Inflation_B = change in spot price(A/B)$$

Not always held in short run.

- (c) Ex-Ante Version of Purchasing Power Parity: Similar to relative PPP, but Ex-Ante uses expected inflation instead of actual inflation.

## 5.5 Describe the relations among the international parity conditions

See Notes Page 263, Vol. 2.

## 5.6 Evaluate the use of the current spot rate, the forward rate, purchasing parity and uncovered interest parity to forecast future spot exchange rates

1. Real Exchange Rate =  $S_t \left[ \frac{CPI_B}{CPI_A} \right]$ ,  $S_t$  is the spot rate at time  $t$  given as A/B

## 5.7 Explain how flows in the balance of payment accounts affect currency exchange rates

1. Balance of Payments: accounting method to track transactions between a country and its international trading partners.
  - (a) Including government, consumer, and business transactions.
  - (b) current account + financial account + official reserve account = 0
  - (c)
    - i. Current account: Exchanges of goods/services, exchanges of investment income and unilateral transfers like gifts.
      - A. Surplus: we sell more to other countries, buy less from them
      - B. Deficit: we buy more from the rest, sell less to them
    - ii. Financial account/Capital account: Flows of funds for debt and equity investment into/out of a country. Surplus: Money is flowing into the country.
    - iii. Official reserve: those made from the reserves held by the government. Normally doesn't change from year to year.
2. Influence of BOP on Exchange Rates
  - (a) Current Account
    - i. Flow mechanism
      - A. Deficit: increase the supply of that currency in the market. Because exporters to our countries need to convert their revenue to their own currency.  $\Rightarrow$  Down on the exchange value.
      - B. Depreciation of the currency may rebalance the current account. Depending on **The initial deficit, the influence of exchange rates on import/export prices, price elasticity of traded goods**. See Notes P265 for details.
    - ii. Portfolio Composition mechanism. Countries with current account surpluses usually have capital account deficits, which typically take the form of investments in countries with current account deficits. As a result of these flows of capital, investor countries may find their portfolios' composition being dominated by few investee currencies. When investor countries decide to rebalance their investment portfolios, it can have a significant negative impact on the value of those investee country currencies.
    - iii. Debt sustainability mechanism: Current account deficit may be balanced by borrowing money from other countries. If the debt too high, lenders may question the security, leading to the depreciation of the borrower's currency.
  - (b) Capital Account Influences: Money flow in  $\Rightarrow$  Demand for my country's currency increases  $\Rightarrow$  Appreciation.
    - i. Good: can help to overcome a shortage of internal savings
    - ii. Bad: Too much money can be problematic for emerging markets.
      - A. Excessive appreciation of the domestic currency
      - B. Financial asset, real estate bubbles
      - C. Increase in external debt
      - D. Excessive consumption in the domestic market funded by credit
3. real exchange rate  $(A/B) = \text{equilibrium real exchange rate } (A/B) + (\text{real interest rate}_B - \text{real interest rate}_A) - (\text{risk premium}_B - \text{risk premium}_A)$   
 This equation is not precise. We cannot use it to calculate the rate.

### 4. Taylor Rule

$$R = r_n + \pi + \alpha(\pi - \pi^*) + \beta(y - y^*)$$

- (a)  $R$  = Central bank policy rate implied by the Taylor Rule



- (b)  $r_n$  = Neutral **real** policy interest rate
- (c)  $\pi$  = Current inflation rate
- (d)  $\pi^*$  = Central bank's target inflation rate
- (e)  $y$  = log of current level of output
- (f)  $y^*$  = log of central bank's target (sustainable) output
- (g)  $\alpha, \beta$  = policy response coefficients. (suggested value: 0.5 for both)

$$\text{Real interest rate} = r = R - \pi = r_n + \alpha(\pi - \pi^*) + \beta(y - y^*)$$

Substitute the real interest rate equation, we have

Real exchange rate (A/B) = equilibrium real exchange rate(A/B) + difference in neutral real policy interest rate(B-A) +  $\alpha$ [difference in inflation gap (B-A)] +  $\beta$ [difference in output gap(B-A)] - (risk premium<sub>B</sub> - risk premium<sub>A</sub>) // Where: Inflation gap = current inflation - target inflation, Output gap = current output - target output

## 5.8 Explain approaches to assessing the long-run fair value of an exchange rate

1. The ex-ante version of relative PPP holds  $\Rightarrow$  The real exchange rates constant. However, relative PPP does not necessarily hold over the short term. Over long term, PPP holds, and the real rate will be near its equilibrium level.
2. IMF assesses long-term equilibrium real exchanges rate based on
  - (a) Macroeconomic balance approach: if the Ex rates need to be adjusted to equalize the expected current account imbalance and the sustainable current account imbalance.
  - (b) External sustainability approach. How rates need to be adjust to force a country's external debt relative to GDP towards its sustainable level.
  - (c) Reduced-form econometric model approach.

## 5.9 Describe the carry trade and its relation to uncovered interest rate parity and calculate the profit from a carry trade.

1. FX carry trade: Invest in a higher yielding funding with the funds borrowed in a lower yielding currency. This is due to the uncovered interest rate parity may not hold.
2. Risk of the Carry Trade
  - (a) The exchange rate may change abruptly.
  - (b) The return distribution is not normal. Negative skewness and excess kurtosis (fat tails).  $\Rightarrow$  High probability of large loss
3. Risk Management in Carry Trades
  - (a) Volatility filter: if volatility > certain threshold, close the carry trade.
  - (b) Valuation filter: valuation band for each currency based on PPP. If the value of a currency falls below the band, we will increase its ratio.

**5.10 Describe the Mundell-Fleming model, the monetary approach and the asset market approach to exchange rate determination.**

**5.11 Forecast the direction of the expected change in an exchange rate based on balance of payment, Mundell-Fleming, monetary, and asset market approaches to exchange rate determination.**

**5.12 Explain the potential effects of monetary and fiscal policy on exchange rates.**

1. Mundell-Fleming Model: evaluate the impact of monetary and fiscal policies on interest rates, and therefore on exchange rates.

2. Flexible Exchange Rate Regimes: rate are determined by markets.

(a) High Capital Mobility: Expansionary M and F are likely to have opposite effects. Expansionary M will reduce the interest rate, reduce the inflow of capital investment, reduce the demand for domestic money, depreciation.

(b) Low Capital Mobility: Uncertain

(c) Summary:

Monetary/Fiscal	High Capital Mobility	Low Capital Mobility
Expan/Expan	Uncertain	Depreciation
Expan/Restr	Depreciation	Uncertain
Restr/Expan	Appre	Uncertain
Restr/Restr	Uncertain	Appreciation

(d) Fixed Ex rate regimes

i. If monetary expansionary (depreciation), governments need to buy money in the FX market, therefore will reverse the effect from monetary expansionary.

ii. Fiscal expansionary → Appreciation (More money needed) → Government need to sell money to keep Ex rate stable. → Fiscal effect on aggregate demand will be reinforced.

3. Monetary Approach to Exchange Rate determination

Inflation play no role in exchange rate in Mundell-Fleming model.

Assumptions: 1. Output is fixed.

(a) Method 1: Pure Monetary model. Assume: PPP holds, output is constant.

(b) Dornbusch overshooting model. Price are inflexible in short term. Expan Monetary → price increase, interest rate down → depreciation of currency. Therefore, in short term, price sticky, interest rate down too much. → depreciation is greater than PPP implies.

4. Portfolio Balance Approach to Exchange rate determination.

(a) It focuses on long-term implications of fiscal policy on currency values.

(b) Fiscal deficit → sell bonds → When investors think the country is safe, they will continue to buy bonds. If the investors refuse to fund the deficits → depreciation

5. In short term, with free capital flows, expan fiscal → appreciation

Long term → government has to reverse expan fiscal. Otherwise, investor will refuse to fund it, then the country have to monetize its debt (print money). → depreciation

**5.13 Objectives of central bank intervention and capital controls and describe the effectiveness of intervention and capital controls.**

See Notes P274. Old version.

### 5.14 Describe warning signs of currency crisis.

1. Terms of trade deteriorate
2. Foreign reserve down quickly
3. Real exchange rate is extremely higher than mean-reverting value.
4. Inflation increases.
5. Equity markets have a boom-bust cycle.
6. Money supply relative to bank reserves increases.
7. Nominal private credit grows.

### 5.15 Technical analysis

See Notes P275 Old version.

## 6 Economic Growth and the Investment Decision

### 6.1 Compare factors favoring and limiting economic growth in developed and developing economies

Two important factors. 1: GDP per capita. 2: Growth of GDP

1. Preconditions for Growth
  - (a) Saving and investment. Positively correlated with economic development.
  - (b) Financial markets and intermediaries. Help resources reallocation. However, it may increase leverage, risks.
  - (c) Political stability, rule of law and property rights.
  - (d) Investment in human capital. Worker's skills.
  - (e) Tax and regulatory systems. Lower tax burdens are good. Lower regulation levels are good.
  - (f) Free trade and unrestricted capital flows.

### 6.2 Describe the relation between the long-run rate of stock market appreciation and the sustainable growth rate of economy.

The growth in the price is related to earnings and GDP:  $\Delta_P = \Delta_G DP + \Delta(E/GDP) + \Delta(P/E)$ . Over the long-term,  $\Delta(E/GDP) = 0, \Delta(P/E) = 0$ . Only GDP growth matters.

### 6.3 Explain why potential GDP and its growth rate matter for equity and fixed income investors.

Higher GDP growth  $\rightarrow$  Higher interest rates  $\rightarrow$  Higher real asset returns.

Higher GDP growth makes people think that future income is increasing, therefore increase consumptions and reduce savings. To encourage consumers save, higher interest rate is needed.

In short term, actual GDP in excess of potential GDP will result in rising prices  $\rightarrow$  inflationary pressure.

## 6.4 Distinguish between capital deepening investment and technological progress and explain how each affects economic growth and labor productivity

### 1. Factor input and Economic growth

- (a) Model: 2-factor aggregate production:  $Y = F(L, K)$  at a level of tech  $T$ . Output  $Y$  is a function of labor ( $L$ ) and capital.
- (b) Cobb-Douglas Production:  $Y = TK^\alpha L^{(1-\alpha)}$   
Dividing both sides by  $L$ , the output per worker is

$$Y/L = T(K/L)^\alpha$$

## 6.5 Forecast potential GDP based on growth accounting relations

### 1. Growth Accounting Relations

$$\Delta Y/Y = \Delta A/A + \alpha \times (\Delta K/K) + (1 - \alpha)(\Delta L/L)$$

i.e. growth rate in potential GDP = long-term growth of tech +  $\alpha$  long-term growth rate of capital +  $(1-\alpha)$ \*(long-term growth rate of labor)

The growth of technology is not observable. Can be estimated from previous data: ex-growth rate - ex-growth rate from  $L$  and  $K$

## 6.6 Explain how natural resources affect economic growth and evaluate the argument that limited availability of natural resources constrains economic growth

- 1. Access to natural resources does not require ownership of resources.
- 2. Another theory: ownership of natural resources may actually inhibit growth. → Dutch disease: global demand for natural resources drives up the country's currency, making all other exports more expensive and uncompetitive.

## 6.7 Explain how demographics, immigration, and labor force participation affect the rate and sustainability of economic growth

### 1. Labor Supply Factors

- (a) Demographics: A country's age distribution. Countries with younger age will have a higher potential growth.
- (b) Labor force participation.
- (c) Immigration: a potential source in developed countries ⇒ increase work force
- (d) Average hours worked

## 6.8 Explain how investment in physical capital, human capital, and technological development affects economic growth

- 1. Human capital: knowledge and skills that individuals possess. Can be enhanced via education.
- 2. Physical capital: infrastructure, computers, telecommunications (ICT) AND non-ICT capital (machinery, transportation and non-residential construction). More investment in physical capital ⇒ Good GDP growth.  
More investment may enhance the tech improvements.

3. Technological development. Investment in tech will increase the productivity.
4. Public infrastructure: like roads, bridges, and municipal facilities. This will enhance total productivity. Because the private investment will not invest these public things for their little returns.

## 6.9 Compare classical growth theory, neoclassical growth theory, and endogenous growth theory

1. Classical growth theory: In the long-term, population growth increases whenever there are increases in per capita income above subsistence level due to increase in capital or tech progress.  $\Rightarrow$  Growth in real GDP per capita is not permanent.  $\Rightarrow$  This is not supported by observed facts.
2. Neoclassical Growth theory:
  - (a) Estimate steady state growth rate. Equilibrium economy is when the output-to-capital ratio is constant. When the output-capital ratio is constant, the labor-to-capital ratio and output per capita also grow at the equilibrium rate. Check textbooks here.
  - (b) Based on Cobb-Douglas function,
    - i. Sustainable growth of output per capita:  $g^* = \frac{\theta}{1-\alpha}$ , where  $\theta$  is the growth rate in technology, and  $1 - \alpha$  is the labor's share of GDP.
    - ii. Sustainable growth rate:  $G^* = \frac{\theta}{1-\alpha} + \Delta_L$ , which is the growth rate of output per capita plus the growth of labor.
    - iii. Comments
      - A. Capital deepening will not affect the growth rate in the long run.
3. Endogenous Growth Theory
  - (a) Technological growth is a result of investment in physical and human capital. Returns to capital are constant.
  - (b) Private investments in R&D also benefits all economy.

## 6.10 Explain and evaluate convergence hypotheses

1. Absolute convergence: Less developed countries will achieve equal living standards overtime.
2. Conditional convergence: Convergence in living standards will only occur for countries with the same savings rates, population growth rates and production functions.
3. Club convergence: Countries may be part of a club. Poorer countries that are part of the club will catch up their richer peers. Institutional changes can help a country to join the club. Those are not in the club will never catch up.

## 6.11 Describe the economic rationale for governments to provide incentives to private investments in technology and knowledge.

R&D are risky. Governments support may provide incentives to private R&D, and therefore boosts the growth of the overall economy.

## 6.12 Describe the expected impact of removing trade barriers on capital investment and profits, employment and wages, and growth in the economies involved.

1. Increased investment from foreign savins

2. Allows focus on industries where the country has advantage.
3. Increased markets
4. Increased sharing of tech
5. Increased competition removes bad firms and relocating assets.

## **7 Reading 15: Economics of Regulation**

### **7.1 Describe classifications of regulations and regulators**

1. Regulations: i. Statues; ii. Administrative regulatinos; iii. judicial law
2. Regulators: government agencies/indepedent regulators/outside bodies. Independent regulators including self-regulating organizations that regulates and represents their members. Outside bodies will not regulate, but their products are referenced by regulators.

### **7.2 Describe uses of self-regulation in financial markets**

1. US: FINRA is an SRO recognized by SEC.
2. In civil-law countries, independent SROs are rare, and government agencies fulfill the role of SROs.
3. In common=law countries, independent SROs are historically good.

### **7.3 Describe the economic rationale for regulatory intervention**

1. Economic Rationale for Regulation. Regulations are needed when
  - (a) Information frictions. When information is not equally availabel or distributed.
  - (b) Externalities.

### **7.4 Describe regulatory interdependencies and their effects.**

1. Regulatory Interdependencies.
  - (a) Regulatory capture theory: Regulators will at some point in time be influenced or controlled byt the industiry that is being regulated. Because the regulators will be influenced by the industry, and the experience will sometimes lead to impartial conclusions.
  - (b) Regulatory competition: Regulatory difference between jurisdictions will lead to it. Regulators compete to provide the most business-friendly environment.
  - (c) Regulatory arbitrage: businesses find a coutry that best for itself.

### **7.5 Describe the tools of regulatory intervention in markets**

1. Price mechanisms
2. Restricting/requiring certain activities. Ban certain activities or require to perform some activities.
3. Provision of public goods or financing private projects.

## 7.6 Explain purposes in regulating commerce and financial markets

1. Regulating commerce: Government regulations, including company laws, tax laws, contract laws, competition laws, banking laws, bankruptcy laws and dispute resolution systems.  
This laws may help or hinder commerce.
2. REgulating financial markets: regulation of securities markets and regulation of financial institutions.
  - protecting investors, creating confidence in the markets, and enhancing capital formation.
  - (a) Regulation of security markets
  - (b) Regulation of Financial Institutions: Prudential supervision, the monitoring and regulation of financial institutions to reduce system-wide risks and to protect investors. Cost-benefit analysis should include hidden costs.

## 7.7 Describe anticompetitive behaviors targeted by antitrust laws globally and evaluate the antitrust risk associated with a given business strategy.

Antitrust regulation works to promote domestic competition. Like blocking a merger that leads to excessive concentration of market share. International companies may be subject to antitrust laws in different countries.

## 7.8 Benefits and costs of regulation

Costs include the implementation cost and the cost of the regulation to the private sector. *Regulatory burden*: the cost of compliance for the regulated entity. Regulatory burden - benefits that private sector receives = Net regulatory burden.

## 7.9 Evaluate how a specific regulation affects and industry company, or security

1. Can help or hinder the industry or the company.
2. Not necessarily always costly for those that being regulated.
3. May introduce inefficiencies in the market. For example, government bailout of financial institutions may convey a message that companies will be helped. And the credit spreads will not fully reflect their risk.
4. Certain industries have more exposure to certain types of regulations.

# 8 Reading 16: Intercorporate Investments

## 8.1 Describe the classification, measurement, and disclosure under IFRS for 1) Investments in financial assets, 2) Investments in associates, 3) joint ventures, 4) bussiness combinations, and 5) special purpose and variable interest entities

## 8.2 Distinguish between IFRS and US GAAP in the classification, measurement, and disclosure of things above.

1. Classification: a. Investments in financial assests. b. Investments in associates (investing firm has a significant influence but not control). c. Bussiness combinations.
  - (a) Financial assets. Ownership < 20%. Accounting treatment:
    - i. IFRS: held-to-maturity, available-for-sale, fair value through profit/loss.



- ii. GAAP: similar to IFRS.
    - iii. IFRS 9 start from 1/1/2018. Early adoption is allowed.
  - (b) Investments in associates. Ownership 20%~50%. Most important thing is “significant influence.” Equity method is used.
  - (c) Business combinations. Ownership > 50%. “Controlling” is important. The acquisition method is used.
  - (d) Joint ventures. Equity method for it.
2. Reporting of Intercompany investments
- (a) Financial assets. Acquisition is recorded at cost, and dividend or interest income is in Income Statement.
    - i. Held-to-maturity. Debt securities that cannot be sold prior to maturity except in unusual circumstances. Long-term: reported on the balance sheet at the amortized cost. Interest income (coupon cash flow adjusted for amortization) in the income statement but subsequent changes in fair value are ignored.
    - ii. Fair value through profit or loss.
      - a. Held-for-trading: Debt/equity for the purpose of profiting in the near term. < 3 month. Changes in fair value (realized or not) and dividend/interest are in Income Statement.
      - b. Designated at fair value: Report debt/equity that may be treated as held-to-maturity or available-for-sale at fair value. Gains/Loss are in Income Statement.
    - iii. Available-for-sale: are neither held-to-maturity nor held-for-trading. Reported on the balance at the fair value. However, only the realized gains/losses and dividend or interest income are in the income statement. Unrealized gains/losses are in comprehensive income. When sold, these unrealized things will move to income statement.  
 NOTE: In IFRS, unrealized gains or losses on available-for-sale **sale** that from foreign exchange movements are in the income statement. In USGAAP, the entire unrealized gain/loss are recognized in equity.  
 Available-for-sale **Equity**, the treatments are similar in IFRS/USGAAP.
  - (b) Reclassification of Investments in Financial Assets.
    - i. IFRS: a. does not allow reclassification into/out of the designated at fair value. b. Out of the held-for-trading is severely restricted.
      - c. Debt securities in available-for-sale can be reclassified as held-to-maturity. The value will be remeasured to reflect its fair value at the time it is reclassified.
      - d. Held-to-maturity: can be reclassified as available-for-sale. Carrying value is remeasured to the fair value, and any difference is recorded in comprehensive income.
    - ii. USGAAP:
      - A. Permit reclassification into/out of held-for-trading or designated at fair value. Unrealized gains on the income statement is reclassified.
      - B. Reclassification out of available-for-sale to held-for-trading, the cumulative gain/loss in comprehensive income will be recognized in income.
      - C. Out-of-available-for-sale to held-to-maturity: Gain/Loss in comprehensive income statement will be amortized over the remaining life of the security.
      - D. Out of held-to-maturity to available-for-sale: Unrealized Gain/Loss goes into comprehensive income statement.
      - E. Summary

From	To	Unrealized G/L
Fair value w/ G/L*	Any	Income Statement
Held-to-maturity	Fair value*	Income statement
Held-to-mat	Available-for-sale	Other comprehensive income
Available-for-sale	Held-to-maturity	Amortize out of other comprehensive income
Available-for-sale	Fair value w/ G/L*	Transfer out of other comprehensive income

\*: Restricted under IFRS

- (c) Impairment of Financial Assets: Held-to-Maturity (HTM) and available-for-sale (AFS) evaluated for impairment at each reporting period.
- US GAAP. If its decline in value is determined to be other than temporary. HTM/AFS, the write-down to fair value is treated as a realized loss.
  - US GAAP Reversals: NOT allowed.
  - IFRS: Impairments are in the income stmt. Impairment of a debt or equity security  $\Leftarrow$  at least one loss event HAS occurred, and its effect on the security's future cash flows can be estimated reliably.  
 Debt: loss events – default on payments  
 Equities: loss events – fair value has experienced a decline, and it's unlikely to recover.  
 HTM security: if it's impaired, its carrying value will be the PV of future cash flows, using the interest rate when the security was PURCHASED.
  - IFRS Reversals: Permitted on HTM, available-for-sale. Not permitted for equity.
- (d) Analysis of Investments in Financial Assets: Separate a firm's operating results from its investment results.  
 For comparison: market values for financial assets.  
 Remove nonoperating assets when calculating the return on operating assets ratio.  
 Investment classification will be misleading.
- (e) IFRS 9 (New standards)
- Instead of HTM, available-for-sale, and held-for-trading, Using new terms: amortized cost, fair value through profit or loss (FVPL), and fair value through other comprehensive income (FVOCI)
  - Amortized cost (For debt securities only): If the securities are
    - Business model test: being held to collect contractual cash flows
    - Cash flow characteristic test: the contractual cash flows are either principal or interest on principal only.
  - Fair Value Through Profit or Loss (for debt and securities)
    - Debt: can be FVTPL if held-for-trading, or Amortized cost results in an accounting mismatch.
    - Equity: Must be FVTPL if it is held-for-trading. Other equity can be FVTPL or fair value through OCI, but once classified, the choice cannot be reversed.
  - Fair Value Through OCI (Equity Only) = Available-for-sale
- (f) Reclassification under IFRS 9
- Reclassification of Equity is not allowed.
  - Reclassification of debt from amortized cost to FVPL or vice versa is OK only if the business model has changed. Unrecognized G/L on debt securities carried at amortized cost and reclassified as FVPL are in the income stmt.
  - Debt that out of FVPL: measured at amortized cost transferred at fair value on the transfer date, and the fair value becomes the carrying amount.
- (g) Investments in Associates
- Using equity method.

- ii. Initial investment is recorded at cost and reported on balance sheet as a noncurrent asset.
  - iii. Subsequent: proportional share of earnings increases the investment account on the balance sheet, and is recognized in the income stmt. Dividends received are treated as a return of capital, and reduce the investment account, will not be in income stmt.
  - iv. If the investee has a loss, investor will have a proportionate loss in balance, and income stmt. If the investment account on balance sheet reduce to 0, we stop using equity method until the earnings recovered.
- (h) Fair Value Option
  - i. USGAAP allows equity method investment to be recorded at fair value.  
IFRS: the fair value only good to venture capital firms, mutual funds and similar firms.  
Decision to use FVO is irrevocable. If use FVO, any changes are in income stmt.
  - ii. Excess of Purchase Price Over Book Value Acquired.
    - A. At the acquisition date: the excess of the purchase price over the proportionate share of book value is allocated to the investee's identifiable assets and liabilities based on their fair values, and in investor's balance sheet. The remainder is good will.
    - B. Investor need to recognize expense based on the excess amount assigned to the investee's asset and liabilities.
    - C. Investor may need to include additional depreciation proportionate of the Excess of purchase price. See Notes-2 P11 examples and textbooks.
  - iii. Impairments of Investments in Associates:
    - A. Equity method investments need tests for impairment.
    - B. GAAP: Fair value of the investment < the carrying value (investment account on the balance sheet), and decline is permanent. Write-down to fair value, loss in income stmt.
    - C. IFRS/GAAP: asset cannot write up
  - iv. Transactions with the Investee Profit from these transactions deferred until the profit is confirmed through use/sale to a third party.
    - A. Upstream (investee to investor): investee recognized all profit in its income stmt. Eliminate its proportionate share of the profit.
    - B. Downstream (investor to investee). Investor recognize profit in its income stmt. Eliminate the proportionate share of unconfirmed profit.
  - v. Analytical Issues for Investments in Associates.
    - A. Equity method may have higher earnings.
    - B. Investor only report investee's proportionate share of equity. Investee's debt are ignored, and leverage is lower.
    - C. Proportionate share of Investee's earnings may be reinvested, not available to investor via dividend.
- (i) Business Combinations
  - i. Classification: Acquisition method is required for business combinations.
    - A. IFRS: None
    - B. GAAP:
      - Merger. Acquiring firm survived.
      - Acquisition. Acquiring and Acquired continue to exist in a parent-subsidary form. Not 100% of sub is owned by parent.
      - Consolidation. A new entity absorbs both of companies.
  - ii. Accounting methods
    - A. Purchase method
    - B. Pooling-of-interests method (eliminated) = uniting-of-interests method in IFRS
      - Just combine assets and liabilities.

- Two companies combined using historical book values
- Operating results are restated, as two have been always combined.
- Ownership interests continue, and former accounting bases maintained.
- C. Acquisition method
  - A, L, Revenue, Expense of sub are combined with the parent. Intercompany transactions are excluded. Stock holder's equity is ignored. Because this is not controlled by the company.
  - noncontrolling interest account may be needed for proportionate asset that are not owned by the parent. Check examples.
- D. Good will in acquisition
  - Goodwill. Fair value for identifiable assets/liabilities. Any remainder will be unidentifiable A/L  $\Rightarrow$  Goodwill
  - GAAP: full goodwill. Fair value of the sub(calculated by acquired ratio) - Fair value of net identifiable net assets of the subsidiary; IFRS can use full goodwill or partial goodwill, partial goodwill = purchase price - (%owned\*FV of net identifiable asset)
  - Noncontrolling interest: For Full good will - nci based on the acquired company's fair value. For Partial goodwill - nci based on the fair value of the acquired company's identifiable net assets.
- E. Annual test impairment of Goodwill
  - IFRS: carrying amount of cash generating unit > the recoverable amount
  - GAAP: 2 steps. Carrying value of the reporting unit > the fair value; the loss = carrying value of the good will - the implied fair value of the goodwill.
- (j) Bargain Purchase: If acquisition price < fair value of net asset acquired, gain should be in income stmt for GAAP and IFRS.
- (k) Joint Ventures:
  - i. One entity shared by multiple investors. Equity method in GAAP and IFRS.
  - ii. Rare case: Proportionate consolidation method is OK for GAAP/IFRS. In Proportionate consolidation, investor only reports the proportionate share of assets, l, reve, expense. No minority owner's interest.
- (l) Special Purpose and Variable Interest Entities
  - i. SPE: Special purpose entity. Isolate certain A and L of the sponsor. SPE is often off-balanced-sheet. Thus enhance the ratios.
  - ii. VIE is a special SPE in FASB. Consolidated by the primary beneficiary. VIE Characteristics:
    - A. At-risk equity, insufficient to finance the entity's activities without additional support.
    - B. Equity investors lack: decision making rights, obligation to absorb loss, or the right to receive expected returns.
  - iii. IFRS: Sponsoring entity must consolidate if it controls SPE.
- 3. Analyze how different methods used to account for intercorporate investments affect financial statements and ratios.
 

Four important effects, Equity/Proportionate consolidation/Acquisition

  - (a) All 3 report the same Net Income.
  - (b) Equity: Equity method = Proportionate = Acquisition method - minority interest
  - (c) Assets and Liabilities: Acquisition > Proportionate consolidation > Equity
  - (d) Revenues and expenses: Acquisition > Proportionate consolidation > Equity

## 9 Reading 17: Employee Compensation: Post-Employment and Share-Based

### 9.1 Describe the types of post-employment benefit plans and implications for financial reports

Types: Defined-contribution plan and Defined-benefit plan. For defined-contribution plan, accounting is easy. Just the employer's contribution.

Defined-benefit:

1. Usually via a separate legal entity, like a trust.
2. funded status: difference between the pension obligation and the plan assets.
3. Other post-employment benefits: basically healthcare benefits.

### 9.2 Explain and calculate measures of a defined benefit pension obligation, i.e., PV of the defined benefit obligation and projected benefit obligation, and net pension liability.

1. Things to know

-Projected Benefit Obligation, or Present Value of Defined Benefit Obligation under IFRS. :The PV of all future obligation, based on expected future salary increases. PVB will change from one period to the next.

- (a) Current service cost: PV of benefits earned by during the current period.
- (b) Interest cost: Increases in the obligation due to the passage of time. Interest will accrue. The cost = the pension obligation at the beginning of the period times the discount rate.
- (c) Past service costs: retroactive benefits awarded to employees when plan's changed. IFRS: expensed immediately. GAAP: amortized over the average service life of employees.
- (d) Changes in actuarial assumptions: Gains/losses due to changes like mortality, employee turnover, retirement age, and the discount rate.
- (e) Benefits paid.

2. Balance Sheet Effects:

Funded status = fair value of plan assets - PBO

Balance sheet asset(liability) = funded status. This is good for IFRS/GAAP.

### 9.3 Describe the components of a company's defined benefit pension costs.

1. Total periodic pension cost = employer contributions - (ending funded status - beginning funded status)  

$$TPPC = \text{current service cost} + \text{interest cost} - \text{actual return on plan assets} + / - \text{actuarial losses, gains due to changes in assumptions affecting PBO} + \text{prior service cost}.$$
2. Periodic Pension Cost Reported in P&L, i.e. Income stmt
  - (a) **Current service cost.** Immediately recognized in income stmt. CSC is the increase in PBO since the employee worked one more period.
  - (b) **Interest cost.** Immediately recognized. Increase in PBO due to the passage of time.
  - (c) **Expected return on plan assets.** The return on the plan assets has no effect on the PBO. Use expected return to compute the reported pension expense. Difference in expected return and actual return are in "actual gains and losses" IFRS: expected rate of return is assumed = the discount rate to compute PBO.

- (d) **Actuarial gains and losses** Recognized in Other Comprehensive Income. has 2 components. G/L due to changes in actuarial assumptions; difference in actual/expected return. IFRS: not amortized. GAAP: amortized with corridor.
- (e) **Corridor Approach.** If  $G/L > 10\%$  of  $\max(\text{beginning PBO, plan assets})$ , the excess amount should be amortized over the remaining service life of employees. Time can be shorter if wanted, but consistent.
- (f) **Past(prior) service costs.** If pension plan is changed, the change reported in OCI. And amortized of the remainig life of affected employees. In IFRS: changes are reported in income stmt instantly.
- (g) Summary

Component	GAAP	IFRS
Current service costs	Income stmt	Income stmt
Past service costs	OCI, amortized over life	Income
Interest costs	Income	Income
Expected return	Income	Income
Actuarial G/L	Amortized part in Income, Others in OCI	OCI

- (h) **Presentation.** GAAP: income stmt aggregated and presented in one line. IFRS: components may be presented separately.
- (i) **Capitalizing Pension Costs.**

## 9.4 Explain and calculate the effect of a defined benefit plan's assumptions on the defined benefit obligation and periodic pension cost.

3 Assumptions need disclosures.

1. **Discount rate:** Interest rate to compute the PV of BO and the current service cost.
2. **Rate of compensation growth:** average annual increase rate of employee's compensation.
3. **Expected return on plan assets:** long-term rate of return on the plan's investments. Only good in GAAP, b/c in IFRS, it's equal to the discount rate.

To improve reports, a company

1. Increase the discount rate to reduce PBO, pension costs, and interest cost.
2. Decrease the compensation growth rate to reduce futher benefit payments, PBO, and current service cost and interest cost.
3. Increase the expected return on plan assets.

Ultimate healthcare trend rate: constant rate of a health care inflation.

## 9.5 Explain and calculate how adjusting for items of pension and other post-employment benefits affect financial stmts and ratios.

One need to pay attention to different assumptions when compare companies:

1. Gross vs. net pension assets/liabilities. ROA will be lower with gross pension A/L; leverage ratios will be higher.
2. Differnces in assumptions used: like discount rates.
3. IFRS, GAAP.
4. Difference due to classification in the income stmt. GAAP: the entire periodic pension cost in P&L, including interest are operating expense. IFRS: can be in various line items.

## 9.6 Interpret pension plan note disclosures including cash flow related information.

If the difference between cash flow and total periodic pension cost is material, the difference can be reclassified from Operating activities to Financing activities.

## 9.7 Explain issues associated with accounting for share-based compensation

1. Forms: stock options and outright share grants.
2. Recording: issues for stocks – the value needs estimating.
3. Should be spread over the period for which they reward the employee.

## 9.8 Explain how accounting for stock grants and stock options affects financial stmts, and the importance of companies assumptions in valuing these grants and options.

IFRS and GAAP are similar.

1. **Stock options.** Expense is based on the fair value of options. Spread over the service time (grant date to the actual date that employees can act). Net income and retaining earnings will decrease, but total-equity will not change.
2. **Determining Fair Value.** If on-market, use market price. Otherwise, Using different models to find it.
3. **Stock grants.** Compensation expense is based on the fair value of the grant date. Allocated over the service period.
4. **Stock appreciation rights.** It's different from stock options. It gives the employee the right to receive compensation based on the increase in the price of the firm's stock over some threshold. No shares are issued. No dilution, but the company needs to pay cash.
5. **Phantom stock.** Similar to stock appreciation rights. But is based on the performance of hypothetical stock

# 10 Reading 18: Multinational Operations

## 10.1 Distinguish among presentation currency, functional currency and local currency.

1. Definition:
  - Local currency: currency of the country being referred to.
  - Functional currency: determined by the management. The main currency the company uses.
  - Presentation (reporting) currency: The currency the parent company prepares stmts

## 10.2 Describe foreign currency transaction exposure, including accounting for and disclosures about foreign currency transaction gains and losses

1. Foreign currency denominated transactions are measured in the presentation currency at the spot rate on the transaction date. Currency risk arises when the transaction date and payment date differ, leads to different spot rate.
2. If balance sheet date occurs before the transaction is settled, recognize G/L in balance sheet, and unrecognized G/L in income stmt. When the transaction settled, additional G/L may need to be recognized.

3. Analyst Issues: G/L due to currency in income stmt may be in operating or non-operating income. B/c accounting std do not provide any guides. Pay attention to this.

### 10.3 Analyze how changes in exchange rates affect the translated sales of the subsidiary and parent company

### 10.4 Compare the current rate method and the temporal method, evaluate how each affects the parent company's balance sheet and income stmt, and determine which method is appropriate in various scenarios.

1. Methods to translate financial stmts of sub to parent reporting currency
  - Remeasurement: converting the local to functional currency with temporal method.
  - Translation: convert functional currency to parent's reporting currency using the current rate method.
  - Define appropriate translation method. See P64 in notes, new version.
  - More definitions. a) Current rate: the exchange rate on the balance sheet date. b) Average rate: the average exchange rate over the reporting period. c). historical rate: the actual when the transactions occurs.
2. Apply the current rate method process:
  - (a) All income stmts are translated at the average rate.
  - (b) All balance sheet accounts are translated at the current rate *except for common stock, at historical rate*.
  - (c) Dividends are at the rate that applied when they were declared.
  - (d) Translation G/L is reported in shareholder's equity as a part of the cumulative translation adjustment.
3. Applying the Temporal Method
  - (a) Monetary A/L (fixed in the amount of currency) remeasured using the current exchange rate.
  - (b) All other A/L are nonmonetary assets, like inventory, fixed assets, intangible assets. for example, Unearned (deferred) revenue. They are remeasured in historical rate. (*Exception: non-money A/L on the balance sheet at fair value are remeasured at the current rate*).
  - (c) Common stock, dividends paid are at historical rate.
  - (d) Expense related to nonmonetary assets are remeasured based on the historical rates at the time of purchase.
  - (e) Revenues and all other expenses are at the average rate.
  - (f) Remeasurement G/L is in income stmt.
4. Inventory and COGS under the Temporal Method.  
Numerous historical exchange rates need to be remembered. Inventory are complicated. Inventory and COGS are remeasured at different rates in FIFO/LIFO.
5. Parents Company Exposure to Changing Exchange Rates
  - (a) In Current rate method: Exposure in the net asset position of the subsidiary.
  - (b) In Temporal method: net monetary A/L are exposed.
6. Calculating the Translation/Remeasurement G/L  
G/L is reported in CTA, and GTP is used to make  $A=L+E$ .



### 10.5 Calculate the translation effects and evaluate the translation of a subsidiary's balance sheet and income

1. -CR method: start with income stmt. As the net income here will be used for the retained earnings in balance stmt.  
-Temporal method: start with balance stmt.
2. Different results from CR and Temporal methods. Why?
  - (a) Income before translation G/L is different, due to the different rate used for items. Example: COGS and depreciation, average rate in CR method and historical rate in Temporal.
  - (b) Translation G/L are different. Since net assets are exposed to the depreciation of Local Currency in CR, but net MONETARY assets are in temporal method.
  - (c) Net income is different. This is due to different exchange rate. Besides, in CR method, translation G/L are in CTA. In Temporal, remeasurement G/L are in income stmt.
  - (d) Total assets are different b/c inventory and net fixed assets are different.
- 3.

### 10.6 Analyze how the current rate method and the temporal method affect financial statements and ratios.

1. Pure Balance Sheet and pure Income Stmt ratios. PURE balance sheet and pure income statement ratios
2. Mixed Balance Sheet/Income Statement ratios. CR result in small changes.  
Key points to remember  
-Pure balance sheet/pure income ratios will be the same.  
-If foreign currency is depreciating, translated mixed ratios (with income stmt in up and end-of-period balance sheet item down) will be larger.
3. Compare ratios from Temporal method and current rate method. Compare the rates is the key.
  - (a) Determine whether the foreign currency is appreciating/depre.
  - (b) which rates is on numerator or denominator.

### 10.7 Analyze how alternative translation methods for subsidiaries operating in hyperinflationary economies affect financial stmts& ratios

1. Hyperinflation def. In FASB, cumulative inflation >100% over 3-yr period. IASB: doesn't have definition. But 100-3-yr is a good indication. Nonmonetary A/L are not affected by hyperinflation.
2. GAAP: in hyperinflation, the parent's presentation currency is the functional currency. - Temporal method
3. IFRS: foreign currency stmts are restated for inflation, and then translated with CR method.
  - Nonmonetary A/L restated with price index.
  - Monetary A/L doesn't change.
  - Shareholder's equity are restated with price index.
  - Retained earnings, plug figure
  - Income stmt: times the change in the price index from the transaction date.
  - Net purchasing power G/L recognized in income stmt
  - Check the examples on P82, new notes, book2
4. Analyzing Foreign Currency Disclosure

- (a) –Multiple foreign subs may exist. And disclosure information are limited. Can be found in footnotes (financial stmt) and management discussion/analysis of the annual report.  
 —Possible Solution: Add the change in CTA into net income.  
 —Also, can add the unrealized G/L to net income.
- (b) – Clean-surplus accounting: add G/L that are reported in shareholder's equity to net income stmt.  
 – Dirty-surplus accounting: report G/L in shareholder's equity.

## 10.8 Describe how multinational operations affect a company's effective tax rate

1. Tax Implications of Multinational Operations
  - Effective tax rate: tax expense divided by pretax profit
  - Statutory tax rate: Provided by the tax code of the home country.
 Companies need to reconcile these two rates.  
 Influence on the effective rate:
  - Changes in the mix of profits from different countries
  - Changes in tax rates

## 10.9 Explain how changes in the components of sales affect the sustainability of sales growth

1. Sales growth due to currency appreciation are not sustainable.
2. Organic growth: growth in sales excluding the effects of acquisitions/ divestitures and currency effects.

## 10.10 Analyze how currency fluctuations potentially affect financial results, given a company's countries of operation

Major Sources of Foreign Exchange Risk

1. Can affect value of A/L
2. Related disclosures in MD&A.
  - Helpful for Earnings change from currency change
  - Can do sensitivity analysis or inquire further information of hedging tools the company used.

# 11 Evaluating Quality of Financial Reports

## 11.1 Demonstrate the use of a conceptual framework for assessing the quality of a company's financial reports

1. Financial Report Quality = earnings quality + reporting quality
  - reporting quality: decision useful information
  - earnings quality: high-level earning + sustainable earning
  - Cannot have low-quality reporting and high-quality earning
2. Questions to ask:
  - Standard compliant AND decision useful?
  - Are the earnings of high quality?

## 11.2 Explain potential problems that affect the quality of financial reports

Two problems: Measurement and timing issues and/or Classification issues

### 1. Problems

- Measurement and Timing Issues: aggressive/conservative recognition practices influence p,e,a; omission/postponement of expense will increase profits,equity,assets.
- Classification Issue: How an individual financial stmt element within a particular financial stmt. Influence particular item.

### 2. Biased Accounting: Examples below.

- (a) Misstate profitability P102 NB2
  - Aggressive revenue recog
  - Lessor use of finance lease classification
  - Classifying non-operating reve/income as operating, and operating expense as non-operating
  - Channeling gains in net income and expense in OCI
- (b) Warnings signs of misstated profitability: high revenue growth than peers; receivable growth > revenue growth; higher rate of returns; high proportion of revenue is received in 4th quarter; unexplained boost to operating margin; operating cash flow lower than operating income; inconsistency in operating vs non-operating classification; aggressive
- (c) Misstate A/L
  - Choose bad inputs to change estimated value of stmt elements
  - Reclassification from current to non-current
  - Over/understating allowances or reserves
  - Understating identifiable assets
- (d) Warning signs of A/L
  - Inconsistent inputs for estimating A/L
  - Typical current A is in non-current.
  - Allowances and reserves differ from peers, and fluctuate
  - high goodwill
  - Use of special purpose entities
  - Large fluctuations in deferred tax A/L
  - Large off-balance-sheet liability
- (e) Overstate operating cash flows
  - Manipulating activities to affect CFlow from operating
  - Misclassifying investing CFlow from operations.

### 3. Business Combinations – Acquisition method accounting

- (a) Give opportunities to change cf stmt: Purchase cash-generating entities to increase CFlow. Payment using stock can bypass the cash flow stmt.
- (b) Give motivations to impact stmt.

### 4. GAAP accounting but not Economic reality

## 11.3 Describe how to evaluate the quality of a company's financial reports

## 11.4 Evaluate the quality of a company's financial reports

### 1. Steps:

- Understand the company, industry, and accounting principles
- Understand management, evaluate insider trades and related party transactions
- Identify material areas of accounting that are vulnerable to subjectivity

- Make cross-sectional and time series comparisons of stmts and ratios
- Check for warning signs
- multinational firms, check for shifting of profits/revenues to specific part of business that the firm wants to highlight.
- Use quantitative tools to evaluate the likelihood of misreporting

## 2. Quantitative tools

- (a) The Beneish model  
M-score > -1.78 indicates a higher-than-acceptable probability of earnings manipulation.  
Limitations: relies on accounting data.
- (b) Altman model: Z-score to assess the probability that a firm will file for bankruptcy.  
Limitations: a single-period static model.

## 11.5 Describe indicators of earnings quality

1. High-quality earnings: sustainable, adequate
2. low-quality earnings may due to
  - below the firm's cost of capital
  - not sustainable
  - poor reporting quality

## 11.6 Describe the concept of sustainable earnings

1. Definition: earnings that are expected to recur.
2. Possible gaming parts: 1. Classification items. 2. use non-GAAP metrics.  
-One way to gauge earnings:  $\text{earnings}(t+1) = \alpha + \beta_1 \text{earnings}(t) + \varepsilon$
3. Accruals:  
 $\text{earnings}(t+1) = \alpha + \beta_1 \text{cash flow}(t) + \beta_2 \text{accruals} + \varepsilon$   
Accruals from normal business: non-discretionary accruals  
Red flag: A company reports positive net income while negative operating cash flow.
4. Other indicators: companies repeatedly meet or barely beat consensus estimates. External: enforcement actions.

## 11.7 Explain mean reversion in earnings and how the accruals component of earnings affects the speed of mean reversion

Extreme earnings will revert back to mean. When earnings are largely comprised of accruals, mean reversion will occur more.

## 11.8 Evaluate the earnings quality of a company

1. Earnings manipulations: 1. Revenue recognition issues; 2. Expense recognition issues (capitalization)
2. Revenue recognition issues:
  - (a) Issues
    1. Channel-stuffing, bill-and-hold
    2. higher growth rate of receivables wrt the growth rate of revenue
    3. Increasing days' sales outstanding over time

## (b) Steps

- 1. Understand the basics
- 2. Evaluate and question ageing receivables
- 3. Cash vs accruals
- 4. Compare financials with physical data provided by the company.
- 5. Evaluate revenue trends and compare with peers
- 6. Check for related party transactions

## 3. Expense Capitalization

## Checking steps

- 1. Understand the basics
- 2. Trend and comparative analysis. Stable profit margins with a buildup of non-current assets is bad.
- 3. Check for related party transactions.

**11.9 Describe indicators of cash flow quality**

1. High-quality cash flow: reported CF is high; reporting quality is high.
2. Startup: negative OCF is OK. Mature: negative OCF is bad.
3. Operating CF is most important. OCF that is sustainable and adequate are good.
4. Manipulate CF via strategic decisions (timing issues)

**11.10 Evaluate the cash flow quality of a company**

## Steps

1. Checking for any unusual items or items that not shown in prior yrs.
2. Checking revenue quality.
3. Checking for strategic provisioning.
4. Remember: different standards of GAAP and IFRS may influence cash flow.

**11.11 Describe indicators of balance sheet quality****11.12 Evaluate the balance sheet quality of a company**

## Completeness, unbiased measurement, clarity of presentation

1. Completeness
  - If off-balance-sheet liabilities exist, then need to restate the balance sheet.
  - Equity method can make certain ratios higher than acquisition method. If firms use equity method rather than acquisition method, then pay attention to it.
2. Unbiased Measurement. Some subjectivity:
  - Value of the pension liability, based on several assumptions
  - Value of investment in debt or equity of other companies for which a market value is not available
  - Goodwill value
  - Inventory valuation
  - Impairment of PP&E
3. Clear Presentation
 

A single-line item or items grouped together? Although standard doesn't specify how much items must be presented. Clear presentation is good.

### 11.13 Describe sources of information about risk

Financial statements; Auditor's report; Notes to financial stmts; Management discussion and Analysis; SEC form "NT"; Financial press

## 12 Reading 20: Integration of Financial Statement Analysis Techniques

### 12.1 Demonstrate the use of a framework for the analysis of financial statements, given a particular problem, question, or purpose. (e.g., valuing equity based on comparables, critiquing a credit rating, obtaining a comprehensive picture of financial leverage, evaluating the perspectives given in management's discussion of financial results)

Steps: in notebook.

### 12.2 Identify financial reporting choices and biases that affect the quality and comparability of companies' financial statements and explain how such biases may affect financial decisions

#### 1. Sources of Earnings and Return on Equity: Use DuPont decomposition

(a) Use DuPont to find the performance drivers.

$$ROE = \frac{NI}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{Revenue} \times \frac{revenue}{averageassets} \times \frac{average}{averageequity}$$

(b) Consider, if the income is generated internally or externally. Remove them from DuPont analysis.

(c) Rm pro-rata share of investee's earnings in influential investments.

(d) In equity method, Rm the carrying value of investments in balance sheet.

#### 2. Asset Base

Try to present balance sheet items in a common-size format. To get an overview of the changes in the composition of assets over time.

#### 3. Capital Structure

Must be able to support management's strategic objectives as well as honor obligations in future. Some liabilities are more burdensome than others.

#### 4. Capital Allocation Decision

(a) Financial stmts should be disaggregated by segment.

- Business segment: > 10% of a large company
- Geographic segment

(b) Compare methods

- Compare EBIT margin to capital allocations, to see if the company invest on most profitable segment.
- Compare cash flow generated by each segment with capital allocations. Cash flow  $\approx$  EBIT + depreciation + amortization

### 12.3 Analyze and interpret how balance sheet modifications, earnings normalization, and cash flow statement related modifications affect a company's financial statements, financial ratios, and overall financial condition

#### 1. Earnings quality and cash flow analysis

- (a) Earnings quality: persistence and sustainability. Earnings closer to OCF are good. Check ratio of accruals to net operating assets to measure earnings quality. Split accruals and cash flow in earnings with balance method or cashflow stmt method.
- (b) Accruals Ratio
  - Balance sheet method:

$$Accruals = \Delta Asset - \Delta Liability - \Delta Cash = NOA_{end} - NOA_{beg}$$

where  $NOA = Netoperatingasset = Asset - Liability - Cash$ .

$$accrualratio^{bs} = \frac{NOA_{end} - NOA_{beg}}{(NOA_{end} + NOA_{beg})/2}$$

-Cash flow statement approach

$$Accruals = NI - CFO - CFI$$

Higher ratio or wide fluctuated ratio are bad, indicating earnings manipulation.

To compare these two measures. Eliminate cash paid for interest and taxes from OCF by adding them back. They are not operating income. - CGO, cash generated from operations.

$$CGO = EBIT + non - cashcharges - increaseinworkingcapital$$

Compare CGO vs operating income to see if any problems.

- (c) Market Value Decomposition
  - It's good to determine the standalone value of the parent company.

### 12.4 Evaluate the quality of a company's financial data and recommend appropriate adjustments to improve quality and comparability with similar companies, including adjustments for differences in accounting standards, methods, and assumptions.

#### 1. Off-Balance-Sheet Financing

Some important items are not reported on Balance sheet. Example: Operating Leases. In analysis, an operating lease should be treated as a finance lease.

Methods to convert operating lease:

- Equity is OK. Since assets and liabilities are increased by the same amount.
- Income statement: replace the rental expense for the operating lease with depreciation expense (on the lease asset) and interest expense (on the lease liability).

## 13 Reading 21: Capital Budgeting

#### 1. Warm-up: Basics of Capital Budgeting

- 2. Categories of Capital Budgeting Projects
  - Replacement project to maintain business
  - Replacement projects for cost reduction

- Expansion projects
- New product or market
- Mandatory
- Other projects

### 3. Principles of Capital Budgeting

- (a) Based on cash flows:
  - Sunk cost: costs that cannot be avoided.
  - Externalities: effects that the acceptance of a project may have on other cash flows
- (b) Cash flows are based on opportunity costs.
  - OC: cash flow that the firm might lose by undertaking the project.
- (c) The timing of cash flow is important.
- (d) Cash flows are analyzed on an after-tax basis.
- (e) Financing costs are reflected in the project's required rate of return.

### 4. Modified Accelerated Cost Recovery System (MACRS)

- (a) Definition: A depreciation method that most US companies used for tax purpose. Should use it as well in capital budgeting.
- (b) You will have a MACRS table to compute incremental cash flows
- (c) Half-year convention: asset is in service in the middle of the first year. Therefore, 3-yr asset will have 4 calendar years.
- (d) Depreciable basis: purchase price + any shipping or handling and installation costs.

## 13.1 Calculate the yearly cash flows of expansion and replacement capital projects and evaluate how the choice of depreciation method affects those cash flows

1. Classification: 1, Initial investment outlay. 2, Operating cash flow over the project's life. 3, terminal-year cash flow
  - Initial investment outlay =  $FCInv + NWCInv$  = invest in Fixed capital + investment in net working capital.  $NWCInv = \Delta \text{non-cash current assets} - \Delta \text{non-debt current liabilities} = \Delta NWC$  = changes in networking capital. Cash is not operating asset. If  $NWCInv$  is positive, cashflow will be negative. Cash is needed to invest in NWC.
  - After-tax operating cash flows:  $CF = (S - C - D)(1 - T) + D = (\text{Sales} - \text{Cash operating expense} - \text{Depreciation expense})(1 - \text{marginal tax rate}) + D$
  - Terminal year after-tax non-operating cash flows (TNOCF). Sometimes,  $NWCInv$  can be reverted at the terminal year.
2. Expansion Project Analysis: increase both the size and earnings of a business. Using Initial investment outlay, After-tax ocf, and TNOCF to calculate NPV and IRR. Then decide if we should accept the project.
3. Other Presentation Formats.
  - Type: table format with cash flows collected by yr; tbl format with cf collected by type.
4. Replacement Project Analysis. Different from Expansion
  - Initial outlay, old asset will be sold:  $\text{Outlay} = FCInv + NWCInv - \text{Sal}_0 + T(\text{Sal}_0 - B_0)$
  - Incremental operating CF, CF from new asset - CF from old asset:  $\Delta CF = (\Delta S - \Delta C)(1 - T) + T\Delta D$
  - TNOCF =  $(\text{Sal}_{T\text{New}} - \text{Sal}_{T\text{Old}}) + NWCInv - T[(\text{Sal}_{T\text{New}} - B_{T\text{New}}) - (\text{Sal}_{T\text{Old}} - B_{T\text{Old}})]$



### 13.2 Explain how inflation affects capital budgeting analysis

1. Analyzing nominal or real CF. Nominal CF has inflation, while real CF not. CF should be discounted at a correct rate. (Nominal rate or real rate.)
2. Changes in inflation affect project profitability. Changes in inflation rate will change the value of future CF.
3. Inflation reduces the tax savings from depreciation. Because the depreciation savings is less valuable, the tax paid is more.
4. Inflation decreases the value of payments to bondholders.
5. Inflation may affect revenues and costs differently.

### 13.3 Evaluate capital projects and determine the optimal capital project in situation of 1) Mutually exclusive projects with unequal lives, using either the least common multiple of lives approach or the equivalent annual annuity approach, and 2) capital rationing.

1. Mutually Exclusive Projects with Different Lives
  - (a) Least Common multiple of lives approach.  
For example. a-3yr, b-6yr. We will use Cashflows for 2\*a to compare with b-6yr.
  - (b) Equivalent annual annuity approach: Use FV=0 and current PV, to calculate the PMT.
2. Capital Rationing  
Firms will continue to invest in positive NPV until marginal return = marginal cost.  
If Firm doesn't have enough funds, it needs to allocate funds to maximize NPV.

### 13.4 Explain how sensitivity analysis, scenario analysis, and Monte Carlo simulation can be used to assess the stand-alone risk of a capital project.

Sensitivity analysis: change an input to see the changes in results.

Scenario analysis: A risk analysis technique that considers both the sensitivity of key output variable to key input variables and the likely probability distributions of these variables. It studies different possible scenarios, like *worst case*, *best case*, *base case*.

### 13.5 Explain and calculate the discount rate, based on market risk methods, to use in valuing a capital project

1. CAPM:  $R_{project} = R_F + \beta_{Project}[E(R_{MKT}) - R_F]$   
The calculated R is the appropriate discount rate. Also, it's the required return rate specific for one project.
2. R=Hurdal rate

### 13.6 Describe types of real options and evaluate a capital project using real options

1. Real options: allow managers to make future decisions that change the value of capital budgeting decisions made today.

2. Types of real options:
  - Timing options: allow to delay making an investment with the hope of having better information in the future.
  - Abandonment options: right to drop a project
  - Expansion options: right to make additional investments.
  - Flexibility options: 1. price-setting options: allow the company to change the price of a product. 2. production-flexibility options: give some flexibilities in productions.
  - Fundamental options: projects that themselves are options. b/c the payoff depends on the price of an underlying asset.
3. Evaluate project with real options. Approaches:
  1. Determine the NPV of the project w/t the option.
  2. Calculate the project NPV without the option and then add the estimated value of the real option.
$$\text{overall NPV} = \text{project NPV (based on DCF)} - \text{option cost} + \text{option value}$$
3. Use decision trees.
4. Use option pricing models.

### 13.7 Describe common capital budgeting mistakes

1. Failing to incorporate economic response into the analysis. Example: low barriers to entry will have more competitors.
2. Misusing standardized templates.
3. Pet projects of senior management. Projects backed by influential people are usually overrated.
4. Basing investment decisions on EPS or ROE. Managers whose incentive is related to ROE.
5. Using the IRR criterion for project decision. NPV is good.
6. Poor cash flow estimation.
7. Misestimation of overheaded costs.
8. Using the incorrect discount rate. Should use the rate for a specific project.
9. Politics involved with spending the entire capital budget. Spend entire budget and then ask for an increase for the next year.
10. Failure to generate alternative investment ideas.
11. Improper handling of sunk and opportunity costs. Shouldn't consider sunk costs in the evaluation of a project.
- 12.

### 13.8 Calculate and interpret accounting income and economic income in the context of capital budgeting.

1. Economic income and Accounting income
 

Economic income = cash flow + (ending market value - begin market value) = cash flow - economic depreciation. beginning market value is PV of the remaining after-tax cash flows.

Accounting income = net income
2. Difference
  1. Accounting depreciation is based on the original cost
  2. Financing costs are subtracted out to arrive at net income.

### 13.9 Distinguish among the economic profit, residual income, and claims valuation models for capital budgeting and evaluate a capital project using each

1. **Economic profit:**  $EP = NOPAT - \$WACC = \text{Net operating profit after tax} - WACC \times \text{capital}$ . Capital = dollar amount of investment = equity + debt  
Returns on all supplies of income.  
Company value = NPV + initial capital investment
2. **MVA:** market value added, is the NPV based on economic profit  
 $NPV = MVA = \sum_{t=1}^{\infty} \frac{EP_t}{(1+WACC)^t}$
3. **Residual income:** returns on equity  
Residual income = net income - equity charge  
 $RI_t = NI_t - r_e B_{t-1}$ .  $r_e$ : required return on equity.  $B_{t-1}$ : beginning of period book value of equity  
 $NPV = \sum_{t=1}^{\infty} \frac{RI_t}{1+r_e^t}$   
Company value = NPV + initial capital = NPV + initial equity + debt
4. **Claims valuation approach:** Value debt and equity cash flows separately.
  - (a) Cash flows to debt holders: interest and principal payments, discounted at the cost of debt
  - (b) Cash flows to equity holders: dividends and share repurchases. rate at the cost of equity.  
CF to equity = Operating income - principle payment to debt = NI + depreciation - principal payments
  - (c) company value = market value of debt + mv of equity

## 14 Reading 22: Capital Structure

### 14.1 Capital Structure Theory

### 14.2 Explain the Modigliani-Miller propositions regarding capital structure, including the effects of leverage, taxes, financial distress, agency costs, and asymmetric information on a company's cost of equity, cost of capital, and optimal capital structure

1. **MM Proposition I (No Taxes):** The capital Structure Irrelevance Proposition  
Sum: MM proved that the value of a firm is unaffected by its capital structure under some restrictive assumptions.  
Assumptions:
  - Capital markets are perfectly competitive. No transactions costs, taxes, bankruptcy costs.
  - Investors have homogeneous expectations.
  - Riskless borrowing and lending: borrow at risk-free rate.
  - No agency costs: no conflict of interest between managers and shareholders.
  - Investment decisions are unaffected by financing decisions.
 Results:  $Value_{leverage} = Value_{unleverage}$
2. **MM Proposition II (No Taxes):** Cost of Equity and Leverage Proposition  
Sum: the cost of equity increases linearly as a company increases its proportion of debt financing.  
Result: -Debt holders have a priority claim on assets and income, thus cost of debt < cost of equity.  
-If the use of debt is increasing, the risk increase. Cost of equity is increasing. -No change in WACC  
 $-r_e = r_0 + \frac{D}{E}(r_0 - r_d)$ ;  $r_e$  is the cost of CAPITAL.  $r_0$  is unleveraged equity.

## 3. MM Proposition I(With Taxes): Value is Maximized at 100% Debt

**Tax shield provided by debt:** Firms like using debt because interest is tax-deductible.

$$V_L = V_U + (t \times d); \text{ Value of Leverage firm} = \text{Value of unxx firm} + \text{tax rate times value of debt}$$

Value will be maximized if use 100% debt.

## 4. MM Proposition II(Wtih Taxes): WACC is Minimized at 100% Debt

$$r_E = r_0 + \frac{D}{E}(r_0 - r_D)(1 - T_c)$$

## 5. Costs and Their Potential Effect on the Capital Structure

## (a) Costs of financial distress

- Costs of financial distress and bankruptcy: direct(direct fees), indirect(lost some investment opportunities and trust from customers, suppliers, etc)
- Probability of financial distress: Higer amounts of leverage result in higher probabily of distress. Higher expected cost of fin. distress will discourage companies from debt.

## (b) Agency costs of euqity: conflicts between interest between managers and shareholders.

Net agency cost of euqity has 3 components

- Monitoring costs: costs to supervise management
- Bonding costs: assumed by manageent to assure shareholders that the managers are working in the shareholder's best interest.
- Residual losses

## (c) Costs of asymmetric information:

Resultig from the fact that managers have more infor than owners or creditors.

Shareholders creditors looking for the signals that tell what management have

- Taking on the commitment to make fixed insterest payments via debt financing is good.
- Issuing equity is usually bad.

## (d) Pecking order theory: signals management sends to investors via financing choices.

Managers will make financing choices that are least likely to send signal to investors.

Choice: Internally generated equity(retained earnings) > Debt > External equity

Based on POT, the capital structure is the by product of the individual financing decision.

## 6. Static Trade-off Theory, include fin. distress: balance costs of fin. distress and tax shielding from debt

$$V_L = V_U + (t \times d) - \text{PV}(\text{costs of financial distress})$$

## 7. Implications for Managerial Decison Making

-MM's Propositions iwth no taxes: 1. capital structure is irrelevant with firm value. 2. WACC will not change. Increase use of debt will increase the cost of euqity.

-MM's Propositions with taxes: 100% debt is good due to tax shielding.

-Static trade-off theory

### 14.3 Describe target capital structure and explian why a compny's actual capial structure may flucturate around its target.

## 1. Target capital structure: optiamal capital structure

## 2. May flucturate

- Management may choose to exploit opportunities in a specific financing source
- Market value flucturation will occur, like changes in stock and bond markets.

### 14.4 Describe the role of debt ratings in captial structure policy

Debt ratings: cost of capital is tied to debt ratings. Thus companies will keep the minimum ratings of debts.

### 14.5 Explain factors an analysis should consider in evaluating the effect of capital structure policy on valuation.

Consider:

1. Changes in the company's capital structure over time
2. Capital structure of competitors with similar business risk
3. Company-specific factors (like quality of corporate governance). Better corporate governance will reduce agency costs.

### 14.6 Describe international differences in the use of financial leverage, factors that explain these differences and implications of these differences for investment analysis

Capital structure of international firms will impact a firm's capital policy.

1. Total debt: Japan, Italy, France will have more total debt in USA, UK.
2. Debt Maturity: Co. in North America will use longer maturity debt than Co in Jp.
3. Emerging market differences: Co. in developed companies will use more and longer debt than those in emerging markets.

Other factors are

1. Institutional and Legal factors
  - Strength of legal system: strong legal system results in less debt and long maturity in capital structure.
  - Information asymmetry: strong asymmetry → More debt.
  - Taxes
2. Financial Markets and Banking system factors
  - Liquidity of capital markets: larger and more liquid markets → longer maturity debt
  - Reliance on banking system: If more rely on banking systems, companies will be more leveraged.
  - Institutional investor presence: If institutional investors play more role, the capital structure may be changed.
3. Macroeconomic factors
  - Inflation: higher inflation → use less debt and short maturity.
  - GDP growth: higher GDP growth → long maturity debt.

Country specific factors	Use of Total Debt	Maturity of Debt
Institutional and Legal factors		
-Strong legal systems	Low	Long
-Less information asymmetry	low	long
-Favorable tax rates on dividend	low	
-Common law opposed to civil law	low	long
Financial Market factors		
-More liquid stock and bond markets		long
-Greater reliance on banking system	high	
-Greater institutional investor presence	low	long
Macroeconomic Factors		
-High inflation	low	short
-High GDP growth	low	long

## 15 Dividends and Share Repurchases: Analysis

### 15.1 Compare theories of dividend policy and explain implications of each for share value given a description of a corporate dividend action

1. **Dividend irrelevance:** In a perfect world with no taxes, broker fees, and infinity divisible shares, dividend policy has no effect on the price of a firm's stock or its cost of capital. Will not affect the required return on equity capital.
2. **Bird-in-hand argument for dividend policy:** Required return on equity capital  $r_s$  decreases as the dividend payout increases.
3. **Tax aversion:** Historically, higher tax on dividends than capital gain. Therefore, investors prefer to not receive dividends. While companies will make dividend payments necessary to avoid tax.
4. Conclusion:

### 15.2 Describe types of information (signals) that dividend initiations, increases, decreases, and omissions may convey

1. Dividend initiation: ambiguous. Positive: company is sharing its wealth; Negative: a company has a lack of profitable reinvestment opportunities.
2. Unexpected dividend increase: Good. Companies future is good.
3. Unexpected dividend decreases or omissions: negative signals.

### 15.3 Explain how clientele effects and agency issues may affect a company's payout policy.

1. Clientele effect: dividend preferences of different groups are different.
  - Tax consideration. High tax-bracket investors (individuals) prefer low dividend payouts. Low-tax-bracket investors prefer high payouts.
  - Requirements of institutional investors: some of institutional investors will only invest companies that have dividend yield above some threshold.
  - Individual investor preferences.
2. Agency issues
  - Between shareholders and managers: agency cost is due to difference interest between managers and stockholder. Manager may overinvest. Therefore, one way to reduce the agency cost is to increase the payout of free cash flow as dividends.
  - Between shareholders and bondholders: If high-risk debt outstanding, shareholders may pay themselves a large dividend.

### 15.4 Explain factors that affect dividend policy.

6 factors:

1. Investment opportunities. If the firm has many opportunities and need to react quickly, dividend payout would be low.
2. Expected volatility of future earnings. If earnings are volatile, firms are more cautious in *changing* dividend payout.
3. Financial flexibility.

4. Tax considerations.
  - Dividend preference may different if capital gains and dividends are taxed at different rate.
  - Taxes on dividends are paid when dividend is received. Capital gain taxes are paid when shares are sold.
  - Tax-exempt institutions will be indifferent between dividends/capital gains.
5. Flotation costs: 3% to 7% fee will be applied for new stocks, while retained earnings have no such fee. High flotation costs→lower dividend payout.
6. Contractual and legal restrictions.
  - Impairment of capital rule: in some countries, dividend cannot be larger than retained earnings.
  - Debt covenants: many covnants require a firm to meet/exceed a certain target for liquidity rations and coverage ratios before they can pay a dividend.

### **15.5 Calculate and interpret the effective tax rate on a given currency unit of corporate earnings under double taxation, dividend imputation, and split-rate tax systems.**

1. Double-taxation system  
Earnings are taxed at corporate regardless of whether dividend. Dividend are taxed again for share-holders.  
Effective rate = Corporate tax rate + (1-Corporate tax rate)(individual tax rate)(payout ratio)
2. Imputation tax system  
All taxes are effectively paid at the shareholder rate.
3. Split-rate  
Earnings that are distributed as dividends are taxed at a lower rate. Individual: dividends are taxed as income.

### **15.6 Compare stable dividend, constant dividend payout ratio, and residual dividend payout policies, and calculate the diviend under each policy.**

1. Stable Dividend Policy:
2. Target Payout Ratio Adjustment Model  
Expected dividend = previous dividend + (exp.d increase in EPS)(target payout ratio)(adjustment factor). Where adjustment factor = 1/number of years of which the adjustment will take place.
3. Constant Dividend Payout Ratio Policy  
Seldom used.
4. Residual Dividend Model:  
(Dividends) is based on (Earnings) less (funds retained to for the equity portion.)  
Advantages: 1. Simple to use; 2. Pursue investment opportunities without being constrained by dividend considerations.  
Disadvantages: Dividends will be unstable.
5. Long-term residual dividend model.

### **15.7 Explain the choice between paying cash dividends and repurchasing shares**

Possible reasons to repurchase shares

1. Potential tax advantage

2. Share price support/signaling: company to show that they are confident with their stock.
3. Added flexibility: repurchase can be a supplement to the dividend. Repurchase doesn't need long-term commitment.
4. Offsetting dilution from employee stock options.
5. Increase financial leverage. If funded by new debt, share repurchase will increase leverage. Besides, share repurchase may increase EPS, if the cost of fund < EPS.

## 15.8 Describe broad trends in corporate dividend policies

1. A lower proportion of US companies pay dividends compared to European ones.
2. In developed markets, the proportion of companies paying cash dividends is down.
3. The percentage making stock repurchases has been upwards.

## 15.9 Calculate and interpret dividend coverage ratios based on 1) net income and 2) free cash flow.

## 15.10 Identify characteristics of companies that may not be able to sustain their cash dividend.

**Dividend safety:** the metric used to evaluate the probability of dividends continuing at the current rate for a company.

-Useful ratios: Dividend payout ratio(dividends/net income) and dividend coverage ratio(net income/dividends)  
Free cash flow to equity(FCEE): cash flow available for distribution to stockholders after working capital and fixed capital needs are accounted for.

FCFE coverage ratio = FCFE/(dividends + share repurchase)

# 16 Reading 24: Corporate Performance, Governance, and Business Ethics

## 16.1 Compare interest of key stakeholders groups and explain the purpose of a stakeholder impact analysis

Stakeholders:

1. Definition: Groups with an interest or claim in a company.
2. Key internal stakeholders
  - Stockholders
  - Employees
  - Managers
  - Members of the board of directors
3. Key external stakeholders
  - Customers
  - Suppliers
  - Creditors
  - Unions
  - Governments
  - Local communities
  - General public



### Reconciling interests and the stakeholder analysis

1. Not all stakeholders are so interested in the profitability. e.g. Customers don't want to overpay.
2. Stakeholder Impact Analysis (SIA): Force the company to identify which stake groups are critical to the company.
3. Stockholders are special stakeholders. Return on invested capital(ROIC) and growth in profits→Measure if the company satisfy shareholders

## 16.2 Discuss problems that can arise in principal-agent relationships and mechanism that may mitigate such problems.

### The Principal-Agent Relationship

1. Definition: PRA arises when one group delegates decision to another group. Problems: Information asymmetry. Agent doesn't tell everything to the principal.
2. Example Problems  
CEOs manipulate the board of directors to extract excessive compensation packages.
3. Controlling PAR problems  
Guide the behavior of agents  
Reduce the asymmetry of information  
Remove agents who misbehave and violate ethical principles.
4. Ethics and Strategy, examples of unethical behavior  
Self-dealing  
Information manipulation  
Anticompetitive behavior  
Substandard working conditions  
Environmental degradation  
Corruption

## 16.3 Discuss roots of unethical behavior and how managers might ensure that ethical issues are considered in business decision making

### Roots of Unethical Behavior

1. Personal ethics are flawed
2. Failure to realize
3. Culture to focus on profit/growth
4. Flawed business culture where top management sets unrealistic goals
5. Unethical leadership

## 16.4 Compare the Friedman doctrine, Utilitarianism, Kantian Ethics, and Rights and Justice Theories as approaches to ethical decision making

1. Friedman Doctrine: The only social responsibility is increase profits "within the rules of the game".
2. Utilitarianism: seeks to produce the highest good for the largest number of people.
3. Kantian Ethics: People are more than an economic input and deserve dignity and respect.

4. Rights theories: all individuals have fundamental rights and privileges, and the utilitarianism's greatest good doesn't trump these fundamental rights.
5. Justice theories: justice is met if all participants would agree the rules are fair if the results is decided under 'veil of ignorance'.

## **17 Reading 25: Corporate Governance**

### **17.1 Describe objectives and core attributes of an effective corporate governance system and evaluate whether a company's corporate governance has those attributes**

1. Objectives
  - Eliminate or reduce conflicts of interest
  - Use the company's assets in a good way
2. Properties of effective corporate governance system

### **17.2 Compare major business forms and describe the conflicts of interests associated with each**

1. Sole proprietorships: Business owned and operated by a single individual No distinction between the business and its owner, unlimited liability.  
Conflict of interest: suppliers, creditors.
2. Partnerships  
Def: two or more owners/managers, but are otherwise similar to a sole proprietorship. Unlimited liability.  
Typical: Law firms, real estate firms, advertising agencies  
CoI: creditors and suppliers; partners conflicts are addressed in contracts.
3. Corporations  
Def: Distinct legal entities that have rights similar to those of an individual person.  
CoI: owners vs management

### **17.3 Explain conflicts that arise in agency relationships, including manager-shareholder conflicts and director-shareholder conflicts**

Principal-agent problem includes:

1. Managers and shareholders, examples
  - Using funds to expand the size of the firm
  - Get high salaries and perquisites
  - Investing in risky ventures
  - Not taking enough risk: Some risk-averse managers will be conservative to keep their job, rather than do a better job for shareholders
2. Directors and shareholders
  - Lack of independence
  - Board members have personal relationships with management
  - Board members have consulting or other business agreement with the firm
  - Interlinked boards
  - Directors are overcompensated.

**17.4 Describe the responsibilities of the board of directors and explain qualifications and core competencies that an investment analyst should look for in the board of directors****17.5 Explain effective corporate governance practice as it relates to the board of directors and evaluate strengths and weaknesses of a company's corporate governance practice**

The Board of Directors – Standards related to the effectiveness

3/4 of board members should be independent.

Whether the board has an independent chairman: separate is good.

Qualifications of directors: should bring skills and experience: for board members to have the requisite industry, strategic planning, and risk management knowledge, not serve on more than two or three boards.

How the board is elected: Annual elections are good

Board self-assessment practices

Frequency of separate sessions for independent directors: independent members should meet at least annually, prefer quarterly.

Audit committee and audit oversight: audit committee only has independent directors, has expertise in financial/accounting, has full access to the cooperation management, and meets with auditors at least annually.

Nominating committee: only have independent directors.

Compensation committee and the compensation awarded to management: should focus on long term goals. Shouldn't use the salary at other companies as a reference point. Good: have salaries as a small percentage of compensation, with bonus, options and restricted stock for good performance.

Use of independent or expert legal counsel. Common practice: advise the board of directors, but this is bad.

Best: use independent, outside counsel whenever legal counsel is required.

Statement of governance policies

Disclosure and transparency. Best: more disclosure is better. Should provide info about organization structure, corporate strategy, insider transactions, compensation policies and changes to governance structure.

Insider or related-party transactions. Best: Any related-party transactions should be proved by the board of directors.

Responsiveness to shareholder proxy votes. Should consider the shareholder's opinions.

**17.6 Describe elements of a company's statement of corporate governance policies that investment analysts should assess.**

1. Code of ethics
2. Directors oversight, monitoring, and review responsibilities
3. Management's responsibility to the board
4. Reports of directors' oversight and review of management
5. Board self assessments
6. Management performance assessments
7. Director training

**17.7 Describe environmental, social, and governance risk exposures**

Environmental, Social, and Governance Factors ESG factors

1. Environmental risk
2. Social risk

### 3. Governance risk

Organized as follows

1. Legislative and Regulatory risk: new laws may be bad
2. Legal risk: potential results for lawsuits may be bad
3. Reputational risk
4. Operating risk: due to impact of ESG factors
5. Financial Risk:

## 17.8 Explain the valuation implications of corporate governance

Strong/effective corporate governance system is good.

Weak or ineffective corporate governance system is bad

1. Financial disclosure risk
2. Asset risk
3. Liability risk
4. Strategic policy risk

## 18 Mergers and Acquisitions

### 18.1 Classify merger and acquisition activities on forms of integration and relatedness of business activities

Forms of Integration

1. Statutory merger: acquiring company acquires all of the target's A and L.
2. Subsidiary merger: the target company will be a sub of the purchaser.
3. Consolidation: both companies will combine into a new company.

Types of Mergers

1. Horizontal merger: businesses in the same or similar industries
2. Vertical merger: the acquiring company seeks to move up/down the product supply chain.
3. Conglomerate merger: two companies operate in completely separate industries.

### 18.2 Explain common motivations behind MA activity.

1. Synergies: combined company will be worth more than the two companies. Horizontal combination will reduce cost.
2. Achieving more rapid growth.
3. Increased market power.
4. Gaining access to unique capabilities.
5. Diversification: diversify the firm's cash flow. Merger are not likely to increase value purely for diversification reasons. B/c merger process involves a lot of costs.

6. Bootstrapping EPS.
7. Personal benefits for managers. Large size of company→high salary for managers.
8. Tax benefits
9. Unlock hidden value.
10. Achieving international business goals, some specific driving factors
  - Taking advantage of market inefficiencies
  - Working around disadvantageous government policies
  - Use technology in new markets
  - Product differentiation
  - Provide support to existing multinational clients

### 18.3 Explain bootstrapping of earnings per share and calculate a company's postmerger EPs

when a high P/E company purchases a low P/E firm in a stock transaction. When we calculate EPS for the new company, total earnings is equal to the sum, however, the total shares outstanding is less than the sum of the combined firms. EPS will increase.

### 18.4 Explain, based on industry life cycles, the relation between merger motivations and types of mergers.

Industry life cycle stage	Industry Characteristics	Merger Motivations
Pioneer/development	<ol style="list-style-type: none"> <li>1. Unsure of product acceptance</li> <li>2. Large capital requirements and low profit margins</li> </ol>	<ol style="list-style-type: none"> <li>1. Gain access to capital from more mature firms</li> <li>2. Share management talent</li> </ol>
Rapid Growth	<ol style="list-style-type: none"> <li>1. High profit margins</li> <li>2. Accelerating sales and earnings</li> <li>3. Competition still low</li> </ol>	<ol style="list-style-type: none"> <li>1. Gain access to capital</li> <li>2. Expand capacity to grow</li> </ol>
Mature growth	<ol style="list-style-type: none"> <li>1. Lots of new competition</li> <li>2. Still opportunities for above average growth</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase operational efficiencies</li> <li>2. Economies of scale/synergies</li> </ol>
Stabilization	<ol style="list-style-type: none"> <li>1. Competition has reduced growth potential</li> <li>2. Capacity constraints</li> </ol>	<ol style="list-style-type: none"> <li>1. Economies of scale/reduce costs</li> <li>2. Improve management</li> </ol>
Decline	<ol style="list-style-type: none"> <li>1. Consumer tastes have shifted</li> <li>2. Overcapacity/shrinking profit margins</li> </ol>	<ol style="list-style-type: none"> <li>1. Survival</li> <li>2. Operational efficiencies</li> <li>3. Acquire new growth opportunities</li> </ol>

### 18.5 Contrast merger transaction characteristics by form of acquisition, method of payment, and attitude of target management

#### Forms of Acquisition

1. Stock purchase: usually entire company.
  - Payment: directly to target company shareholders in exchange for their shares.
  - Approval: Majority shareholder approval required.
  - Corporate taxes: None.
  - Shareholder taxes: shareholders pay capital gains tax.
  - Liabilities Acquirer assumes liabilities of target.
2. Asset purchase: usually part of a company
  - Payment: Made directly to target company.
  - Approval: No shareholder approval needed unless asset sale is substantial.

<i>Industry Life Cycle Stage</i>	<i>Industry Characteristics</i>	<i>Merger Motivations</i>	<i>Common Types of Mergers</i>
Pioneer/ development	<ul style="list-style-type: none"> <li>• Unsure of product acceptance</li> <li>• Large capital requirements and low profit margins</li> </ul>	<ul style="list-style-type: none"> <li>• Gain access to capital from more mature businesses</li> <li>• Share management talent</li> </ul>	<ul style="list-style-type: none"> <li>• Conglomerate</li> <li>• Horizontal</li> </ul>
Rapid growth	<ul style="list-style-type: none"> <li>• High profit margins</li> <li>• Accelerating sales and earnings</li> <li>• Competition still low</li> </ul>	<ul style="list-style-type: none"> <li>• Gain access to capital</li> <li>• Expand capacity to grow</li> </ul>	<ul style="list-style-type: none"> <li>• Conglomerate</li> <li>• Horizontal</li> </ul>
Mature growth	<ul style="list-style-type: none"> <li>• Lots of new competition</li> <li>• Still opportunities for above average growth</li> </ul>	<ul style="list-style-type: none"> <li>• Increase operational efficiencies</li> <li>• Economies of scale/synergies</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal</li> <li>• Vertical</li> </ul>
Stabilization	<ul style="list-style-type: none"> <li>• Competition has reduced growth potential</li> <li>• Capacity constraints</li> </ul>	<ul style="list-style-type: none"> <li>• Economies of scale/reduce costs</li> <li>• Improve management</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal</li> </ul>
Decline	<ul style="list-style-type: none"> <li>• Consumer tastes have shifted</li> <li>• Overcapacity/shrinking profit margins</li> </ul>	<ul style="list-style-type: none"> <li>• Survival</li> <li>• Operational efficiencies</li> <li>• Acquire new growth opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Horizontal</li> <li>• Vertical</li> <li>• Conglomerate</li> </ul>

-Corporate taxes: Target company pay capital gain tax.

-Shareholder taxes: None.

-Liabilities: Acquirer usually avoids assumptions of target's liabilities.

#### Method of Payment

1. Securities offering: pay with shares.
2. Cash offers: pay with cash.
3. Factors to choose securities/cashes
  - Distribution between risk and reward for the acquirer and target shareholders.
  - Relative valuations of companies involved. Stock offering is kind of a signal that acquirer's share may be overvalued.
  - Changes in capital structure.

#### Attitude of Target management

1. Friendly merger offers process
  - both companies will negotiate, and draft a merger agreement, and finally release all the information to the public.

## 2. Hostile merger offers

- Bear hug: Acquirer submits a merger proposal directly to the target's board of directors.
- If bear hug fails, appeal directly to shareholders
- Tender offer: buy the shares directly from shareholders
- Proxy battle: have shareholders approve a new "acquirer approved" board of directors."

## 18.6 Distinguish among pre-offer and post-offer takeover defense mechanisms

Pre-offer and Post-offer. Pre-offer defense is better, b/c faces less scrutiny in court.

### Pre-Offer Defense Mechanisms

1. Poison pill: give shareholder's right to buy shares at extremely attractive price
  - flip-in pill: target company's shareholders can buy target's share at a discount
  - flip-over pill: target shareholders can buy acquirer's shares at a discount
2. Poison put: give bondholder's the option to get repayment immediately
3. Restrictive takeover laws: some states in US will protect company against a hostile takeover. Ohio/Pennsylvania
4. Staggered board: Board of directors are split into 3 groups, each is elected for a 3-year term. Prevent bidder controlling the board.
5. Supermajority voting provision for mergers: require more support for merger, like 66.7%, 75% or 80%.
6. Fair price amendment: restricts a merger offer unless a fair price is offered.
7. Golden parachutes: give the managers a lot of money if they leave the company after merger.

### Post-Offer Defense Mechanisms

1. Just say no: target can tell shareholders merger is bad.
2. Litigation: file a lawsuit against the acquirer that takes long time and a lot of money.
3. Greenmail: payoff to the acquirer to terminate the merger.
4. Share repurchases: target company submit a tender offer for its own shares. Acquirer therefore has to increase the bid price.
5. Leveraged recapitalization: target assumes a lot of debt to repurchase shares. The capital structure will be unattractive.
6. Crown jewel defense: target sell a essential subsidiary or major asset to a neutral third party.
7. Pac-Man defense: target can acquire the acquirer.
8. White knight defense: a white knight is a friendly third party. The friendly third party will start a bidding war against the acquirer.
9. White squire defense: seek a third party to buy a minority stake of the company. However, the stake is big enough to block the merger.

## 18.7 Calculate and interpret the Herfindahl-Hirschman Index, and evaluate the likelihood of an antitrust challenge for a given business combination.

Calculation:

$$HHI = \sum_{i=1}^n (MS_i \times 100)^2$$

where  $MS_i$  = market share of firm i.

Steps to challenge antitrust

1. Whether the post-merger HHI > 1000?
2. If post-merger HHI between 1000 and 1800 → Moderately concentrated category → check the changes of HHI. If > 100, bad. possible antitrust.
3. If post-merger HHI > 1800 → Highly concentrated → check the change of HHI. If > 50, bad. Antitrust almost certain.

Valuing a target company

1. Discounted cash flow analysis
2. Comparable company analysis
3. Comparable transaction analysis

## 18.8 Calculate free cash flows for a target company, and estimate the company's intrinsic value based on discount

Discounted Cash Flow (DCF) analysis: 1) Calculate future free cash flow. 2) Calculate discounted cash.

1. Determine which free cash flow model to use for the analysis.
2. Develop pro forma financial estimates.
3. Calculate free cash flows using the pro forma data, starting with net income:

	Net Income
+	Net interest after tax
=	Unlevered net income
±	Change in deferred taxes
=	Net operating profit less adjusted taxes (NOPLAT)
+	Net non cash charges
-	Change in net working capital
-	Capital expenditures (capex)
=	Free cash flow

4. Discounted free cash flows back to the present at the appropriate discount rate. Usually use WACC, or  $WACC_{adjusted}$  which includes the risk from the merger.
5. Determine the terminal value and discount it back to the present.  
Method 1: assumes the company grows at a constant rate.

$$terminalvalue = \frac{FCF_T(1+g)}{WACC_{adjusted}} - g$$

Method 2:  $Terminalvalue_T = FCF_T \times (Projectedprice/FCF)$

6. Add the discounted FCF values for the first state and the terminal value to determine the value of the target firm. Check examples on Page 294.



## 18.9 Estimate the value of a target company using comparable company and comparable transaction analyses

Comparable company analysis

1. Identify the set of comparable firms: same industry with similar size and capital structure.
2. Calculate various relative value measures based on the current market price of companies in the sample with some useful quantities:
  - Enterprise value(EV)=market value of debt and equity - the value of cash and investments.
  - Price to earnings P/E
  - Price to book P/B
  - Price to sales P/S
3. Calculate descriptive statistics for the relative value metrics and apply those measures to the target firm.
4. Estimate a takeover premium:  $TP = \frac{DP - SP}{SP}$ , where TP: takeover premium, DP: deal price per share, SP: target company's stock price. The takeover premium is estimated by looking at recent takeovers on similar companies.
5. Calculate the estimated takeover price for the target as the sum of estimated stock value based on comparable and the takeover premium.

Comparable transaction analysis: using recent takeover transactions of similar companies to estimate the takeover price.

1. Identify a set of recent takeover transactions. Should be firms in the same industry and have a similar capital structure.
2. Calculate various relative value measures based on **completed deal prices** for companies in the sample.
3. Calculate descriptive statistics for the relative value metrics and apply those measures to the target firm.

## 18.10 Compare the discounted cash flow, comparable company, and comparable transaction analyses for valuing a target company, including the advantages and disadvantages of each.

Discounted cash flow analysis: based on a forecast of the target firm's CF

1. Advantages
  - relatively easy to model
  - based on forecasts of conditions in the future
  - the model is easy to customize
2. Disadvantages
  - Hard to apply when free cash flows are negative
  - estimates of CF and earnings have error.
  - Discount rate changes over time
  - Estimation error

Comparable company analysis: use market data from similar firms AND a takeover premium

1. Advantages
  - Data for comparable companies is easy to access
  - Assumptions that similar assets have similar value is good.
  - Estimates of value are from the market.

## 2. Disadvantages

- Assumes that the market valuation of the comparable companies is accurate
- Just get a fair stock price. Takeover premium must be determined.
- Difficult to incorporate merger synergies or changing capital structures in analysis.
- Historical data for premium estimate may not be timely.

Comparable transaction analysis: uses data from completed M&A deals

## 1. Advantages

- No need to estimate takeover premiums
- Estimates of value from actual M&A deals
- Reduce the risk that shareholders sue that the managers/BoD for mispricing the deal.

## 2. Disadvantages

- Assumes that M&A transactions are valued accurately.
- Not enough transactions to use.
- Difficult to incorporate merger synergies or changing capital structure.

### 18.11 Evaluate a takeover bid, and calculate the estimated post-acquisition value of an acquirer and the gains accrued to the target shareholders versus the acquirer shareholders.

1. Post-Merger Value of an Acquirer:  $V_{AT} = V_A + V_T + S - C$ , where  $V_{AT}$  is the post-merger value of the combined company,  $V_A$ ,  $V_T$  are acquirer and target,  $S$  is synergies, and  $C$  is the cash paid to target shareholders.
2. Gain Accrued to the Target:  $Gain_T = TP = \text{Takeover premium} = P_T - V_T$
3. Cash payment VS Stock payment
  - Cash payment: price is just the cash
  - Stock payment:  $P_T = N \times P_{AT}$  = number of new shares  $\times$  price per share of combined firm after the merger announcement.

Check the examples in notes. P306-Vol2

### 18.12 Explain how price and payment method affect the distribution of risks and benefits in M&A transactions

1. Effect of price: acquirer hopes buy low, target hopes to sell high.
2. Effect of Payment Method
  - Cash offer: acquirers assumes the risk and the potential reward.
  - Stock offer: some of the risk and potential rewards from the merger shift to the target.

### 18.13 Describe characteristics of M&A transactions that create value

1. Short term: target's stock price gains 30%, and acquirer's lose 1% 3%
  - Winner's curse: the firm who wins will overpay the most
  - Managerial hubris: managers overestimate the synergies and expected benefits.
2. Long term: Acquirers tend to underperform their peers
3. mergers enhance value for the acquirer
  - Strong buyer: acquirers that have strong performance in the prior 3 yrs.
  - Low premium
  - Few bidders
  - Favorable market reaction

### 18.14 Distinguish among equity carve-outs, spin-offs, split-offs and liquidation

Diverstitures: a company selling, liquidating, spinning off a division or subsidiary.

1. Equity carve-outs: create a new company. Shares are issued in public.
2. Spin-offs: create a new company. Shares are not issued to public but distributed to shareholders of parent company.
3. Liquidations: break up the firm, and sell assets.

### 18.15 Explain common reasons for restructuring

1. Division no longer fits into management's long-term strategy.
2. Lack of profitability
3. Individual parts are worth more than the whole.
4. Infusion of cash. Parents need money.

## 19 Reading 27: Equity Valuation: Applications and Process

### 19.1 Define valuation and intrinsic value and explain sources of perceived mispricing

Valuation assets, steps:

1. Understand the business
2. Forecast company performance
3. Select the appropriate valuation model
4. Convert the forecasts into a valuation.
5. Apply the valuation conclusions

Intrinsic value and actual intrinsic

$$IV_{analyst} - price = (IV_{actual} - price) + (IV_{analyst} - IV_{actual})$$

### 19.2 Explain the going concern assumption and contrast a going concern value to liquid value.

Going concern assumption: a company will continue to operate.

Liquidatio value: company will die.

### 19.3 Describe definitions of value and justify which definition of value is most relevant to public company valuation.

1. Intrinsic value: used for valuing public equities
2. Fair market value: the price that a hypothetical willing, informed, and able seller would trade an seet to a willing, informed, and able buyer.
3. Investment value: the value of a stock to a particular buyer. Some buyer's may have specific values for specific stocks.

Investment: intrinsic value is best. Acquisition: investment value is good.

## 19.4 Describe applications of equity valuation

Valuation: the process of estimating the value of an asset.

Methods: 1) Modeling 2) Comparing with similar assets

Uses:

1. Stock selection
2. Reading the market
3. Projecting the value of corporate actions
4. Fairness opinions
5. Planning and consulting
6. Communication with analysts and investors
7. Valuation of private business
8. Portfolio Management
  - Planning: plan investment strategy, select portfolios
  - Executing the investment plan

## 19.5 Describe questions that should be addressed in conducting an industry and competitive analysis

Five elements of industry structure (Porter's five forces)

1. Threat of new entrants in the industry
2. Threat of substitutes
3. Bargaining power of buyers
4. Bargaining power of suppliers
5. Rivalry among existing competitors

Three generic strategies to compete and generate profits

1. Cost leadership: being the lowest-cost producer of the good
2. Product differentiation
3. Focus:

Several problems may be encountered

1. Accelerating or premature recognition of income
2. Reclassifying gains and nonoperating income
3. Expense recognition and losses
4. Amortization, depreciation, and discount rates
5. Off-balance sheet issues: SPE, leases

## 19.6 Contrast absolute and relative valuation models and describe examples of each type of model

1. Absolute valuation models: determine an asset's intrinsic value
  - PV of all cash flows
  - Dividend discount models
  - free cash flow
  - residual income
  - Asset-based models: estimate a firm's value as the sum of the mkt value of the assets it owns.
2. Relative valuation models: Financial factor should be similar for similar companies, like P/E. P/E higher than others: overvalued.

## 19.7 Describe sum-of-the-parts valuation and conglomerate discounts

1. Sum-of-the-parts value: company operates multiple divisions. Analyst value individual parts and add them.
2. Conglomerate discount: investors apply a markdown to the value of a company that operates in many unrelated divisions.
 

Reason

  - Internal capital inefficiency
  - Endogenous(internal) factors
  - Research measurement errors: some hypothesize that this discount does not exist.

## 19.8 Explain broad criteria for choosing an appropriate approach for valuing a given company

Things to consider

1. Fits the characteristics of the company
2. appropriate based on the quality and availability of input data
3. suitable for the given purpose of the analysis

## 20 Reading 28: Return Concepts

### 20.1 Distinguish among realized holding period return, expected holding period return, required return, return from convergence of price to intrinsic value, discount rate and internal rate of return.

1. Holding Period Return:  $r = \frac{P_1 - P_0 + CF_1}{P_0} = \frac{P_1 + CF_1}{P_0} - 1$  If the CF is received before the end of the period,  $CF_1$  = the cash flow received and the interest earned.  
Holding period return is annualized.
2. Realized and Expected Holding Period Return  
Realized return: historical return based on past prices/Cf  
Expected return: forecast
3. Required return: minimum return an investor requires given the asset's risk.  
Also called Opportunity cost.  
Expected return greater(less) than required return → Undervalued(Overvalued)
4. Price Convergence: Expected return = required return +  $\frac{V_0 - P_0}{P_0}$

5. Discount Rate:
6. Internal Rate of Return: Rate that makes PV of CF = The current price of securities  
In efficient market, IRR=required return

## 20.2 Calculate and interpret an equity risk premium using historical and forward-looking estimation approaches

Background:

1. Equity risk premium: The return in excess of risk-free rate = required return on equity index - risk-free rate
2. Required return for individual stocks =  $r_{fr} + \beta_j \times (\text{equity risk premium})$

Estimates of The Equity Risk Premium:

1. Historical Estimates: use mean market return and mean rfr  
-Strength: Objectivity, simplicity, unbiased  
-Weakness: i) Assume mean/variable constant over time. ii) Biased by survivorship
2. Forward-Looking Estimates: use current information and expectations on economic/financial variables.  
-Strength: doesn't rely on stationary assumption; less influenced by survivorship.  
-Three model: Gordon growth, supply-side, estimate from surveys

Three main

1. Gordon Growth Model=constant growth model  
GGM equity risk premium = (1-year forecasted dividend yield on mkt index) + (consensus long-term earnings growth rate) - (long-term government bond yield) =  $D_1/P + \hat{g} - r_{LT,0}$   
-Weakness: i) this estimation will change over time. ii) Assume stable growth rate
2. Supply-Side Estimates(Marcoeconomic Models): based on relations between macroeconomic variables and financial variables.  
-Strength: proven models and current information  
-Weakness: only good for developed countries  
-Model:  $ERP = [1 + \hat{i}] \times [1 + r\hat{E}g \times [1 + P\hat{E}g]] - 1 + \hat{Y} - \hat{R}F$   
where  $\hat{i}$ =expectation inflation,  $r\hat{E}g$ =expected real growth in EPS,  $P\hat{E}g$ =expected changes in the P/E ratio,  $\hat{Y}$ =the expected yield on the index,  $\hat{R}F$
3. Survey Estimates: easy to obtain, but may have a wide disparity.

## 20.3 Estimate the required return on an equity investment using the capital asset pricing model, the Fama-French model, the Pator-Stambaugh model, macro-economic multifactor models, and the build-up method.

1. Capital Asset Pricing Model  
Required return on stock j = risk-free rate + equity risk premium  $\times$  beta of j
2. Multifactor models  
Required return =  $RF + \text{risk premium}_1 + \text{risk premium}_2 + \dots + \text{risk premium}_n$   
 $\text{risk premium}_i = \text{factor sensitivity} \times \text{factor risk premium}$
3. Fama-French Model: accounts for the higher returns associated with small-cap stocks  
required return of stock j =  $RF + \beta_{mkt,j} \times (R_{mkt} - RF) + \beta_{SMB,j} \times (R_{small} - R_{big}) + \beta_{HML,j} \times (R_{HBM} - R_{LBM})$   
( $R_{mkt} - RF$ ) = return on a value-weighted market index - risk free rate;

$R_{small} - R_{big}$  = a small-cap return premium equal to the average return on small-cap portfolios - the average return on large-cap portfolios;

$R_{HBM} - R_{LBM}$  = a value return premium equal to the average return on high-book-to-market portfolios - the average return on low-book-to-market portfolios

Expected value for  $\beta_{mkt,j} = 1$ , latter two  $\beta$  are 0

4. Pastor-Stambaugh Model: adds a liquidity factor to the F-F model. base: 0; less liquid: positive  $\beta$
5. Macroeconomic Multifactor Models: use multiple factors and corresponding beta. Burmeister, Roll, and Ross Model:
  - Confidence risk
  - Time horizon risk
  - Inflation risk
  - Business cycle risk
  - Market timing risk
 Add RF and beta times these risks.
6. Build-up method: good for a company where betas are not readily obtainable  
 Required return = RF + equity risk premium + size premium + specific-company premium
7. Bond-Yield Plus Risk Premium Method: good for a company with publicly traded debt  
 Risk Premium = Risk premium + the YTM of Long-term debt

## 20.4 Explain beta estimation for public companies for public companies, thinly traded public companies, and nonpublic companies

1. Beta Estimates for Public Companies
  - Public company: compute by regressing the returns of stock on the returns of the overall mkt.
  - Common Index: SP500, NYSE; Common time scale: 5 years of monthly or 2 years of weekly data.
2. Adjusted Beta for Public Companies
  - beta drift: tendency of an estimated beta to revert to 1.0 over time
  - Blume method: adjusted beta = (2/3 regression beta) + (1/3 × 1.0)
3. Best Estimates for Thinly Traded stocks and Nonpublic Companies
 

Steps

  - Find a benchmark company XYZ, publicly traded and similar
  - Estimate the benchmark beta
  - Find Unlevered beta: unlevered beta for XYZ = (beta of XYZ)  $1/(1 + \text{debtof}XYZ/\text{equityof}XYZ)$
  - Estimated beat for ABC = unlevered beta of XYZ  $\times (1 + \text{debtof}ABC/\text{equityof}ABC)$

## 20.5 Describe strengths and weaknesses of methods used to estimate the required return on an equity investment

1. CAPM
  - S: simple, one factor
  - W: need to choose appropriate factor; low explanatory power
2. Multifactor models:
  - S: higher explanatory power
  - W: Complex, expensive
3. Build-up models:
  - S: simple
  - W: use historical values that may or may not be relevant to current market conditions

## 20.6 Explain international considerations in required return estimation

Need to consider the exchange risk. Two models

1. Country Spread Model: Use a developed market as benchmark and add a risk premium (difference between the yield on bonds)
2. Country Risk Rating Model: Use a model, and take the risk rating as independent variable.

## 20.7 Explain and calculate the weighted average cost of capital for a company

WACC=

$$\frac{\text{marketvalueofdebt}}{\text{mktvalueofdebtandequity}} \times r_d \times (1 - \text{taxrate}) + \frac{\text{mktvalueofequity}}{\text{mktvalueofdebtandequity}} \times r_e$$

## 20.8 Evaluate the appropriateness of using a particular rate of return as a discount rate, given a description of the cash flow to be discounted and other relevant facts

CF to the entire company: WACC

CF to equity: required return on equity

## 21 Reading 29: Industry and Company Analysis

### 21.1 Compare top-down, bottom-up, and hybrid approaches for developing inputs to equity valuation models

1. Bottom-Up: starts with an individual company
2. Top-down: starts with macroeconomic variables, often the expected growth rate of nominal GDP
3. Hybrid: incorporate both. Most common.

### 21.2 Compare growth relative to GDP growth and mkt growth and mkt share approaches to forecasting revenue

1. Growth Relative to GDP growth: modeled as GDP plus x%
2. Mkt growth and mkt share: mkt share  $\times$  mkt growth(industry sales)

### 21.3 Evaluate whether economies of scale are present in an industry by analyzing operating margins and sales levels

1. Economies of scale: average costs of production down and sales up
2. Check income stmts. Lower COGS as a proportion of sales for larger companies  $\rightarrow$  economies of scale in COGS

### 21.4 Forecast the following cost: COGS, SGA, financing cost and income taxes

1. Cost of Goods Sold(COGS)
  - Forecast COGS = historical COGS/revenue  $\times$  estimate of future revenue
  - Or Forecast COGS = (1 - gross margin)  $\times$  (estimate of future revenue)



2. Selling General and Administrative Costs(SG&A)
  - SGA operating expenses are less sensitive to changes in sales.
  - SGA selling and distribution costs are more directly related to sales volumes.
3. Financing Cost: interest for debt/equity financing
  - Net Debt: gross debt - cash, cash equivalents and short-term securities
  - Net interest expense: gross interest expense - interest income on cash/short-term debt securities
4. Income Tax Expense
  - Statutory rate: percentage tax charged in the country where the firm is
  - Effective tax rate: income tax expense as a percentage of pretax income
  - Cash tax rate: cash taxes paid as a percentage of pretax income

## 21.5 Describe approaches to balance sheet modeling

1. Inventory management: inventory turnover. Use forecasted COGS/inventory ratio to forecast inventory value
2. Accounts receivable: Projected accounts receivable = days sales outstanding  $\times$  forecasted sales/365
3. Property, Plant, and Equipment(PP&E)
  - Method 1: equal to its historical average proportion of sales

## 21.6 Describe the relationship between return on invested capital and competitive advantage

1. Return on invested capital = Net operating profit adjusted for taxes / Invested capital(operating assets - operating liabilities)
2. Return on capital employed = Pretax operating earnings / invested capital

## 21.7 Explain how competitive factors affect prices and costs

## 21.8 Judge the competitive position of a company based on a Porter's five forces analysis

1. Companies have less pricing power when the **Threat of substitute products** high and switching costs are low
2. Companies have less pricing power when the **intensity of industry rivalry** is high, when industry concentration is less, fixed cost/exit barriers are high, industry growth is slow/negative, products not differentiated to a significant degree.
3. Company prospects for earnings growth are lower when the **bargaining power of supplier** is high
4. Company has less pricing power when the **bargaining power of customers** is high
5. Company has more pricing power and better for earnings growth when **threat of new entrants** is low

## 21.9 Explain how to forecast industry and company sales and costs when they are subject to price inflation or deflation

1. Costs of input will affect. Hedge or vertical integration can avoid the risk.
2. Raw material Product's elasticity of demand will affect the price
3. Analysts should understand a company's hedging activities

### **21.10 Evaluate the effects of technological development on demand, selling prices, costs, and margins**

Advances in technology will decrease costs of production; improved substitutes or wholly new products.  
Model the introduction of new substitutes: cannibalization factor – new product sales that will replace the old sales.

### **21.11 Explain considerations in the choice of an explicit forecast horizon**

1. Forecast horizon: expected holding period for a stock.
2. Highly cyclical companies: long enough to include middle of a business cycle to get mid-cycle level of sales and profits
3. Important events(merger, acquisition): long enough to include the related profits.

### **21.12 Explain an analyst's choices in developing projections beyond the short-term forecast horizon**

1. Earnings in short term: trend growth rate of revenue will continue
2. Terminal value: estimated with a relative valuation approach or a discounted cash flow approach
3. Multiples approach: make sure the multiples used are consistent with the estimated growth rate and required rate of return.
4. Discounted cash flow to estimate the terminal value:
  - Cash flows: using a mid-cycle value
  - Expected growth rate
5. IMPORTANT: find inflection points, from when the future will not be like the past
  - Changes in overall economic environment
  - Changes in business cycle stage
  - Changes in Government regulations
  - Changes in Technology

### **21.13 Demonstrate the development of a sales-based pro forma company model**

Steps

1. Estimate revenue growth and future expected revenue
2. Estimate COGS
3. Estimate SGA
4. Estimate financing costs
5. Estimate income tax expenses and cash taxes
6. Estimate cash taxes, taking into account changes in deferred tax items
7. Model the balance sheet based on items that flow from the income stmt
8. Using depreciation and capital expenditures to estimate capital expenditures and net PP&E for the balance sheet
9. Use the completed pro forma income stmt and balance sheet to construct a pro forma cash flow stmt

## 22 Reading 30: Discounted Dividend Valuation

### 22.1 Compare dividends, free cash flow, and residual income as inputs to discounted cash flow models and identify investment situations for which each measure is suitable

Dividend discount models:

1. Definition: DDM define cash flow as the dividends to be received by the shareholders.
2. Advantages and disadvantages
  - A: theoretically justified; dividends are less volatile than other measures
  - DA: hard for firms that don't pay dividends; dividend policy may be controlled by someone, therefore doesn't show the expected cash flow to shareholders
3. Appropriate for
  - Companies that have a history of dividend payments
  - Dividend policy is clear and related to the earnings of the firm
  - when The valuation Perspective is that of a minority shareholder

Free cash flow to the firm(FCFF):

1. Definition: Cash flow generated by the firm's operations that in excess of the capital investment required to sustain the firm's current productive capacity.
2. Free cash flow to equity: cash available to stockholders after funding capital and expenses related with debt financing
3. Advantages and disadvantages
  - A: good for many firms
  - Dis: i) Company may have negative CF for many years.
4. Appropriate for
  - Firms do not have dividend payment history or payment history is not related to earnings
  - firms which CF corresponds to earnings
  - when valuation perspective is of a controlling shareholder.

Residual income

1. Definition: RI - earnings that exceeds the investor's required return.
2. Advantage and disadvantages
  - A: good for companies with negative cf and to dividend-and non-dividend-paying firms
  - Dis: require in-depth analysis on accountings.
3. Appropriate:
  - firms that do not have dividend histories
  - negative free cf
  - firms with transparent financial reporting

### 22.2 Calculate and interpret the value of a common stock using the dividend discount model for single and multiple holding periods

1. One-Period DDM:  $V_0 = \frac{D_1 + P_1}{1+r}$ 
  - $D_1$ : dividends to be received at end of year 1
  - $P_1$ : price expected upon sale at end of year 1
  - required return

2. Two-Period DDM:  $V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2+P_2}{(1+r)^2}$
3. Multi-Period DDM:  $V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \dots + \frac{D_n+P_n}{(1+r)^n}$

## 22.3 Calculate the value of a common stock using the Gordon growth model and explain the model's underlying assumptions

1. Assumptions: dividends increase at a constant rate
  - Firm expects to pay a dividend,  $D_1$ , in one year
  - Dividends grow in a constant rate  $g$
  - the growth rate  $g$  is less than the required return  $r$
2. Formula:  $V_0 = \frac{D_0(1+g)^1}{1+r} + \dots + \frac{D_0(1+g)^n}{(1+r)^n} = \frac{D_0(1+g)}{r-g} = \frac{D_1}{r-g}$

## 22.4 Calculate and interpret the implied growth rate of dividends using the Gordon growth model and current stock price

Gordon  $V_0 = \frac{D_1}{r-g}$ . Know 3 of them, we can find the last one.

## 22.5 Calculate and interpret the present value of growth opportunities (PVGO) and the component of the leading price-to-earnings ratio(P/E) related to PVGO

$V_0 = \frac{E_1}{r} + PVGO$  where

$E_1$ =earnings at  $t=1$

$r$ =required return on equity If the company has additional opportunities, it will be great.

## 22.6 Calculate and interpret the justified leading and trailing P/Es using the Gordon growth model

1. Leading P/E =  $\frac{P_0}{E_1} = \frac{D_1/E_1}{r-g} = \frac{1-b}{r-g}$   
 Trailing P/E =  $\frac{P_0}{E_0} = \frac{D_0 \times (1+g)/E_0}{r-g} = \frac{(1-b) \times (1+g)}{r-g}$   
 Here,  $P_0$ = fundamental value,  $D_0$ =dividends just paid,  $D_1$ =dividends expected to be received in one year,  $b$ =retention ratio,  $1-b$ =dividend payout ratio

## 22.7 Calculate the value of noncallable fixed-rate perpetual preferred stock

1. Value of perpetual preferred shares =  $\frac{D_P}{r_P}$ , where  $D_P$  is preferred dividend, and  $r_P$ =cost of preferred equity.

## 22.8 Describe strengths and limitations of the Gordon growth model and justify its selection to value a company's common shares

1. Strength:
  - good for stable, mature, dividend-paying firms
  - good for valuing market indices
  - easily communicated and explained
  - Can be used to determine price-implied growth rates, required rates of return and value of growth opportunities
2. Limitations
  - Valuations are sensitive to growth rates and required returns

- not good for non-dividend-paying stocks
- unpredictable growth patterns of some firms will be bad for the company

## 22.9 Explain the assumptions and justify the selection of the two-stage DDM, the H-model, the three-stage DDM, or spreadsheet modeling to value a company's common shares

1. Two stage DDM:  
the company grows at a high rate for a short time, then back to a long-run perpetual growth rate. ie. Dividend growth rates will change.
2. H-Model:  
The growth rate will declines linearly over the high-growth stage until it reaches the long-run average growth rate.
3. Three-stage DDM: good for firms that have three distinct stages of earnings growth.
4. Spreadsheet modeling: in practice, use spreadsheets to model any pattern of dividend growth every year.

## 22.10 Explain the growth phase, transitional phase, and maturity phase of a business

1. Initial growth phase: rapidly increasing earnings, little or no dividends, and heavy reinvestment
2. Transition phase: earnings and dividends are increasing but still low
3. Maturity phase: earnings growth at a stable but slower rate, payout ratios are stable, ROE=required rate of return

## 22.11 Describe terminal value and explain alternative approaches to determining the terminal value in a DDM

Ways to determine the terminal value:

1. Gordon growth model: at some point of future, assume dividends will begin to grow at a constant.
2. Market price multiples: estimate market price multiples, and using it to estimate future price.

## 22.12 Calculate and interpret the value of common shares using the two-stage of DDM, the H-model, and the three-stage DDM.

1. Valuation Using the Two-Stage Model:

$$V_0 = \sum_{t=1}^n \frac{D_0(1+g_s)^t}{(1+r)^t} + \frac{D_0(1+g_s)^n(1+g_L)}{(1+r)^n(r-g_L)}$$

2. Valuation using the H-Model

$$V_0 = \frac{D_0(1+g_L)}{r-g_L} + \frac{D_0 \times H \times (g_s - g_L)}{r - g_L}$$

Where  $H = t/2$  =half-life (in years) of high-growth period

3. Valuation using the Three-stage DDM  
Similar to two-stage DDM

### 22.13 Estimate a required return based on any DDM, including the Gordon growth model and the H-model

LOS doesn't need you to calculate the required return.

1. From Gordon growth model:  $r = \frac{D_1}{P_0} + g$
2. From H-Model:  $r = \frac{D_0}{P_0}((1 + g_L) + H(g_s - g_L)) + g_L$

### 22.14 Explain the use of spreadsheet modeling to forecast dividends and to value common shares

Need to estimate the terminal value of a security. Then discount it back to current days.

### 22.15 Calculate and interpret the sustainable growth rate of a company and demonstrate the use of DuPont analysis to estimate a company's sustainable growth rate.

SGR: the rate at which earnings and dividends can continue to grow indefinitely

$SGR = b \times ROE$

$$ROE = \frac{\text{netincome}}{\text{stockholder's equity}} = \frac{\text{netincome}}{\text{sales}} \frac{\text{sales}}{\text{total assets}} \times \frac{\text{total assets}}{\text{stockholder's equity}}$$

PRAT Model: Profit margin, Retention rate, Asset turnover, and financial leverage

$$SGR = b \times ROE = \frac{\text{Netincome} - \text{dividends}}{\text{netincome}} \frac{\text{netincome}}{\text{sales}} \frac{\text{sales}}{\text{total assets}} \times \frac{\text{total assets}}{\text{stockholder's equity}}$$

### 22.16 Evaluate whether a stock is overvalued, fairly valued, or undervalued by the market based on a DDM estimate of value.

If market price higher than the DDM price, then it's overvalued.

## 23 Reading 31: Free Cash Flow Valuation

Free Cash Flow: Free cash flow removes cash to pay operation expense, working capital investment, and fixed capital investment.

FCFF: cash available to stockholder's and bondholders.

### 23.1 Compare the FCFF and FCFE approaches to valuation.

1. Firm value = FCFF discounted at WACC
2. Equity value = FCFE discounted at required return on equity
3. Equity value = Firm value - Market value of debt

Difference between FCFF and FCFE:

1. FCFE is easier and straightforward
2. FCFF is good if the firm has significant debt outstanding.

## 23.2 Explain the ownership perspective implicit in the FCFE approach

Ownership perspective

1. Free cash flow approach
  - (a) Control perspective: for an acquirer, who can change the firm's dividend policy
  - (b) For minority shareholders perspective
2. Dividend approach  
 Perspective: minority owner. They have no direct control over the firm's dividend policy.

Why prefer Free Cash Flow than dividend-based valuation?

1. Companies pay no/low cash dividends.
2. Dividends are decided by the board of directors. Not align with the firm's long-run profitability.
3. Free Cash Flow are better if the company is an acquisition target. B/c new owners might change the distribution of dividends.
4. FCF is more related to long-run profitability.

## 23.3 Explain the appropriate adjustments to net income, EBIT, EBITDA, CFO to calculate FCFF and FCFE

Terms:

1. EBIT: Earnings before interest and taxes
2. EBITDA: Earnings before interest, taxes, depreciations, and amortization
3. CFO: Cash flow from operations

Calculating FCFF from net income:

$$\text{FCFF} = \text{NI} + \text{NCC} + \text{Int} \times (1 - \text{tax rate}) - \text{FCInv} - \text{WCInv}$$

1. NCC(non cash charges): like amortization of intangible assets, amortization of a bond discount, deferred taxes.
2. Fixed capital investment: they do not appear on the income statement, but they represent cash leaving the firm.  
 $\text{FCInv} = \text{Capital expenditures} - \text{proceeds from sales of long-term assets}$ 
  - (a) If no long-term assets were sold:  $\text{FCInv} = \text{ending net PP\&E} - \text{beginning PP\&E} + \text{depreciation}$
  - (b) If long-term assets sold:  $\text{FCInv} = \text{ending net PP\&E} - \text{beginning PP\&E} + \text{depreciation} - \text{Gain on sale}$ .
- (a) Working capital investment: Change in working capital, excluding cash, cash equivalents, notes payable, and the current portion of long-term debt
- (b) Interest expense: should add it back.

Other Formulas:

1. Calculating FCFF from EBIT:  
 $\text{FCFF} = \text{EBIT} \times (1 - \text{tax rate}) + \text{Depreciation} - \text{FCInv} - \text{WCInv}$
2. Calculating FCFF from EBITDA  
 $\text{FCFF} = \text{EBITDA} \times (1 - \text{tax rate}) + \text{Dep} \times \text{tax rate} - \text{FCInv} - \text{WCInv}$

3. Calculating FCFF from CFO  

$$\text{FCFF} = \text{CFO} + \text{Int} \times (1 - \text{tax rate}) - \text{FCInv}$$
4. Calculating FCFE from FCFF:  

$$\text{FCFE} = \text{FCFF} - \text{Int} \times (1 - \text{tax rate}) + \text{net borrowing}$$
5. Calculating FCFE from net income  

$$\text{FCFE} = \text{NI} + \text{NCC} - \text{FCInv} - \text{WCInv} + \text{Net borrowing}$$
6. Calculate FCFE from CFO:  

$$\text{FCFE} = \text{CFO} - \text{FCInv} + \text{Net borrowing}$$

Free Cash flow with Preferred stock

1. FCFF/FCFE above assume that the company only have debt and common equity. Preferred stock dividends should be added back to get FCFF. PS can be considered as debt, but dividends are not tax deductible.

### 23.4 Calculate FCFF and FCFE

1.  $\text{FCFF} = \text{Changes in cash balance} + \text{Net payments to debt providers} + \text{Net payments to equity stakeholders}$
2.  $\text{FCFE} = \text{Changes in cash balances} + \text{Net payments to equity stakeholders}$

### 23.5 Describe approaches for forecasting FCFF and FCFE

Two approaches

1. Historical Free Cash Flow:  
 -Assumptions: constant growth, constant fundamental factors
2. Components of free cash flow  
 -Assumptions: each component grow at different rate; ties sales forecasts to future capital expenditures, depreciation expenses, and changes in working capital  
 -IMPORTANT: Capital expenditures → i) Outlays that are needed to maintain existing capacity: current levels of sales; ii) Outlays that are needed to support growth: predicted sales growth.

Forecasting FCFE with the second method, Target debt-to-asset ratio for the new investment is fixed in Fixed Capital and Working Capital

$$\text{FCFE} = \text{NI} - (1 - \text{DFR}) \times (\text{FCInv} - \text{Dep}) - (1 - \text{DR}) \times \text{WCInv}$$

### 23.6 Compare the FCFE model and dividend discount models

The FCFE: control perspective

Dividend discount: Minority perspective

### 23.7 Explain how dividends, share repurchases, share issues, and changes in leverage may affect future FCFF and FCFE

dividends, share repurchases, share issues have no effect on FCFF and FCFE

Changes in leverage have no effects on FCFF and minor effects on FCFE.



### 23.8 Evaluate the use of net income and EBITDA as proxies for cash flow in valuation

Net income: Poor for FCFE

FCFE=NI+NCC-FCInv-WCInv+net borrowing

EBITDA: poor for FCFF

FCFF=EBITDA $\times$ (1-tax rate)+Dep $\times$ tax rate-FCInv-WCInv

### 23.9 Explain the single-stage, two-stage, and three-stage FCFF and FCFE models and select and justify the appropriate model given a company's characteristics

Single-Stage FCFF Model

1. Assumptions: i)FCFF grows@constant g. ii)growth rate<WACC
2. Equation: Value of the firm =  $\frac{FCFF_1}{WACC-g} = \frac{FCFF_0 \times (1+g)}{WACC-g}$

Single-stage FCFE Model

1. Assumptions: Similar to FCFF
2. Value of the equity =  $\frac{FCFE_1}{r-g} = \frac{FCFE_0 \times (1+g)}{r-g}$
3. Often used in international valuation

Multistage Models: How Many Variations are there?

1. key: Value = PV of expected future CF discounted at the appropriate discount rate
2. Comparisons
  - FCFF VS FCFE: FCFF - WACC, FCFE - required return on equity
  - Two stage vs three stage: just different time scale
  - Forecasting growth in total free cash flow (FCFF or FCFE) VS forecasting the growth rates in the components of free cash flow: These two models are good.

Model Assumptions and Firm Characteristics

1. Two- or three stage? two stage: short-term supernormal growth; three-stage: like growth phase, mature phase, and a transition phase

### 23.10 Estimate a company's value using the appropriate free cash flow models

Examples on Vol 3 P137

### 23.11 Explain the use of sensitivity analysis in FCFF and FCFE Valuations

1. Sensitivity analysis: how sensitive an analyst's valuation results are to changes in each of a model's inputs
2. Two major sources
  - Estimate the future growth in FCFF and FCFE, growth forecasts depend on a firm's future profitability.
  - The chosen base years for FCFF or FCFE growth forecasts

### 23.12 Describe approaches for calculating the terminal value in multistage valuation model

Two way

1. Use single-stage model, assume that the forecasted FCFF and FCFE will grow at the long-term stable growth rate after some time
2. Use multiples:
  - Terminal value in year  $n$  = trailing  $P/E \times$  earnings in year  $n$
  - Terminal value in year  $n$  = leading  $P/E \times$  earnings in year  $n+1$

## 24 Reading 32: Market-Based Valuation: Price and Enterprise Value Multiples

### 24.1 Distinguish between the method of comparables and the method based on forecasted fundamentals as approaches to using price multiples in valuation, and explain economic rationales for each approach.

1. Method of comparables: values a stock based on the average price multiple of the stock of similar companies
  - Law of One Price
2. Method of forecasted fundamentals: values a stock based on the ratio of its value from a discounted cash flow model to some fundamental variables.
  - Value = PV of all future cash flows

### 24.2 Calculate and interpret a justified price multiple

### 24.3 Describe rationales for and possible drawbacks to using alternative price multiples and dividend yield in valuation

### 24.4 Calculate and interpret alternative price multiples and dividend yield

Justified price multiple: The multiple when the stock is fairly valued.

P/E Ratio: price to earnings

1. A and DisA:
  - A: popular used, P/E differences different significantly related to long-run average
  - DisA: Earnings can  $< 0$ , Earnings can be volatile, earnings can be distorted in reports.
2. Equation:
  - Trailing P/E = Mkt Price per Share / EPS over previous 12 months.
  - Leading P/E = Mkt Price per Share / EPS expected over next 12 months

P/B Ratio: price to book value

1. A and DisA:
  - A: Book value usually  $> 0$ ; Bv more stable than EPS; Good for firms that hold liquid assets; good for firms that are expected to go out of business; good to explain differences in long-run average stock returns
  - DisA: exclude intangible economic assets; misleading; accounting conventions may different; inflation/tech change will change the book value/mkt values of assets
2.  $P/B \text{ ratio} = \text{Mkt value of equity} / \text{book value of equity} = \text{Mkt price pshare} / \text{BValue pshare}$   
 Book value of equity = Common shareholder's equity = Total Assets - total liabilities - Preferred stock

P/S Ratio: price to sale

1. A and DisA

A: always positive; hard to manipulate sales; not volatile; good for mature/cyclical industries or start-up

DisA: high growth in sales  $\neq$  high profit; P/S ratio doesn't describe cost structures; revenue recognition may be distorted.

2. P/S ratio = Mkt value of equity / total sales

P/CF ratio: price to cash flow

1. A: CF is hard to manipulate; P/CF more stable than P/E

2. Dis: If we use  $CF = Eps + \text{noncash charges}$ , noncash revenue and net changes in working capital are ignored, though they will affect actual cash flow; FCFE is preferable to operating CF, however, FCFE is more volatile.

Dividend Yield: common dividend to the market price

1. A and DisA:

-A: dividend yield contributes to total investment return; dividends are not as risky as the capital appreciation component of total return

-DisA: DY doesn't include capital appreciation;

2. Equation

Trailing D/P =  $4 \times \text{most recent quarterly dividend} / \text{mkt price ps}$

Leading D/P =  $\text{forecasted dividends over next four quarters} / \text{mkt ps}$

## 24.5 Calculate and interpret underlying earnings, explain methods of normalizing earnings per share(EPS), and calculate normalized EPS

Underlying Earnings:

1. Definition: earnings - nonrecurring components (gain/loss from asset sales, asset write-downs, provisions for future losses, and changes in accounting estimates)

2. Molodovsky effect: earnings have a transitory portion that is due to cyclicalities. In business cycles, P/Es will be high due to lower EPS at the bottom of the cycle and low P/Es due to high EPS at the top of the cycle.

Normalized Earnings: use estimate of EPS in the middle of business cycle

1. Method of historical average EPS: average EPS over some recent period

2. Method of average return on equity: average return on equity times the current book value per share = average  $ROE \times BVPS$ . -Preferred.

## 24.6 Explain and justify the use of earnings yield(E/P)

When earnings  $< 0$ , P/E ratios are meaningless. we can use E/P:

High E/P  $\rightarrow$  cheap security; Low E/P  $\rightarrow$  Expensive security.

## 24.7 Describe fundamental factors that influence alternative price multiples and dividend yield

## 24.8 Calculate and interpret the justified P/E, P/B, P/S ratios for a stock, based on forecasted fundamentals

Justified P/E Multiple

1. Equations:

$$P_0 = V_0 = \frac{D_0 \times (1 + g)}{r - g} = \frac{D_1}{r - g}$$

Trailing P/E=

$$\frac{P_0}{E_0} = \frac{D_0 \times (1 + g)/E_0}{r - g} = \frac{(1 - b)(1 + g)}{r - g}$$

Leading P/E=

$$\frac{P_0}{E_1} = \frac{D_1/(r - g)}{E_1} = \frac{1 - b}{r - g}$$

Here,  $b$  is the retention rate.

Justified P/B Multiple

1. Equation and derivation

$$\begin{aligned} P_0 &= D_1/(r - g) = E_1 \times (1 - b)/(r - g) \\ &= B_0 \times ROE \times (1 - b)/(r - g) \\ &= B_0 \times (ROE - g)/(r - g) \\ g &= ROE \times b, E_1 = B_0 \times ROE \\ P/B &= P_0/B_0 = \frac{ROE - g}{r - g} \end{aligned}$$

2. P/B increase  
ROE increase

Justified P/S Multiple

1. Equation and derivation

$$\begin{aligned} \frac{P_0}{S_0} &= \frac{E_0/S_0 \times (1 - b)(1 + g)}{r - g} \\ &= (E_0/S_0) \times \frac{(1 - b) \times (1 + g)}{r - g} = \text{net profit margin} \times \text{justified trailing P/E} \end{aligned}$$

2. P/S will increase if  
Profit margin increases  
Earnings growth rate increase

Justified P/CF Multiple

1. Equations and derivation

$$\begin{aligned} \text{From FCFE: } V_0 &= FCFE_0 \times (1 + g)/(r - g) \\ P/CF &= V_0/CF_0 \end{aligned}$$

2. P/CF increase if  
 $r$  down,  $g$  up

Justified EV/EBITDA Multiple: Enterprise value/EBITDA

1. Positively related to the growth rate in FCFF and EBITDA
2. Negatively related to WACC

Justified Dividend Yield

1.  $D_0/P_0 = (r-g)/(1+g)$
2. Positively related to  $r$ , negatively related to growth rate in dividends.

## **24.9 Calculate and interpret a predicted P/E, given a cross-sectional regression on fundamental, and explain limitations to the cross-sectional regression methodology**

1. Calculation: linear regression of historical P/Es on fundamental variables.
2. Limitations
  - Predictive power of the estimated P/E for a different is uncertain
  - Relationships between P/E and the fundamental variables examined may change over time
  - Multicollinearity, makes it difficult to interpret individual regression coefficients

## **24.10 Evaluate a stock by the method of comparables and explain the importance of fundamentals in using method of comparables**

## **24.11 Evaluate whether a stock is overvalued, fairly valued, or undervalued based on comparisons of multiples**

Use multiples to value stocks

1. P/E
  - (a)  $P/E \text{ Multiples} < \text{the benchmark} \rightarrow \text{Undervalued}$
  - (b) Usual P/E multiples
    - P/E of another company's with similar properties
    - average or median peer group
    - P/E of an index
    - average historical P/E for the stock.
2. P/B
  - (a) Similar to P/E
  - (b) Difference:
    - Use trailing book values in calculating P/Bs
3. P/S
  - (a) Similar to P/E
  - (b) Difference
    - Use trailing sales
4. EV/EBITDA
  - (a)  $< \text{benchmark} \rightarrow \text{undervalue}$
5. Dividend yield

(a) high dividend yield → undervalue

The Fed and Yardeni models

1. Fed model: the overall mkt overvalued when the earnings yield (E/P) on the SP500 < the yield on 10-year US Treasury bonds.
2. Yardeni model  
 $-CEY = CBY - k \times LTEG + \varepsilon_i$   
 CEY = Current earnings yield of the market; CBY = current Moody's A-rated corporate bond yield  
 LTEG = five-year consensus earnings growth rate; k = constant,  $\approx 0.20$

## 24.12 Calculate and interpret the P/E-to-growth ratio (PEG) and explain its use in relative valuation

$$PEG_{ratio} = \frac{P/E_{ratio}}{g}$$

PEG ratio “standardizes” the P/E ratio for stocks with different growth rates. Small PEG ratio → better.  
 Drawbacks:

1. P/E and g is not linear.
2. PEG ratio doesn't account for risk.
3. PEG ratio doesn't reflect the duration of the high-growth period for a multistage valuation model.

## 24.13 Calculate and explain the use of price multiples in determining terminal value in a multistage discounted cash flow model.

Two methods:

1. based on fundamentals
  1. Terminal value in year n = justified leading P/E × forecasted earnings in year n+1
  2. Terminal value in year n = justified trailing P/E × forecasted earnings in year n
2. based on comparables
  1. Terminal value in year n = benchmark leading P/E × forecasted earnings in year n+1
  2. Terminal value in year n = benchmark trailing P/E × forecasted earnings in year n

## 24.14 Explain alternative definitions of cash flow used in price and enterprise value (EV) multiples and describe limitations of each definition

Definitions of cash flow available for use in calculating the P/CF

1. Earnings-plus-noncash charges (CF)
2. Adjusted cash flow (adjusted CFO)
3. Free cash flow to equity (FCFE)
4. Earnings before interest, taxes, depreciation and amortization (EBITDA)

Earnings-plus-noncash-charges (CF)

1. Definition: CF = net income + depreciation + amortization

2. Limitation: it ignores items that affect cash flow, like noncash revenue and changes in net working capital.

#### Cash Flow from Operations or Adjusted CFO

1. How to adjust for nonrecurring cash flows:
  - GAAP: interest paid/received, dividends received to be classified as operating cash flows
  - IFRS: interest paid in Operating/Financing, interest and dividends received in Operating/Investing

#### FCFE/EBITDA:

1.  $FCFE = CFO - FCInv + \text{net borrowing}$ , where  $FCInv$  = fixed capital investing, net borrowing = (long- and short-term debt issues) - (long- and short-term debt repayments)
2. EBITDA

$P/CF \text{ ratio} = \text{market value of equity} / \text{cash flow} = \text{mkt price per share} / \text{cash flow per share}$

### 24.15 Calculate and interpret EV multiples and evaluate the use EV/EBITDA

1. Enterprise value(EV) = market value of common stock + mkt value of preferred equity + mkt value of debt + minority interest - cash and investments
2.  $EV/EBITDA \text{ ratio} = \text{Enterprise value} / EBITDA$
3.  $EBITDA = \text{recurring earnings from continuing operations} + \text{interest} + \text{taxes} + \text{depreciation} + \text{amortization}$   
 $= EBIT + \text{depreciation} + \text{amortization}$

#### EV/EBITDA good/bad

1. Good
  - good when comparing firms with different degrees of financial leverages
  - EBITDA is useful for valuing capital-intensive businesses with high levels of depreciation and amortization
  - EBITDA is usually positive
2. Bad
  - EBITDA might overstate CFO
  - FCFF has the amount of capital expenditures, it's more related with valuation theory.

Alternative to EV: Total invested capital(TIC) = mkt value of invested capital = mkt value of companies equity and debt.

### 24.16 Explain sources of differences in cross-border valuation comparisons

1. Differences in accounting methods, cultures, risk, and growth opportunities.
2. Other differences: accounting treatment for goodwill, deferred income taxes, foreign exchange adjustments, R&D, pension expense, and tangible asset revaluations

### 24.17 Describe momentum indicators and their use in valuation.

1. Momentum indicators: mkt price/fundamental variable to the time series of historical/expected value.
  - Example: earning surprise, standardized unexpected earnings, relative strength.

Common momentum indicators

1. Unexpected earnings/earnings surprise=reported EPS-expected EPS
2. Standardized unexpected earnings(SUE): SUE=earnings surprise/standard deviation of earnings surprise  
Std comes from historical data.
3. Relative strength indicators: compare a stock's price or return performance with its own historical performance.

## 24.18 Explain the use of the arithmetic mean, the weighted harmonic mean, and the median to describe the central tendency of a group of multiples

Use Weighted harmonic mean to calculate Portfolio or index P/E:

$$WHM = \frac{1}{\sum_i \frac{w_i}{X_i}}$$

where  $X_i$  is the P/Es,  $w$  is the weights.

## 25 Reading 33: Residual Income Valuation

### 25.1 Calculate and interpret residual income, economic value added, and market value added.

Definitions

1. Residual income = economic profit = net income of a firm - a charge that measures stockholder's opportunity cost of capital.
2. Residual income explicitly deducts all capital costs.

EVA and MVA

1. Economic value added:  $EVA = NOPAT - (WACC \times \text{total capital}) = [EBIT \times (1-t)] - \$WACC$ 
  - (a) Use beginning year capital
  - (b) Terms:  
NOPAT= Net operating profit after tax(before subtracting interest expenses)  
t=marginal tax rate  
\$WACC= dollar cost of capital  
total capital=net working capital + net fixed assets = book value of long-term debt + book value of equity
  - (c) Adjustments that may be needed  
-Capitalize and amortize research and development charges, and add them back to earnings to get NOPAT.  
-Add back charges on strategic investments that will generate returns in the future  
-Eliminate deferred taxes and consider only cash taxes as an expense.  
-Treat operating leases as capital leases  
-Add LIFO reserve to invested capital and add back change in LIFO reserve to NOPAT.
2. Market value added:  $MVA = \text{market value} - \text{total capital} = \text{mkt value of equity and long-term debt} - \text{book value of invested capital}$   
-Use end-year capital.



## 25.2 Describe the use of residual income models

For the exam→Use residual income models to value equity and goodwill impairment.

## 25.3 Calculate the intrinsic value of a common stock using the residual income model and compare value recognition in residual income and other present value models

1. Equation:

$$RI_t = E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$$

$r$ =required return on equity;  $E_t$ =expected EPS for year  $t$ .

$B_{t-1}$ =book value per share in year  $t-1$

$ROE$ =expected return on new investments(expected return on equity.)

2. NOTE: Check examples in Notes.

Residual Income Valuation model

- 1.

$$V_0 = B_0 + \frac{RI_1}{(1+r)^1} + \frac{RI_2}{(1+r)^2} + \dots$$

2. Limitations:

-assumptions needed to calculate the PV of residual incomes.

## 25.4 Explain fundamental determinants of residual income

Single-stage residual income valuation model

1. Equations:

$$V_0 = B_0 + \left[ \frac{(ROE - r) \times B_0}{r - g} \right]$$

2. Assumptions:

-Constant dividend/earnings growth rate

-Stock is correctly valued:  $V_0 = P_0$

3. Fundamental drivers of residual income

- ROE must be greater than  $r$  to get additional value.

4. Tobin's Q:

$Q = (\text{mkt value of debt} + \text{mkt value of equity}) / (\text{replacement cost of total assets})$

=total mkt value of firm/total asset value of firm

## 25.5 Explain the relation between residual income valuation and the justified price-to-book ratio based on forecasted fundamentals.

Residual income models are most closely related to the price-to-book value.

## 25.6 Calculate and interpret the intrinsic value of a common stock using single-stage(constant-growth) and multistage residual income models.

Just check the examples in the Notes. Nothing special here.

## 25.7 Calculate the implied growth rate in residual income, given the market price-to-book ratio and an estimate of the required rate of return on equity.

Use equation:

$$g = r - \left[ \frac{B_0 \times (ROE - r)}{V_0 - B_0} \right]$$

## 25.8 Explain continuing residual income and justify an estimate of continuing residual income at the forecast horizon, given company and industry prospects

Continuing residual income:

- General summary: forecast short-horizon(5 years) residual income, and then use assumptions for long-term residual income.
- Persistence factor: $\omega$ , the projected rate at which the residual income is going to fade over the life cycle of the firm
- Assumptions(use one of below)
  - Residual income will persist at its current level forever
  - Residual income will drop to zero immediately
  - Residual income will decline over time as ROE falls to the cost of equity
  - Residual income will decline to a long-run average level consistent with a mature industry
- Equation:  $V_0 = B_0 + \text{PV of high-growth RI} + \text{PV of continuing residual income}$   
 NOTE: PV of continuing residual at the end of year T-1 =  $RI_T / (1+r-\omega)$ 
  - Assumptions 1: Residual income persist at the current level forever  
 $\omega = 1$   
 PV of continuing residual income in year T-1 =  $RI_T / r$
  - Assumptions 2: Residual income drops to 0  
 $\omega = 0$   
 PV of continuing residual income in year T-1 =  $RI_T / (1+r)$
  - Assumptions 3: Residual income declines over time to zero  
 $\omega \in [0, 1]$
  - Assumptions 4: Residual income declines to long-run level in mature industry.  
 PV of continuing residual in year T =  $P_T - B_T$ , where  $P_T$ =mkt value.  
 -Estimate  $P_T$ :  $P_T = B_T \times \text{Price-to-book value}$   
 -PV of continuing residual income in year T-1 =  $(P_T - B_T + RI_T) / (1+r)$

## 25.9 Compare residual income models to dividend discount and free cash flow models

DDM and FCFE: Discounting expected cash flows.

RI: starts with a book value.

## 25.10 Explain strengths and weaknesses of residual income models and justify the selection of a residual income model to value a company's common stock.

- Strength:
  - Terminal value does not dominate.

- RI use accounting data.
- Applicable to firms that do not pay dividends or do not have positive FCF
- applicable when CF is volatile
- Focus on economic profitability

## 2. Weakness

- rely on accounting data, which may be manipulated
- Need many adjustments
- Assumes that  $B_t = B_{t-1} + E_t - D_t$  holds(clean surplus model). However, any accounting charges that taken directly to equity accounts will break this relation, like currency translation gains/losses.

When to use RI models or not?

1. When:
  - firms do not pay dividends, or payments too volatile
  - Expected FCF are negative
  - Terminal forecast is highly uncertain
2. Not
  - Clean surplus model broke.
  - Estimates of book value and ROE is uncertain.

## 25.11 Describe accounting issues in applying residual income models.

Clean surplus violations, delete them

1. Foreign currency translation gains/losses that go to retained earnings
2. Certain pension adjustments
3. Gain/losses on certain hedging instruments
4. Changes in revaluation surplus for long-lived assets. IFRS only.
5. Changes in the mkt value of debt and equity that classified as available-for-sale.

Variations from Fair Value: accrual method may make book value are different from market values

1. Operating leases should be capitalized rather than expensed.
2. Special purpose entities' A/L should be consolidated to the parent company.
3. Reserve and allowances should be adjusted.
4. Inventory with LIFO should be adjusted to FIFO.
5. Pension asset or liability should be adjusted to reflect the funded status of the plan.
6. Deferred tax liabilities should be eliminated and reported as equity if it's not going to reverse.

Intangible Asset Effects on book value

1. Intangibles recognized at acquisition
2. R&D expenditures: productive R&D increase ROE and RI.

Nonrecurring items and Other Aggressive Accounting Practices: Shouldn't include them to calculate CONTINUING RI.

International Accounting Differences.

## **25.12 Evaluate whether a stock is overvalued, fairly valued or undervalued based on a residual income model.**

Market price > model price → Overvalued.

## **26 Reading 34: Private Company Valuation**

### **26.1 Compare public and private company valuation**

#### **1. Company-Specific Factors**

- Stage of lifecycle: usually less mature, but sometimes mature firms/bankrupt firms near liquidation.
- Size: less capital, fewer assets, and fewer employees. Riskier.
- Quality and depth of management: maybe bad than public firms
- Management/shareholder overlap: substantial ownership position, long-term perspective
- Short-term investor: public firms usually take a shorter-term view, b/c shareholders often focus on short-term performance
- Quality of financial and other information: less information about financial disclosures.
- Taxes: private firms will be more concerned with taxes than public firms

#### **2. Stock-specific factors**

- Liquidity: equity has fewer potential owners, less liquid
- Restrictions on marketability: have agreement for not selling shares
- Concentration of control: concentrated in a few shareholders

### **26.2 Describe uses of private business valuation and explain applications of greatest concern to financial analyst**

3 Reasons: transactions, complicity, and litigation

#### **1. Transaction-Related Valuation**

- Venture capital financing: valuation subject to negotiation and informal
- Initial public offering (IPO): use values of similar public firms as benchmark
- Sales in an acquisition
- Bankruptcy proceedings
- Performance-based managerial compensation

#### **2. Compliance-related valuations**

- Financial reporting: often related to goodwill impairment test
- Tax purposes
- Litigation-Related valuation: shareholder suits, damage claims, lost profits claims or divorce settlements

### **26.3 Explain various definitions of value and demonstrate how different definitions can lead to different estimates of value**

Definitions of Value: depends on what valuation will be used for

1. Fair market value: for tax purposes
2. Fair value for financial reporting
3. Fair value for litigation
4. Market value: used for real assets where purchase will be levered.
5. Investment value: value to a particular buyer

## 6. Intrinsic value

The effect of Value Definition on Estimated Value

1. The definition of value affects the estimated value of an asset.
2. The valuation should be used for its intended purpose.

## 26.4 Explain the income, market, and asset-based approaches to private company valuation and factors relevant to the selection of each approach.

Three approaches:

1. Income approach: value a firm as PV of expected future income
2. Market approach: value a firm using the price multiples
3. Asset-based approach: values a firm's asset - liabilities

Related issues

1. Selection: depends on the firm's operations and its lifecycle stage
  - Early: asset-based
  - Developing: income approach
  - Mature: market approach
2. Firm size: parameters from large benchmark company shouldn't be used in small companies
3. Should include both Operating/nonoperating assets

## 26.5 Explain cash flow estimation issues related to private companies and adjustments required to estimate normalized earnings

Normalized earnings: "Firm earnings IF the firm were acquired." Adjustments needed are listed below.

Estimating Normalized Earnings

1. Exclude nonrecurring and unusual items. Adjustments may be needed for highly concentrated small firms, like internal transactions between the firm and its owner.
  - Example: high management compensation → normalized earnings will be larger than reporting earnings
  - low management compensation → normalized earnings will be smaller than reporting earnings
2. Company owned real estate: should be separated from the firm's operations  
Treatment: remove related income/expense. Use market lease rates.

Strategic and Nonstrategic Buyers

1. Strategic buyers: need to consider the perceived synergies related to other assets
2. Nonstrategic buyers: no synergies

Estimating Cash Flow

1. Controlling/uncontrolling equity interests will have different values
2. Scenarios should be considered if there is significant uncertainty
  - Development: sale of the firm, IPO, bankruptcy, continued private operation
  - Mature firm: different assumed growth rates
3. Aware: management may be biased on future estimates
4. FCFF/FCFE: FCFF is more appropriate when significant changes are anticipated.

## 26.6 Calculate the value of a private company using free cash flow, capitalized cash flow, and/or excess earnings methods

ALL of them are based on INCOME APPROACH

1. Free Cash Flow
  - Terminal value: usually five years out.
  - use constant growth model/price multiple approach
  - NOTE: double counting. In a high growth industry, PE ratio may result in double counting growth.
2. Capitalized Cash Flow
  - Good for: no comparables are available, projections are uncertain and stable growth is reasonable
  - Value of firm =  $FCFF_1 / (WACC - g)$ , where  $FCFF_1$  is the expected free cash flow to the firm over the next year.
  - Value of equity =  $FCFE_1 / (r - g)$
3. Retained Earnings/Excess Earnings
  - Starts with the earnings that SHOULD be generated by working capital and fixed assets
  - Excess earnings = firm earnings - required return of earnings
  - Value of intangible assets = PV of the stream of excess earnings. Using the excess earnings and the growing perpetuity formula from Capitalized Cash Flow.
  - Check EXAMPLES!

## 26.7 Explain factors that require adjustment when estimating the discount rate for private companies

1. Size premiums: small companies may have financial distress. Size premiums are added to the discount rates for small private companies.
2. Availability and cost of debt: private companies have less access to debt, and WACC will be higher
3. Acquirer versus target: some acquirer will incorrectly use their own cost of capital (low) to get a wrong high value of target company.
4. Projection risk: information availability; inexperienced manager forecasting
5. Lifecycle stage

## 26.8 Compare models used to estimate the required rate of return to private company, (for example, the CAPM, the expanded CAPM, and the build-up approach)

1. CAPM: Beta is estimated from public firm data. Not good for private firms that won't go public
2. Expanded CAPM: Includes additional premiums for size and firm-specific (unsystematic) risk
3. Build-up method: Used when it's impossible to find comparable public firms to estimate beta. Beginning with the expected return on the mkt, and add premiums for small size, industry factors, and company specific factors.

## 26.9 Calculate the value of a private company based on market approach methods and describe advantages and disadvantages of each method

Three main methods: Guideline Public Company (GPCM), Guideline Transactions Method (GTM), Prior Transaction Method (PTM)

Market approaches are preferred over income and asset approaches. Basic issues:

1. When choosing public comparables, consider industry, operations, size, and lifecycle.
2. Large private firm valuation is usually EBIT or EBITDA multiples, and Market Value of Invested Capital(MVIC) as numerator.
3. Small private firms: usually use net income multiples. A revenue multiple might be used for extremely small firms.

#### GPCM

1. Use price multiples from trade data for public companies.
2. Evaluating a controlling equity interest in a private firm, control premium should be considered. , because public trades transactions are for small noncontrolling interests.
  - (a) Transaction type: financial transactions has a smaller price premium.
  - (b) Industry conditions: Sometimes, there is a flurry in industry acquisition activity, which drives up acquisition prices. Control premium are somewhat included in such markets.
  - (c) Type of consideration: Historical Acquisitions may involve stocks, and the value are "bubbled", which may overstate the estimation of the control premium.
  - (d) Reasonableness: The estimation of control premiums should be checked.

Controlling premium only applies to the equity portion of the firm's value. Two way to include:

-Use raw multiple to estimate firm value, estimate the equity portion, and apply the control premium to the equity portion.

-Adjust controlling premium: Adjusted premium = (control premium on equity) × (1-DR), where DR = debt-to-asset ratio of the private company.

3.

#### GTM

1. Prior acquisition values for entire companies are used, and no additional adjustment for a controlling interest is necessary.
2. Issues related to limited information of private companies
  - (a) Transaction type: need to adjust the historical multiple, if data is strategic transaction while the valuated subject is non-strategic transaction.
  - (b) Contingent consideration: if part of the acquisition price is contingent on the achievement of specific company performance, analysts should pay more attention when comparing transactions without such contingencies.
  - (c) Type of consideration: stock transactions or cash transactions.
  - (d) Availability of data: relevance and accuracy of the historical data
  - (e) Date of data

#### Price Transaction Method

1. Use transactions data from the stock of the actual subject company. Most appropriate when valuing minority interests.

## 26.10 Describe the assetbased approach to private company valuation

1. Value of the firm = fair value of its assets - fair value of its liabilities
2. Usually not used. Because it's easier to find comparable data at the firm level than asset level; difficult to find intangible assets data
3. Results in lowest valuation, bc firm's assets combination together will have more value than just simply sum them together  $\rightarrow 1+1 > 2$
4. Good for
  - Firms with minimal profits and little hope for better prospects
  - Finance firms such as banks
  - Investment companies such as real estate investment trusts and closed-end investment companies where the underlying assets values are determined using the market or income approaches.
  - Small companies or early stage companies with few intangible assets
  - Natural resource firms

## 26.11 Explain and evaluate the effects on private company valuations of discounts

Adjustments are needed when liquidity or control position of an acquisition differs from that of the comparable companies: Comparable data is controlling interest, and subject valuation is noncontrolling interest.

–Lack of Control and Lack of Marketability

The Discount for Lack of Control (DLOC)

1.  $DLOC = 1 - 1/(1 + \text{control premium})$

The Discount for Lack of Marketability (DLOM)

1. If an interest in a firm cannot be easily sold, DLOM is needed.
2. Estimate DLOM:
  - (a) Compare the price of restricted shares to the price of the publicly traded shares.
  - (b) Compare the price of pre-IPO shares and post-IPO shares. Issues here: post-IPO price are thought to have more certain cash flows and lower risk, therefore not purely reflect changes in marketability.
  - (c) Use the price of put option divided by the stock price, where the put used is at the money.
3. TOTAL discount =  $1 - [(1 - DLOC)(1 - DLOM)]$

## 26.12 Describe the role of valuation standards in valuing private companies

Two stds:

1. Uniform Standards of Professional Appraisal Practice (USPAP) from US Appraisal Foundation
2. International Valuation Standards from International Valuation Standards Committee (IVSC)

Challenges

1. Not required to follow these standards
2. Hard to follow standards
3. Valuation reports are private. Hard to ensure the compliance of the standards.



## 27 Reading 35: The Term Structure and Interest Rate Dynamics

### 27.1 Describe relationships among spot rates, forward rates, yield to maturity, expected and realized returns on bonds, and the shape of the yield curve

1. Spot Rates:  $P_T = 1/(1+S_T)^T$
2. Forward Rates: annualized interest rate on a loan to be initiated at a future period is the forward rate.
3. Yield to Maturity: included coupon payments, and the spot rate of each coupon might be different. YTM is a summary parameter.
4. Expected and Realized Returns on Bonds: ex-ante holding period return that a bond investor expects to earn.  
When: 1. The bond is held to maturity, all payments are made on time and full, and all coupons are reinvested at the original YTM, the expected return = YTM

### 27.2 Describe the forward pricing and forward rate models and calculate forward and spot prices and rates using those models.

1. The Forward Pricing Model: arbitrage-free pricing
2. The Forward Rate Model:  $[1 + S_{j+k}]^{j+k} = (1 + S_j)^j [1 + f(j, k)]^k$ , where  $f$  is the forward rate.

### 27.3 Describe how zero-coupon rates (spot rates) may be obtained from the par curve by bootstrapping.

Par rate: YTM of a bond trading at par.  
 Par rate curve: par rates for bonds with different maturities.  
 Par rate = the coupon rate on the bond.

### 27.4 Describe the assumptions concerning the evolution of spot rates in relation to forward rates implicit in active bond portfolio management.

Relationships between Spot and Forward Rates

1. Upward-sloping spot curve  $\rightarrow$  Forward rate rises as  $j$  increases
2. Upward-sloping spot curve  $\rightarrow$  Forward curve will be above the spot curve

Forward Price Evolution

1. If future spot rates evolve as forecasted by the forward curve, the forward price will remain unchanged.
2. Spot rate lower than the forward curve  $\rightarrow$  forward price up

### 27.5 Describe the strategy of riding the yield curve

“Riding the Yield Curve”

1. Maturity matching: purchasing bonds that have a maturity = investment horizon
2. “Rolling down the yield curve”: If the yield curve remains unchanged, you can buy a long-maturity bond, and sell it before its maturity.

## 27.6 Explain the swap rate curve and why and how market participants use it in valuation

### The Swap Rate Curve

1. plain vanilla interest swap: A pays on a fixed rate, B pays on a floating rate.
  - the fixed rate → swap fixed rate OR swap rate
2. swap rate curve is preferred as a benchmark interest rate curve.
  - reflects the credit risk of commercial banks
  - swap mkt is not regulated by government, therefore comparable across different countries.
  - Has yield quotes at many maturities.
3. Wholesale banking uses Swap rate; Retail banking uses government bond yield curve
4. Calculating SFR

$$\sum_{t=1}^T \frac{SFR_T}{(1 + S_t)^t} + \frac{100}{(1 + S_T)^T} = 100$$

## 27.7 Calculate and interpret the swap spread for a given maturity

### Swap spread:

1. Definition: the swap rate exceeds the yield of government bond with the same maturity
2. swap spread<sub>t</sub> = swap rate<sub>t</sub> - Treasury yield<sub>t</sub>

### I-spread:

1. The amount by which the risky bond exceeds the swap rate for the same maturity. Linear interpolation for missing swap rates.
2. I-spread reflects compensation for risk.

### Describe the Z-spread

1. Definition: the spread that, when added to each spot rate on the default-free spot curve, makes the present value of a bond's cash flows equal to the bond's market price.
2. zero-volatility: assumption of zero interest rate volatility.

## 27.8 Describe the TED and Libor-OIS spreads

### TED Spread

1. Definition: T: T-bill, ED: Eurodollar futures contract  
The amount by which the interest rate on loans between banks (3-mon LIBOR) exceeds the interest rate on short-term US government debt (3-mon T-bills)
2. Indication of the risk of interbank loans. Captures the risk in the banking system.

### LIBOR-OIS Spread

1. OIS: Overnight Indexed Swap. Reflects the federal funds rate. Includes minimal credit risk.
2. LIBOR-OIS spread: LIBOR rate - OIS rate

## 27.9 Explain traditional theories of the term structure of interest rates and describe the implications of each theory for forward rates and the shape of the yield curve

Unbiased Expectation Theory/Pure expectation theory:

1. Main point: Investor's expectations determine the shape of interest rate term structure.
2. Example:
  - A. Investor should earn the same return by investing in a 5-yr bond, or by investing in a 3-yr bond and then a 2-yr bond.
  - B. with 3-yr horizon, investors will be indifferent between 3-yr bond or 5-yr bond.
3. Behind point is: risk neutrality. Investors don't demand a risk-premium for maturity strategies that differ from their investment horizon.

Local Expectations Theory

1. Main point: preserves risk-neutrality assumption only for short holding periods.
2. Not hold.

Liquidity Preference Theory

1. Main point: Forward rates reflect investors' expectations + a liquidity premium to compensate investors for exposure to interest rate risk.
2. Implication: Forward rates are biased estimates of the market's expectation of future rates.

Segmented Markets Theory

1. Main Point: The shape of yield curve is determined by the preferences of borrowers and lenders – supply and demand for loans of different maturities.

Preferred Habitat Theory

1. Main point: Forward rates represent expected future spot rates plus a premium. The premiums are related to supply and demand for funds at various maturities, give incentives to investors to shift from their preferred maturity.

## 27.10 Describe modern term structure models and how they are used.

Equilibrium Term Structure Models: use fundamental economic variables

1. Cox-Ingersoll-Ross model: interest movements depends on whether people choose consumption or investing today

$$(a) \quad dr = a(b - r)dt + \sigma\sqrt{r}dz$$

$dr$  = change in the short-term interest rate

$a$  = speed of mean reversion parameter.

$b$  = long-run value of short-term interest rate

$t$  = time

$\sigma$  = volatility

$dz$  = a small random walk movement

2. The Vasicek Model

$$dr = a(b - r)dt + \sigma dz.$$

Arbitrage-free Models: assumes that bonds trading now are correctly priced.

1. Ho-Lee Model:  $dr_t = \theta_t dt + \sigma dz_t$   
 $-\theta_t = a \text{ time} - \text{dependent drift term}$   
 -Using market prices to find the drift term

### 27.11 Explain how a bond's exposure to each of the factors driving the yield curve can be measured and how these exposures can be used to manage yield curve

Managing Yield Curve Risks: risk to the portfolio value to changes in the yield curve.

Sensitivity measures:

1. Effective Duration: price sensitivity to a small parallel shifts in the yield curve.
2. Key Rate Duration: the sensitivity of the portfolio value to changes in a single par rate. (percentage change in the value in response to a 100 basis point change in the corresponding key rate, all other rates are constant.)  
Example: a portfolio has 3 bond. 1-yr, 5-yr, 25-yr. Key rate durations:  $D_1 = 0.7, D_2 = 3.5, D_{25} = 9.5$ ,  
 $\Delta P/P \approx -D_1 \Delta r_1 - D_5 \Delta r_5 - D_{25} \Delta r_{25}$
3. Sensitivity to Parallel, Steepness, and Curvature Movements
  - (a) Level  $\Delta x_L$ : parallel increase/decrease
  - (b) Steepness  $\Delta x_S$ : Long-term interest rates increase while short-term rates decrease
  - (c) Curvature  $\Delta x_C$ : short-term and long-term rates increase, while intermediate rates do not change.

### 27.12 Explain the maturity structure of yield volatilities and their effect on price volatility

Term structure of interest rate volatility: Yield volatility versus maturity.

Long-maturity volatility < Short-term volatility

Long-maturity volatility → uncertainty regarding real economy and inflation.

Short-maturity volatility → risks regarding monetary policy.

## 28 Reading 36 The Arbitrage-Free Valuation Framework

### 28.1 Explain what is meant by arbitrage-free valuation of a fixed-income instrument.

Arbitrage-free valuation: no one can earn arbitrage profit. Arbitrage opportunities

1. Value additivity: value of whole differs from the sum of the values of parts
2. Dominance: one asset trades at a lower price than another asset with identical characteristics

### 28.2 Calculate the arbitrage-free value of an option-free, fixed-rate coupon bond.

Method: Discount cash flows using the corresponding spot rate.

### 28.3 Describe a binomial interest rate tree framework

Binomial interest rate tree: interest rates have an equal probability of taking one of possible values in the next period.

Model: Lognormal random walk.

$$r_1 = r_0 \exp(m_1 h \pm \sigma \sqrt{h})$$

$$r_2 = r_0 \exp(m_1 h + \pm \sigma \sqrt{h} + m_2 h \pm \sigma \sqrt{h})$$

## 28.4 Describe the backward induction valuation methodology and calculate the value of a fixed income

Valuing an Option-Free Bond with the Binomial Model

1. Backward induction: just binomial tree calculations. See examples in LOS 36d.

## 28.5 Describe the process of calibrating a binomial interest rate tree to specific term structure.

3 Rules needed

1. Tree should generate arbitrage-free values for the benchmark security. Value generated = the actual market value of benchmark security to make sure the model works.
2. Adjacent forward rates are  $e^{2\sigma}$
3. Middle forward rate in a period  $\approx$  the implied one-period forward rate for that period. Because there might be some drifting terms, we can use this method to calibrate interest rate.

## 28.6 Compare pricing using the zero-coupon yield curve with pricing using an arbitrage-free binomial lattice.

zero-coupon yield curve = spot rate curve. Discount all future cash flows based on the interest rate. Only good for option free options.

Binomial tree can value bonds with options.

## 28.7 Describe pathwise valuation in a binomial interest rate framework and calculate the value of a fixed-income instrument given its cash flows along each path.

Pathwise Valuation: calculate bond's value based on each possible path, and then average all possible values.

## 28.8 Describe a Monte Carlo forward-rate simulation and its application.

Path Dependency:

1. Typical problem: Prepayments on underlying residential mortgages. This risk is affected by interest level AND interest path.
2. Monte Carlo forward-rate simulation: good for path-dependent problems. Note, rates should be calibrated to get an arbitrage-free valuation.

# 29 Reading 37: Valuation and Analysis: Bonds with Embedded Options

## 29.1 Describe fixed-income securities with embedded options

Simple Options

1. Callable bonds: give the issuer the option to call back the bond.
  - European: option can only be exercised on maturity
  - American: can be exercised at any time after the lock out period
  - Bermudan-style: can be exercised at fixed dates after the lockout period

2. Putable bonds: investor can sell bond back to the issuers  
-Extendible bond: allows the investor to extend the maturity of the bond.
3. Complex options:  
-Estate put: allows the heirs of an investor to put the bond back to the issuer upon the death of investor.  
-Sinking fund bonds(sinkers): requires the issuer to set aside funds periodically to retire the bond.

**29.2 Explain the relationships between the values of a callable or putable bond, the underlying option-free (straight) bond, and the embedded option.**

$$V_{call} = V_{straight} - V_{callable}$$

$$V_{putable} = V_{straight} + V_{put}$$

**29.3 Describe how the arbitrage-free framework can be used to value a bond with embedded options.**

**29.4 Calculate the value of a callable or putable bond from an interest rate tree.**

Rate used in binomial tree for option-embedded bonds: one-period forward rates instead of spot rates.

Call Rule: value at any node = min(issuer call the bond, issuer not call the bond.)

Put Rule: value at any node = max(investor put the bond, investor not put the bond.)

**29.5 Explain how interest rate volatility affects the value of a callable or putable bond.**

1. Option values positively related to the volatility of their underlying.
2. Value of straight bonds is affected by changes in the level of interest rate but unaffected by the volatility.
3. Volatility of interest increases, value of callable bond decreases but value of putable bond increases.

**29.6 Explain how changes in the level and shape of the yield curve affect the value of a callable or putable bond.**

1. Level of Interest Rates:  
-Interest rate down→value of callable bonds rises slower than straight bond.  
-Interest rate up→value of putable bonds falls slower than straight bond.  
-Call option value is inversely related to the interest rate; put option value positively related to ir.
2. Shape of the Yield Curve  
-Call option value will become lower along an upward sloping yield curve.  
-Put option value: vice versa.

**29.7 Explain the calculation and use of option-adjusted spreads.**

1. Option Adjusted Spread: value added to the interest rate to show the credit risks. Otherwise, the calculated price will be lower.  
-Note: OAS are added after the adjustment for the embedded options. (Call/Put rule)
2. Uses: similar bonds should have similar OAS. Higher OAS→undervalued, good to invest.

### 29.8 Explain how interest rate volatility affects option adjusted spreads

1. For callable bonds, interest rate volatility increases  $\rightarrow$  calculated price of bonds down  $\rightarrow$  OSA will be smaller.
2. Puttable bonds, interest rate volatility increase  $\rightarrow$  calculated price of bonds up  $\rightarrow$  OSA up.
3. Assumed level of volatility will affect OSAs.

### 29.9 Calculate and interpret effective duration of a callable or puttable bond

Effective duration, effective convexity: good for bonds with embedded bonds.

1. Effective duration =  $ED = (BV_{-\Delta y} - BV_{+\Delta y}) / (2BV_0\Delta y)$
2. Effective convexity =  $EC = (BV_{-\Delta y} + BV_{+\Delta y} - 2BV_0) / (BV_0\Delta y^2)$   
 $-\Delta y$  is the change in required yield.
3. Steps
  1. Use assumed interest rates, volatility to calculate OAS.
  2. Add a small shift in the benchmark yield curve, build a new binomial tree, add OAS from 1. Calculate new  $BV$ .

### 29.10 Compare effective durations of callable, puttable, and straight bonds

1.  $ED_{callable} < ED_{straight}$
2.  $ED_{puttable} < ED_{straight}$
3.  $ED_{zero-coupon} \approx$  maturity of the bond
4.  $ED_{fixedrate} <$  maturity of the bond
5.  $ED_{floater} \approx$  time (years) to next reset

### 29.11 Describe the use of one-sided durations and key rate durations to evaluate the interest rate sensitivity of bonds with embedded options.

1. One-sided Durations: when the bonds are at-the-money/near-the-money, changes in price will be different for interest changing up or down. – Durations that apply only when interest rise/fall.
2. Key rate Duration/partial durations: capture the interest sensitivity of a bond to changes in yields (par rate) of specific benchmark maturities. Only one par rate is moved.

### 29.12 Compare effective convexities of callable, puttable, and straight bonds

1. Callable: High rates  $\rightarrow$  positive convexity; near the money  $\rightarrow$  negative effective convexity
2. Puttable: Positive effective convexity
3. Straight: Positive effective convexity

### 29.13 Describe defining features of a convertible bond.

1. Convertible bonds: investor has rights to convert the bond into a fixed number of common stocks.  
 - Conversion ratio = issue value / conversion price.
2. Offer documents often provide a contingent put option in the event of change-of-control.  
 - Hard option: redeem for cash; - Soft option: issuer decide to redeem for cash or stock.

**29.14 Calculate and interpret the components of a convertible bond's value**

1. Conversion value = market price of stock  $\times$  conversion ratio
2. Straight value: Investment value. PV of the bond's cash flow
3. Minimum value of a convertible bond =  $\max(\text{conversion value, straight value})$
4. Market conversion price = mkt price of convertible bond / conversion ratio.
5. Market conversion premium per share = mkt conversion price - stock's market price
6. Market conversion premium ratio = market conversion premium per share / market price of common stock
7. Premium over straight value = market price of convertible bond / straight value - 1

**29.15 Describe how a convertible bond is value in an arbitrage-free framework.**

1. Noncallable/nonputtable convertible bond = an option-free bond + a call option on an amount of the common stock equal to the conversion ratio.
2. Callable convertible bond value = straight value of bond + value of call option on stock - value of call option on bond

**29.16 Compare the risk-return characteristics of a convertible bond with the risk-return characteristics of a straight bond and of the underlying common stock**

1. Convertible bonds limits downside risk. Have to face: credit risk, call risk, interest rate risk, and liquidity risk.
2. Comparison
  - (a) Stock price fall, returns on convertible bonds high
  - (b) Stock price rise, returns on convertible bonds low
3. Special case:
  - (a) Fixed-income equivalent/busted convertible: the price of common stock associated with a convertible issue is so low.
  - (b) Hybrid security: the price of the stock is high enough, and the price of the convertible is like an equity security.
4. Bond Analytics: Output of pricing systems should follow:
  - (a) Put-call parity:  $C - P = \text{PV}(\text{Forward price of the bond on exercise date}) - \text{PV}(\text{Exercise price})$
  - (b) Option-free bond pricing: value of option-free bonds is independent of the volatility.

**30 Reading 38: Credit Analysis Models****30.1 Explain probability of default, loss given default, expected loss, and present value of the expected loss and describe the relative importance of each across the credit spectrum**

Measure of Credit Risk



1. Probability of default, default probability
2. Loss given default: the value a bond investor will lose if the issuer defaults.
3. Recovery rate:  $\text{Loss given default}(\%) = 100 - \text{recovery rate}$
4. Expected loss:  $= \text{Default probability} \times \text{the loss given default}$
5. Present value of expected loss: The highest price a hypothetical investor would be willing to pay to an insurer to bear the credit risk of the investment.  
 $\text{Present value of expected loss} = \text{value of risk-free bond} - \text{value of credit-risky bond}$   
 $\text{Present value of expected loss} = \text{value of risk-free bond} - \text{value of credit-risky bond}$   
 -Adjustments on the expected loss:  
 -1. Time value adjustment: discount by interest rates  
 -2. Risk neutral adjustment: Add risk premium.
6. Credit spread: difference of YtoMat between a risk-free zero coupon bond and a risky zero coupon bond.

### 30.2 Explain credit scoring and credit ratings, including why they are called ordinal rankings

1. Ordinal ranking: Categorize borrowers into different ranks, but didn't provide the degree to which the credit risk differs in different groups.
2. Credit scoring: for small businesses and individuals.
  - (a) Ordinal rankings, not percentile rankings.
  - (b) Do not care current economic conditions
  - (c) Scoring agency is under pressure from users of credit scores (lenders) - Stability in scores over time.
  - (d) Didn't take into account differing probability of default for different loans.
3. Credit ratings: for corporate debt, asset-backed securities, and government/quasi-government debt.

### 30.3 Explain strengths and weaknesses of credit ratings

#### Strength

1. Simple to understand
2. Stable, reduce volatility in the debt market.

#### Weakness of Credit ratings

1. Stability means the reduction of accuracy
2. Ratings do not adjust with the business cycle
3. Issuer-pays model comes with conflicts of interest

### 30.4 Explain structural models of corporate credit risk, including why equity can be viewed as a call option on the company's assets

1. Structural models: based on the balance sheet, and insights by option pricing theory
2. Option Analogy
  - (a) NOTE: Asset = Equity + Liability
  - (b) At time T, maturity of debt:
    - i. Value of  $Stock_T = \text{Max}(0, A_T - \text{Face value of debt})$
    - ii. Value of  $debt_T = \text{Min}(A_T, \text{Face value of debt})$
  - (c) Value of risky debt = value of risk-free debt - value of put option on company's assets
3. Valuation

$$D_t = A_t N(-d_1) + K e^{-r(T-t)} N(d_2)$$

$$N = \text{cumstdnormaldist.}$$

$$d_1 = \frac{\ln(A_t/K) + r(T-t) + \frac{1}{2}\sigma^2(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\sqrt{T-t}$$

r = continuously compounded risk-free rate  
= std of asset returns.

4. Risk Measures  
Probability of default =  $1 - N(e_2)$   
where

$$e_1 = \frac{\ln(A_t/K) + \mu(T-t) + \frac{1}{2}\sigma^2(T-t)}{\sigma\sqrt{T-t}}$$

$$e_2 = e_1 - \sigma\sqrt{T-t}$$

Expected loss =  $KN(-e_2) - A_t e^{\mu(T-t)} N(-e_1)$   
Present value of expected loss =  $Ke^{-r(T-t)} N(-d_2) - A_t N(-d_1)$

5. Input Estimates: Using calibration/implicit estimation techniques if company's stock is traded.

### 30.5 Explain reduced form models of corporate credit risk, including why debt can be valued as the sum of expected discounted cash flows after adjusting for risk

Structural model: assume that the assets of the company are traded in the market. → Impractical  
Reduced form models of corporate credit risk: impose assumptions on the output of a structural model

1. Value of debt

$$D_t = E\left(\frac{K}{\prod(1+r_i)}\right)$$

where  $r_i$  is the risk-free rate for year i. E is the expectation operation, using risk-neutral probabilities.

2. Input estimates: from historical data.

### 30.6 Explain assumptions, strengths, and weaknesses of both structural and reduced form models of corporate credit risk.

#### Structural Model

1. Assumptions:
  - Asset are traded freely.  $\sigma^2$  is constant.
  - Risk-free interest rate( $r$ ) is constant over time.  $\rightarrow$ no interest risk
  - Simple balance sheet structure, only one class of zero-coupon debt
2. Strength
  - Use option pricing theory
  - Use current mkt price to estimate the model
3. Weakness
  - Balance is not that so simple, especially for the single zero-coupon bond
  - Assets are not traded.
  - Do not consider the business cycle.

#### Reduced Form Model

1. Assumptions:
  - Company has a zero-coupon bond liability that trades in frictionless and arbitrage-free markets. No restriction for other liabilities of the company.
  - $r$  is stochastic.
  - The state of the economy is stochastic and depends on nonconstant macroeconomic variables.
  - PD is not constant.
  - A particular company defaults depend on company-specific considerations
  - Recovery rate is stochastic. Depend on economy
2. Strength:
  - Use historical estimation, b/c inputs are observable.
  - Consider the business cycle
  - Do not require specific balance sheet structure.
3. Weakness
  - Historical estimation(hazard rate estimation) may not be valid

### 30.7 Explain the determinants of the term structure of credit spreads.

Definition: Time patterns of difference in spot rates for credit-risky bonds and risk-free bond

NOTE: The credit spread INCLUDES a premium for liquidity risk.

### 30.8 Calculate and interpret the present value of the expected loss on a bond over a given time horizon.

Difference in the value of a risk-free bond and a similar risky bond.

### 30.9 Compare the credit analysis required for asset-backed securities to analysis of corporate debt.

ABS is different. Needs to consider the distribution waterfall of the ABS.

## 31 Reading 39: Credit Default Swaps

Credit Default Swaps: insurance contract.

CDS spread: has been standardized. 1% for investment-grade, 5% for high-yield bond.

### 31.1 Describe credit default swaps (CDS), single-name and index CDS, and the parameters that define a given CDS product.

Single-Name CDS:

1. Reference obligation: The fixed-income security
2. Reference entity: issuer of the reference obligation
3. Pay offs when the reference entity defaults, also when the reference entity defaults on any other issue that ranked same rank or higher.
4. Payoff: based on the mkt value of the cheapest-to-deliver bond that has the same seniority as the reference obligation, and deliver the difference between the notational principal and the mkt value of the CTD.

Index CDS:

1. Covers multiple issuers.
2. Pricing depends on the correlation of default among index constituents.

### 31.2 Describe credit events and settlement protocols with respect to CDS.

Credit events

1. Default
2. bankruptcy
3. Failure to pay: misses a scheduled coupon or principal
4. Restructuring

### 31.3 Explain the principles underlying, and factors that influence, the market's pricing of CDS.

Factors that influence the pricing of CDS

1. Probability of default  
When defaults, CDS seller pays CDS buyer, and CDS ceased to exist.  
Probability of default given that it has not already occurred preceding years. → Hazard rate
2. Loss given default and coupon rate of swap  

$$(\text{Expected loss})_t = (\text{Hazard rate})_t \times (\text{Loss given default})_t$$
 Premium leg: payments by the protection buyer to the seller. Paid as a coupon.  
 Protection leg: payments by the protection seller to the buyer.  
 Upfront payment by protection buyer = PV(protection leg) - PV(premium leg)  
 Approximate the upfront premium  $\approx (\text{CDS spread} - \text{CDS coupon}) \times \text{duration}$

Valuation After Inception of CDS

1. Profit for protection buyer  $\approx \text{change in spread} \times \text{duration} \times \text{notational principal}$
2. Profit for protection buyer  $\% \approx \text{change in spread}(\%) \times \text{duration}$

### 31.4 Describe the use of CDS to manage credit exposures and to express views regarding changes in shape and/or level of the credit curve.

1. Credit Curve: relationship between credit spreads for different bonds issued by an entity/maturities.  
-CDS: manage credit exposure of a bond portfolio: Decline credit spreads → credit improve → increase credit exposure by being a protection seller.
2. Naked CDS: just buy CDS. No underlying.
3. Long-short trade: buy one CDS, sell another.
4. Curve trade: long/short trade on the SAME reference entity, different maturities.

### 31.5 Describe the use of CDS to take advantage of valuation disparities among separate markets, such as bonds, loans, equities, and equity-linked instruments.

Uses of CDS

1. Earning arbitrage profits  
-basis trade: difference in credit spreads between bond mkt and CDS mkt  
-Leverage buyout: investors who anticipate an LBO will buy stock, CDS protection.  
-Credit risks of the index constituents is different priced than the index CDS  
Collateralized Debt Obligations: Synthetic CDO vs Cash CDO, similar risk. If synthetic CDO has lower costs than the equivalent Cash CDO, buy low sell high.

## 32 Reading 40: Pricing and Valuation of Forward Commitments.

### Warm-up

Day count and compounding conventions

1. 360 days/yr, simple interest (multiply by days/360) → ALL LIBAR based contracts
2. 365 days/yr, compound interest (days/365) → Equities, bonds, currencies, and stock options
3. 365 days/yr, continuous compounding → Equity indexes

### 32.1 Describe and compare how equity, interest rate, fixed-income, and currency forward and futures contracts.

### 32.2 Calculate and interpret the no-arbitrage value of equity, interest rate, fixed-income, and currency forward and futures contract.

Equity Forward Contracts With Discrete Dividends

1. The main equation of Forward Price:

$$FP = (S_0 - PVD) \times (1 + R_f)^T$$

2. The value of a forward contract at time t:

$$V_t = [S_t - PVD_t] - \frac{FP}{(1 + R_f)^{(T-t)}}$$

Equity Forward With Continuous Dividends

1. Good for an equity index forward contract

- 2.

$$P = S_0 \times e^{(R_f^c - \delta^c) \times T} = (S_0 \times e^{-\delta^c \times T}) \times e^{R_f^c \times T}$$

Where  $\delta$  is the continuous compounded dividend yield.

3. Value of the forward contract on an equity index

$$V_t = \frac{S_t}{e^{\delta^c(T-t)}} - \frac{FP}{e^{R_f^c(T-t)}}$$

#### Forwards and Futures on Fixed Income Securities

- 1.

$$FP = (S_0 - PVC) \times (1 + R_f)^T = S_0 \times (1 + R_f)^T - FVC$$

2. Value of the forward contract

$$V_t = (S_t - PVC_t) - \frac{FP}{(1 + R_f)^{(T-t)}}$$

#### Bond Futures

1. Define: Allow the short the option to deliver any of several bonds, which satisfy the delivery terms of the contract.
2. Clean price: Buyer pay = the clean price + accrued interest
3. Accrued interest = (days since last coupon)/(days between coupon) × coupon amount
4. Main equation:  $FP = (\text{Full price})(1 + R_f)^T - AI_T - FVC$   
 $AI_T$  is the accrued interest at the maturity.
5. Quoted futures price =  $FP / \text{Conversion factor}$ .

#### Warm-Up: LIBOR-Based Loans and Forward Rate Agreements

1. Eurodollar deposit: dollars deposit in banks outside US. → LIBOR: lending rate on dollar loans between banks. → 360-day year, add-on rate
2. Euribor: interbank euro lending rate
3. Forward rate agreement (FRA): who borrow money will long the loan.  
 - Number of months until the contract expires  
 - number of months until the loan settled.  
 $2 \times 3$  loan. Check examples. Page 141 of 256, Book 4

#### Pricing FRAs

1. Notice  
 - LIBOR rates is add-on, 30/360 basis.  
 - long position in FRA → fixed the rate  
 - Payoff on the FRA occurs at the expiration of FRA, which is the beginning of the loan → should use PV of interest savings.
2. Price → The forward interest rate.

Valuing an FRA at Maturity: PV of interest savings at the FRA maturity.

Valuing an FRA before Maturity: also the PV of interest savings.

Pricing Currency Forward Contracts:

1. Based on interest parity.

2. Main equation

$$F_T = S_0 \times \frac{(1 + R_{PC})^T}{(1 + R_{BC})^T}$$

Where  $R_{PC}$  is the price currency interest rate,  $R_{BC}$  is the base currency interest rate.

3. 365-day basis

4. Valuing Currency Forwarding Contracts

$$V_t = \frac{R_t}{(1 + R_{BC})^{T-t}} - \frac{F_T}{(1 + R_{PC})^{T-t}}$$

5. Continuous compounding

$$F_T = S_0 \times e^{(R_{PC}^c - R_{BC}^c) \times T}$$

$$V_t = \frac{S_t}{e^{R_{BC}^c(T-t)}} - \frac{F_T}{e^{R_{PC}^c(T-t)}}$$

#### Future Contracts

1. Has clearing house, settled daily.

2. Value of futures contract = current futures price - previous market price

### 32.3 Describe and compare how interest rate, currency, and equity swaps are priced and valued.

### 32.4 Calculate and interpret the no-arbitrage value of interest rate, currency, and equity swaps.

Deriving the Formula for Determining the Swap Rate: Interest rate swap can be seen as: buy a floating-rate bond and sell a fixed-rate bond

1. Swap rate: initial rate that makes the swap zero value.

2. How to define the swap rate? Using bonds priced at par.

$$1 = \sum_i = 1^n \frac{C}{1 + R_i} + \frac{1}{1 + R_n}$$

$C$  will be the swap rate.

Calculating the Market Value of an Interest Rate Swap.

1. Define: Swap value = Value of the float-rate bond - value of the fixed-rate bond

2. The floating rate bond reprices to par at each payment day. Why?

-Every settlement date, the coupon rate on the bond is equal to the market rate. If the coupon rate on a bond = market rate, the bond sells at par.

#### Currency Swaps

1. Determining the Fixed Rate and Foreign Notational Principal

(a) - Fixed-for-Fixed rate currency swap:

Solve for the swap rates of each currency.

- (b) - Fixed-for-floating or floating-for-floating:  
Replace the fixed rate on either or both of the currencies with the floating rate in the country corresponding to the currency of payment.
- 2. Value of a currency swap after initiation = PV expect to receive - PV expect to pay.
- 3. Remember to Check examples.

#### Equity Swaps

- 1. Pay fixed, receive the return on index

### 33 Reading 41: Valuation of Contingent Claims

- 33.1 Describe and interpret the binomial option valuation model and its component terms.**
- 33.2 Calculate the no-arbitrage values of European and American options using a two-period binomial model.**
- 33.3 Describe how the value of a European option can be analyzed as the present value of the option's expected payoff at expiration.**

#### Binomial Model:

- 1. Def: over the next period, the value of an asset will change to one of two possible values.
- 2. One-Period Binomial Model
  - (a) Some definitiona:
    - $\pi_U, \pi_D$ : prob of up-move and down-move
    - $U, D$ , size of up move, size of down move =  $S^+/S$
  - (b)  $\pi_U = \frac{1+R_f-D}{U-D}$ ,  $R_f$  is the periodically compounded annual risk-free rate.
- 3. Put-Call Parity
  - (a)  $S_0 + P_0 = C_0 + PV(X)$   
 $S_0$  = Stock price,  $PV(X)$  = PV of the (strike-price)
- 4. Two-Period Binomial Model
  - Similar. Calculate the stock values at the end of two periods, and then calculate the possible option payoffs.
- 5. American-Style Options

### 33.4 Identify an arbitrage opportunity involving options and describe the related arbitrage.

#### Arbitrage with a One-Period Binomial Model

- 1. Mispricing in options and stocks.
- 2. Hedge ratio:  $h = \frac{C^+ - C^-}{S^+ - S^-}$ .  
This ratio gives us how many shares of stocks needed for each option to eliminate the risk, and obtain pure arbitrage interests.



**33.5 Describe how interest rate options are valued using a two-period binomial model**

**33.6 Calculate and interpret the values of an interest rate option using a two-period binomial model.**

Interest rates here at each node is a one-period forward rate.

Interest Rate Options

1. Define:

Call Payoff = Notational principal  $\times$  Max(0, Ref rate - Exercise rate)

Payoff = Notational principal  $\times$  Max(0, Exercise rate - Ref rate)

When calculating the value of each node, remember to discount to PV.

**33.7 Identify assumptions of the Black-Scholes-Merton option valuation model.**

Assumptions

1. Underlying price: geometric Brownian motion. Return: lognormal distribution.
2. Risk-free rate is constant and known. Borrowing, lending are at rfr.
3. Volatility of the returns is constant and known. Prices change smoothly.
4. Markets are frictionless. No taxes, no transaction fess, no restrictions on short sales, continuous trading, no arbitrage opportunities.
5. Yield on the asset is constant.
6. Options are European options.

**33.8 Interpret the components of the Black-Scholes-Merton model as applied to call options in terms of leveraged position in the underlying.**

1. Call:  $C_0 = S_0 N(d_1) - e^{-rT} X N(d_2)$

2. Put:  $P_0 = -S_0 N(-d_1) + e^{-rT} X N(-d_2)$

Interpretion:

1. BSM  $\rightarrow$  PV of the expected option payoff at expiration
2. Call can be seen as Leveraged stock investment  $\rightarrow$  long  $N(d_1)$  units of stocks, short  $e^{-rT} X N(-d_2)$
3.  $N(d_2) \rightarrow$  Risk-neutral probability that a call option will expire in the money;  $N(-d_2) \rightarrow$  put option will expire in the money.

**33.9 Describe how the Black-Scholes-Merton model is used to value European options on equities and currencies.**

Options on Dividend Paying Stocks

1.  $C_0 = S_0 e^{-\delta T} N(d_1) - e^{-rT} X N(d_2)$

2.  $P_0 = -S_0 N(-d_1) + e^{-rT} X N(-d_2)$

Where  $\delta$  = continuously compounded dividend yield.

1. Put-Call parity:  $P_0 + S_0 e^{-\delta T} = C_0 + e^{-rT} X$

## Options on Currencies

1.  $C_0 = S_0 e^{-r(B)T} N(d_1) - e^{-r(P)T} X N(d_2)$
2.  $P_0 = -S_0 e^{-r(B)T} N(-d_1) + e^{-r(P)T} X N(-d_2)$
3.  $r(P)$  = continuously compounded price currency interest rate.  
 $r(B)$  = continuously compounded base currency interest rate.

**33.10 Describe how the Black model is used to value European options of futures**

The Black Model: Can price European options on forwards and futures

1.  $C_0 = e^{-R_f \times T} [F_T \times N(d_1) - X \times N(d_2)]$
2.  $F_T$  is the futures price, and  $\sigma$  is the standard deviation of returns on the futures contract.
3. Interpretation
  - (a) Call values: long futures position (multiplied by  $N(d_1)$ ), short bond position (multiplied by  $N(d_1)$ ).

**33.11 Describe how the Black model is used to value European interest rate options and European swaptions**

## Interest Rate Options

1. Def: options on Forward rates or FRAs. Call options gains when rate rise, and put options gains when rate fall. Use an actual/365 convention.
2.  $C_0 = (AP) e^{-r(N \times \frac{30}{360})} [FRA_{(M \times N)} N(d_1) - X N(d_2)] \times NP$ 
  - (a) AP = Accrual Period =  $\frac{(N-M) \times 30}{360}$
  - (b) NP = notional principal on the FRA
  - (c) This is for an  $(M \times N)$  FRA expiring in M months that has a strike rate of X
3. Equivalencies in interest rate derivative contracts
  - (a) Long interest call + short interest rate put  $\rightarrow$  Long FRA, Receive float and pay-fixed
  - (b) A series of interest rate call options with different maturities and same exercise price  $\rightarrow$  Interest rate cap  $\rightarrow$  Hedge a floating rate loan
  - (c) A series of interest rate put options with different maturities and same exercise price  $\rightarrow$  Interest rate floor  $\rightarrow$  Hedge a floating rate bond
  - (d) Cap + Floor = Payer Swap

## Swaptions

1. Definition: gives the holder the right to enter into an interest rate swap.
2. Payer swaption: options to pays fixed, receive float; Receiver swaption: receives fixed, pays float.
3.  $PAY = (AP) * PV[SFRN(d_1) - XN(d_2)]NP$ 
  - AP = 1/# of settlement periods per year
  - SFR = current market swap fixed rate
  - X = exercise rate specified in the payer swaption
  - NP = notational principal of the underlying swap.
4.  $REC = (AP) * PV[-SFRN(-d_1) + XN(-d_2)]NP$

## Equivalencies

### 33.12 Interpret each of the option Greeks.

1. Inputs: Asset price, exercise price, asset price volatility, time to expiration, and the risk free rate.

#### Delta

1. Delta: Changes in Asset prices and changes in option prices.
2.  $\Delta_C = e^{-\delta T} N(d_1)$ ,  $\Delta_P = -e^{-\delta T} N(-d_1)$
3. Interpreting Delta:
  - (a) Delta→The slope of the "prior-to-expiration" curve in the change in call price per unit change in stock price.
  - (b) Call option's delta→increase from 0 to  $e^{-\delta T}$  as stock price increases
  - (c) Put option's delta → $-e^{-\delta T}$  to 0 as stk price up.

#### Gamma

1. Rate of change in delta as the underlying stock price changes.
2. Long call/put →Gamma>0; At-the-money options→Max Gamma
3.  $\Delta_C \approx \text{call delta} \times S + 1/2 \text{gamma} \delta S^2$ ;  $\Delta_P \approx \text{put delta} \times S + 1/2 \text{gamma} \delta S^2$

#### Vega

1. d(the option price)/d(volatility of returns)
2. Vega > 0 for put and call. Large volatility→more valuable options

#### Rho

1. d(option price)/d(risk-free rate)
2. rho>0 for Call, <0 for put.
3. not a important value.

#### theta

1. d(option price)/d(time):w
2. Time-decay: as tim passes, option value decreases for all calls and for most put options.

### 33.13 Describe how a delta hedge is executed.

#### Dynamic Hedging

1. Delta-neutral portfolio: long stock, short call options; OR long stock, long puts.
2. # of call options needed = # of shares hedged/delta of call option

Delta hedge is only good for a small range of stock prices.

### 33.14 Describe the role of gamma risk in options trading

Gamma: how a dynamic hedge performs when it's not rebalanced.

When the stock price changes abruptly, hedge will fail→Gamma risk.

### 33.15 Define implied volatility and explain how it is used in options trading

Implied volatility

1. Definition: Standard deviation of continuously compounded asset returns that is implied by the market price of the option. → Solved from BSM model.

## 34 Reading 42: Derivative Strategies

### 34.1 Describe how interest rate, currency, and equity swaps, futures, and forwards can be used to modify risk and return.

1. Interest Rate Swaps: modify the duration of a fixed income portfolio  
 Value of a payer swap = value of a floating rate note - value of a fixed rate bond  
 → Duration of a payer swap = Duration of floating rate note - duration of a fixed rate note  
 Duration of a fixed rate bond > duration of a floating rate note
2. Interest Rate Futures  
 = Bond futures.
3. Currency Swaps  
 Currency swaps: borrowing in their own capital markets, and receive money in which they want to actually borrow. → Decrease the currency risk
4. Currency Futures: Used to hedge an asset or liability in a foreign currency that is expected to be settled in the future
5. Equity Swaps: exchange returns of an equity index/single stock for returns on another asset → Temporarily switch assets to cash/other assets, no transaction fees/costs
6. Stock Index Futures: Change the exposure of equities  
 Money out of equity → short stock index futures

### 34.2 Describe how to replicate an asset by using options and by using cash plus forwards or futures

1. Synthetic Stock using options: long stock = long call + short put
2. Synthetic Puts and Calls:  
 long call = long stock + long put  
 long put = long call + short stock
3. Synthetic Assets with Forwards/Futures  
 long stock = long futures + risk-free asset  
 long stock + short futures = risk-free asset
4. Foreign Currency Options: to hedge the downside, but didn't give up the upside.

### 34.3 Describe the investment objectives, structure, payoff, and risk(s) of a covered call position

A covered call = long stock + short call

1. earn the income via the premium on the call
2. Improving on the market: the premium on the option may be greater than the intrinsic value.
3. Target price realization: short a call option at a specific price.
4. Profit: Covered call has the downside risk of long stock.

### 34.4 Describe the investment options, structure, payoff, and risks of a protective put position.

Protective Put = long stock + long put → long put is similar to an insurance.

### 34.5 Calculate and interpret the value at expiration, profit, maximum profit, maximum loss, and break even underlying price at expiration for covered call and protective puts.

See example.

### 34.6 Contrast protective put and covered call positions to being long an asset and short a forward on the asset

1. Delta of a call: 0 to 1  
Delta of a put: 0 to -1
2. Delta of a covered call position:  
Covered call = long stock + short call  
Covered call delta = delta of stock - delta of call option

Cash-secured puts: write a put option and deposit an amount equal to the put exercise price in a designated account.

### 34.7 Describe the investment objective(s), structure, payoffs, and risk of the following option strategies: bull spread, bear spread, collar, and straddle.

## 35 Calculate and interpret the value at expiration, profit, maximum profit, maximum loss, and breakeven underlying price at expiration of the following option strategies: bull spread, bear spread, collar, and straddle.

Bull Call Spread

1. = Buy low price call + sell high price call
2. Limited upside if underlying rises with limited downside.

Bear Call Spread

1. = Sell low price call + buy high price call

Bear Put Spread

1. = Buy high price put + sell low price puts

Risk of Spreads

1. Limit the downside risk and upside risk. "Chopping off" the tails of return.

Collar

1. = Protective put and covered call = long stock + long put + short call
2. Objective: who wants to buy a protective put will sell a call to offset the put premium

## 3. Structure:

-Usually, put strike ( $X_L$ ) < call strike( $X_L$ )

## 4. Risk of a Collar: Give up the upside, chops the tails of return distributions

## Straddle

1. = Long put + Long call

2. Only lose money if the stock price doesn't change much.

**35.1 Describe uses of calendar spreads.**

## Calendar Spread

## 1. Structure

Long calendar spread = short near-dated call + long longer dated call

Short calendar spread = short longer dated call + long near-dated call

## 2. Profit

Long calendar spread: negative initial investment

Short calendar spread: positive initial investment

## 3. Use

Investor may believe stock price will be flat in near term, while change dramatically in long term.

**35.2 Identify and evaluate appropriate derivatives strategies consistent with given investment objectives.**

## Investment Objective

1. Strong bull(bear) → Long call(put)

2. Average bull(bear) → Long call + short put (short call + long put)

3. Weak bull(bear) → Short put(short call)

4. High(low) volatility → Long (short) straddle

High volatility → Fast market

## Breakeven Price Analytics

1. Annual volatility can be decided by the breakeven price (trading days = 252)

$$\sigma_{annual} = \% \Delta P \times \sqrt{\frac{252}{tradingdaysuntilmaturity}}$$

$$\% \Delta P = \frac{|breakevenprice - currentprice|}{currentprice}$$

**36 Reading 43: Private Real Estate Investments****36.1 Classify and describe basic forms of real estate investments.**

Forms of Real Estate: [Public, Private] × [Debt, Equity]

1. Public: securities, real estate investment trust (REIT), real estate operating company (REOC), mortgage-backed securities

2. Private: Solely owned or indirectly owned through partnership or commingled real estate funds. (REOC)
3. Equity: ownership
4. Debt: lender that owns a mortgage or mortgage securities

Debt investors just receive returns from promised cash flows. Equity investors expect appreciation of underlying assets and renting income.

### **36.2 Describe the characteristics, the classification, and basic segments of real estate.**

#### Real Estate Characteristics

1. Heterogeneity: no two properties are same.
2. High unit value: indivisible, so high unit value.
3. Active management: Private real estate requires active management, maintenance, lease, and collection of rents.
4. High transaction fees.
5. Depreciation and desirability
6. Cost and availability of debt capital: property values are impacted by interest rates.
7. Lack of liquidity
8. Difficulty in determining price

#### Property classifications

1. Residential VS Non-Residential
2. Residential: single-family, multi-family properties
3. Non-Residential: Commercial properties (including residential properties that was bought to generate income.), farmland

### **36.3 Explain the role in a portfolio, economic value determinants, investment characteristics, and principal risks of private real estate.**

### **36.4 Explain the role in a portfolio, the major economic value determinants, investment characteristics, principal risks, and due diligence of private estate debt investment.**

#### Reasons to invest in real estate

1. Current income: for rent
2. Capital appreciation
3. Inflation hedge
4. Diversification
5. Tax benefits: may have some favorable tax treatment

### Principal Risks

1. Business conditions
2. New property lead time: things may change significantly when new property is completed.
3. Cost and availability of capital
4. Unexpected inflation
5. Demographic factors: Size/age distribution
6. Lack of liquidity
7. Environmental issues
8. Availability of information
9. Management expertise
10. Leverage: Loan-to-Value ratio(LTV)
11. Other factors: unobserved property defects, natural disasters

### Role of Real Estate in a Portfolio

1. Both bond-like and stock like
2. Bond-like: lease, rent payments → coupon in bonds
3. Stock like: uncertainty regarding renewal rates.

### Role of Leverage in Real Estate Investment

1. Debt/equity ratio will not affect property's value.
2. High-leverage → High returns, high risks

## **36.5 Describe commercial property types, including their distinctive investment characteristics.**

### Commercial Property Types

1. Office: depends on job growth.  
Gross lease: owner pays operating expenses; net lease: tenant pays.
2. Industrial: depends on overall economy, import/export activity
3. Retail: demands depend on consumer spending, which from overall economy, job growth, population growth, and saving rates.  
- Percentage lease/percentage rent: additional rent after a certain level of sales
4. Multi-family



### 36.6 Compare the income, cost, and sales comparison approaches to valuing real estate properties.

#### Real Estate Appraisals

1. Market value
2. value in use
3. investment value
4. assessed value: value used by a taxing authority
5. mortgage lending value

#### Valuation Approaches

1. Cost Approach: we won't pay more than it would cost to buy land and build a similar building  
- Good for new property, b/c it's hard to get the depreciation.
2. Sales comparison approach: won't pay more than others pay for a similar property.  
- Good for single-family homes
3. Income approach: = PV of future cash flows  
- Good for commercial real estates

#### Highest and Best Use

1. Not that results in the highest TOTAL value; rather it should be that produces the highest implied land value = TOTAL value - cost of constructing the improvements

### 36.7 Estimate and interpret the inputs (for example, net operating income, capitalization rate, and discount rate) to the direct capitalization) and discounted cash flow valuation methods.

### 36.8 Calculate the value of a property using the direct capitalization and discounted cash flow valuation methods.

Income Approach: 1) Direct capitalization method; 2) Discounted cash flow method.

#### Direct capitalization method

1. Direct Capitalization: capitalizing first year Net Operating Income using a capitalization rate.  
NOI is before finance cost and income taxes.  

$$\text{NOI} = \text{Rental income} + \text{Other income} = \text{Potential gross income} - \text{Vacancy and collection loss} = \text{Effective gross income} - \text{Operating expense (property tax, insurance, utilities, maintenance)} = \text{Net operating income}$$
2. The Capitalization Rate
  - (a) Cap rate is applied on first-year NOI, discount rate is on first-year and future NOI.
  - (b) Cap rate = discount rate - growth rate, where growth rate is "NOI/Value is expected to grow"
  - (c) Cap rate =  $\text{NOI}_1 / \text{Value} = \text{NOI}_1 / \text{comparable sales price}$
  - (d) If renters pay all expense, value =  $\text{rent}_1 / \text{APY (All risk yield)}$
3. Stabilized NOI
  - (a) Temporary unusual NOI should be stabilized.
  - (b) Temp Decline in NOI should be removed from the value calculated from the stabilized NOI.

4. Gross income multiplier = sale price / gross income in the year after purchase  
 Value = gross income  $\times$  gross income multiplier  
 - Property's vacancy rate and operating expenses are not included.

#### Discounted Cash Flow Method

1. Cap rate = discount rate - growth rate
2. Value =  $V_0 = \text{NOI}_1 / (r-g)$

#### Terminal Cap Rate

1. Terms:  
 Terminal value: The property value at the end of the holding period.  
 Terminal cap rate: future cap rate
2. Terminal Cap Rate is not necessarily the same as the going-in cap rate.

#### Valuation with Different Lease structures

1. Country difference. UK: tenants pay all expenses.
2. Reversionary potential: rent will adjust to the market price. Cap rent will be different from the market rent. Use different cap rate.
3. Total value = PV of current term rent to be received + PV of Reversion potential.

#### Layer Method

1. a variation of the term and reversion approach.
2. Total income = contract rent layer in perpetuity + rent increase
  - (a) Low cap rate for less risky layer
  - (b) High cap rate for the second layer, which is more risky.

### 36.9 Compare the direct capitalization and discounted cash flow valuation methods.

#### Compare

1. Direct: a cap rate/income multiplier is on the first-year NOI. Cap rate may increase.
2. DCF: Cash flows will be discounted.

### 36.10 Calculate the value of a property using the costs and sales comparison approaches

#### Cost Approach

1. Buyer pay = purchase of land + build a comparable building (replacement cost - depreciation)
2. Depreciation including
  - Physical deterioration: First remove curable physical deterioration, then calculate
  - Functional obsolescence: like bad floor plans
  - Locational obsolescence: when the location is no longer optimal.
  - Economic obsolescence: New construction is not feasible under current economics.

#### Sales Comparison Approach

1. Buyer pay = others paying for a similar properties.
2. Adjust. Average.

#### Reconciliation of Value

1. Weights on different approaches will be based on property type or market conditions.

### 36.11 Describe due diligence in private equity real estate investment.

1. Lease review, rental history
2. Confirm operating expense by examining bills
3. Review cash flow statements
4. Obtain environmental report
5. Physical/engineering inspection.
6. Title/legal documents
7. Survey the property.
8. Verifying compliance with zoning laws, building codes, regulations
9. Payment of taxes, insurance, special assessments, and so on.

### 36.12 Discuss private equity real estate investment indices, including their construction and potential biases.

#### Appraisal-based indices

1. NCREIF Property Index in US  
Members of NCREIF submit appraisal data quarterly.  
 $\text{Return} = (\text{NOI} - \text{capital expenditures} + \text{end mkt value} - \text{beg mkt value}) / \text{beg mkt value}$   
Value-weighted index.
2. Good
  - To Compare with other assets,
3. Bad
  - Lag actual transactions
  - Smooth the index and reduce its volatility.
  - Lower correlations with other assets.

#### Transaction-Based indices

1. Repeat-sales index: relies on repeat sales of the same property
2. Hedonic index: only one sale. Including a regression.

### 36.13 Calculate and interpret financial ratios used to analyze and evaluate private real estate investments.

1. Debt service coverage ratio:  $\text{DSCR} = \text{First-year NOI} / \text{Debt service}$
2. Loan-to-value:  $\text{LTV} = \text{loan amount} / \text{appraisal value}$
3. Equity dividend rate = first year cash flow/equity. Measured the cash return on the amount of cash invested.  
Only covers one period.
4. IRR with leverage: need to remove the outstanding mortgage balance.

## 37 Reading 44: Publicly Traded Real Estate Securities

### 37.1 Describe types of publicly traded real estate securities.

Forms:

1. real estate investment trusts REITS
2. real estate operating companies REOCs
3. residential or commercial mortgage-backed securities

Can be divided into two broad groups

1. Equity
  - REITs: exempt from corporate income tax, active managed, own real estate, generate rental incomes.
  - REOCs: Real estate operating companies. Ordinary companies, own real estate. ge REITs: Primarily invest in mortgages, mortgage securities or loans.
2. Debt
  - MBS: residential/commercial mortgage-backed securities. Public traded asset-backed securitized debt obligations that receive cash flows from an underlying pool of mortgage loans.
  - Mortga

### 37.2 Explain advantages and disadvantages of investing in real estate through publicly traded securities.

Advantages

1. Superior liquidity
2. Lower minimum investment
3. Limited liability
4. Access to premium properties
5. Active professional management
6. Protections accorded to publicly traded securities.
7. Greater potential for diversification.

REIT-Specific Advantages

1. Exemption from taxation
2. Predictable earnings: rental income fixed by contracts
3. High yield: REIT needs to pay out most of taxable income as dividends to maintain tax-advantage status.

Disadvantages

1. Taxes VS direct ownership: REIT/REOCs cannot deduct loss from taxable income
2. Lack of control
3. Cost of a publicly traded corporate structure
4. Price is determined by the stock market: underestimated volatility

5. Structural conflicts of interest

#### REIT-Specific disadvantages

1. Limited potential for income growth
2. Forced equity issuance
3. Lack of flexibility: REIT needs to meet some requirements.

### **37.3 Explain economic value determinants, investment characteristics, principal risks, and due diligence considerations for real estate investment trust shares.**

#### Economic Value determinants

1. GDP growth
2. More jobs, more office space needed, more disposable income, more growth in shopping malls, more demand for hotel rooms

#### Investment Characteristics of REITs

1. Exemption from corporate-level income taxes
2. High dividend yield
3. Low income volatility
4. Secondary equity offerings

#### Principal Risks of REITs

1. Mismatch between supply and demand is possible. (health care, hotel, office)
2. Occupancy rates fluctuate. (hotels)

#### Due Diligence considerations of REITs

1. Remaining lease terms
2. Inflation protection
3. In-place rents(current rents paying) versus market rents
4. Costs to re-lease space: rent loss, lease incentive offered, tenant-demanded improvement, broker commissions
5. Tenant concentration in the portfolio
6. Tenants' financial health
7. New competition
8. Balance sheet analysis: leverage, cost of debt, and debt's maturity
9. Quality of management.

### 37.4 Describe types of REITs

#### Subtypes of Equity REITs

1. Retail or Shopping Center REITs
  - (a) Regional Shopping malls
    - Anchore tenants: long-term fixed rate leases
    - Smaller tenants: percentage lease
  - (b) Community shopping centers: stores surround parking plots
    - Scheduled lease increase.
2. Office REITs
  - long, scheduled increasing leases.
  - Tenants pay part of property taxes, operating expenses, common costs based on office size.
  - Consider location, transportation, and quality of the space
3. Residential (Multi-Family) REITs
  - Short lease, fluctuate income
  - Gross lease, need to consider rising costs
4. Health care REITS
  - Net leases.
  - Relatively unaffected by the overall economy
  - Other factors like Government funds, demographic shifts may be important
5. Industrial REITS
  - long leases, 5-25 years
  - Transportation
  - Local market, new properties, and demand for such space.
6. Hotel REITs
  - High volatility
  - Remember to compare operating margins, occupancy rates, and average room rates
  - RevPAR: Revenue per available room = average rate x average occupancy rate
7. Storage REITs
  - Rent self-storage lockers
  - Gross lease, monthly
  - Local factors that drive demand for storage
8. Diversified REITs
  - Uncommon in North America

### 37.5 Justify the use of net asset value per share (NAVPS) in REIT valuation and estimate NAVPS based on forecasted cash net operating income.

NAVPS: using current mkt values, net asset value - liabilities

Estimating NAVPS based on Forecasted Cash Net Operating Income

1. Step 1: Estimated first-year NOI is capitalized using a market cap rate. Note: NOI should be the expected income in the coming year. Noncash rent should be removed.
2. Step 2: + the value of other tangible assets - the value of liabilities
3. Step 3: Net asset value divided by the number of outstanding shares

### 37.6 Describe the use of funds from operations (FFO) and adjusted funds from operations (AFFO) in REIT valuation

1.  $FFO = \text{Accounting net earnings} + \text{Depreciation expense} + \text{Deferred tax expenses} - \text{Gains from sales of property and debt restructuring} + \text{Losses from sales and debt restructuring}$ 
  - A good measure of the continuing operating income
  - Gains/Losses from debt restructuring or sales of property are removed, since they are not due to operating income.
2.  $AFFO = FFO - \text{Non-cash rent adjustment} - \text{Recurring maintenance-type capital expenditures and leasing commissions}$ 
  - AKA: CAD(cash available for distribution) or FAD(funds available for distribution)
  - Better measure

### 37.7 Compare the net asset value, relative value (price-to-FFO and price-to-AFFO) , and discounted cash flow approaches to REIT valuation.

Value REITs and REOSc using:

1. Net asset value per share: NAV estimates is good, but maybe it's not suitable for estimating the price in stock market.
2. Relative value: Price-to-FFO and price-to-AFFO: Factors that may impact
  - for growth of FFO or AFFO
  - The level of risks inherent in the underlying real estate
  - Risk related to the firm's leverage and access to capital
3. Discounted cash flow approach
  - Good for REITs and REOCs, b/c REITs and REOCs are all dividend-style.

### 37.8 Calculate the value of a REIT share using net asset value, price-to-FFO and price-to-AFFO, and discounted cash flow approaches.

CHECK examples

## 38 Reading 45: Private Equity Valuation.

Background: Private Equity

1. Portfolio company: companies that private companies invest in
2. Private equity firm: intermediary in the transaction
3. Private equity investor: the outside investor who makes an investment in a fund offered by PE firm

### 38.1 Explain sources of value creation in private equity.

Three sources to increase value:

1. Re-engineer the portfolio Intercompany
2. Obtain Debt financing on more advantageous terms
3. Superior alignment of interest between management and private equity ownership

Re-engineering the Portfolio Company

1. PE firms have their own CEOs, CFOs. They can share experience.

#### Obtaining Favorable Debt Financing

1. The use of debt can save tax - interest tax shield, increase the firm value.
2. Use of debt makes company more efficient.

#### Alignment of interest between private equity owners and managers

### **38.2 Explain how private equity firms align their interest with those of the managers of portfolio companies.**

Private companies will not face the pressure from stock markets. Private companies can focus more on long-term performances.

#### Control Mechanisms

1. Compensation
2. Tag-along, drag-along clauses: anyone who acquires control of the company, he must extend the offer to all shareholders, including management.
3. Board representations
4. Noncompete clauses: company founders must agree that they will not compete against the firm within a prespecified period of time.
5. Priority in claims: private equity receive distributions first.
6. Required approvals: important things should be approved by the PE firm
7. Earn-outs

### **38.3 Distinguish between the characteristics of buyout and venture capital investments**

#### Valuation Characteristics of Venture Capital vs. Buyout Investments

1. Venture: less mature company; buyout: mature company
2. Venture: revenue growth; buyout: EBIT, EBITDA growth

#### General Valuation Issues For Private Equity

1. (a) Private companies are bought by specific individuals, who may have different valuation towards the company.  
(b) Future cash flows may be different, due to PE firms are changed.
2. Private Equity Valuation Methodologies
  - (a) Discounted Cash flow analysis
  - (b) Relative value, market approach
  - (c) Real option analysis
  - (d) Replacement cost
  - (e) Venture capital method
  - (f) Leveraged buyout method



3. Other considerations
  - (a) Control premiums, country risk, marketability, illiquidity discounts
4. Price Multiples: can use public companies to estimate private equity portfolio companies.
5. Discounted Cash Flow Analysis:

#### Buyout Valuation Issues

1. Types of Buyouts: Acquirers acquires a controlling equity position takeovers  
Management buyouts (MBOs)  
Leveraged buyouts (LBOs): much debt is used
2. Leveraged Buyout (LBO): determine the maximum price in negotiation
3. LBO Model Important issues
  - Target company's forecasted cash flows: provided by target's management, checked by PE
  - The expected returns to the providers of the financing
  - Total amount of financing

### 38.4 Describe valuation issues in buyout and venture capital transactions

1. Exit value = investment cost + earnings growth + increase in price multiple + reduction in debt

#### Valuation Issues in Venture Capital Investments

1. Pre- and Post-Money Valuation  
 $\text{Pre-money} + \text{Investment} = \text{Post-money valuation}$   
 $\text{Ownership} = \text{Inv}/\text{Post}$
2. Usually use equity as a main form of financing.

#### Appropriate Methods for Venture Capital Valuation

1. Discounted Cash Flow analysis: not good. Since it's hard to tell future cash flows in a VC company.
2. Relative, market method: not good. Since VC companies are usually a unique company.
3. Real option analysis method or the Venture capital method might be good.

### 38.5 Explain alternative exit routes in private equity and their impact on value.

#### Types of Exit Routes

1. IPO  
Highest exit value, greater access to equity and hire better managers  
less flexible, costly, cumbersome process  
Appropriate for excellent companies
2. Secondary market sale  
Sold to another investor  
Second highest company valuations
3. Management buyout - MBOs  
Sold to management, who utilize a large amount of leverage. Leverage results in less flexibility.
4. Liquidation  
Used when the company will fail

#### Exit timing

1. Be flexible to exit. Should sell the company when the capital market is strong.
2. If an exit is expected in the next 1 year or 2, the exit valuation multiple can be forecasted. Big error will be possible beyond this time horizon.

### **38.6 Explain private equity fund structures, terms, valuation, and due diligence in the context of an analysis of private equity fund returns.**

#### Limited Partnerships

1. Most common form.
2. LP and GP  
LPs provide funding, do not have an active role in management; liability is limited to what they have invested.  
General Partner in a limited partnership is liable for all the firm's debts – the manager of the fund.
3. Private equity firms will raise fund and manage the investment.

#### Private Equity Fund Terms

1. Private equity investments are only available to qualified investors. – 1 million assets.
2. Terms are negotiated between GP and LP. Focus on: align interest between GPs and LPs, and the compensation of the GP.
3. Economic and corporate governance terms

#### Economic Terms of a Private Equity Fund

1. Management fees: percent of committed capital, 2%; can also based on NAV or paid-in capital
2. Transaction fees: Paid by 3rd parties to GP; half/half divided to LP/AP; Deduced from management fees.
3. Carried interest/performance fees: for GP, 20% of profits after management fees.
4. Ratchet: tell the allocation of equity between stockholders and management. management can increase their allocation depending on company performance.
5. Hurdle rate: Required IRR by the fund before GP can receive the carried interest.
6. Target fund size: maximum size of PE fund.
7. Vintage: the fund was started and facilitates performance comparison with other funds.
8. Terms of the fund. The life of the fund. 10 years usually.

#### Corporate Governance Terms of a Private Equity Fund

1. Key man clauses: If the key man leaves, GP cannot invest.
2. Performance disclosure and confidentiality
3. Clawback: If the fund earns at first, GP receives compensation. If the fund goes bad later, the GP will return a portion of the early profits.

4. Distribution waterfall, there are two methods
  - Deal-by-deal: carried interest to be distributed after each deal.
  - Total-return: Pay the carried interest when the portfolio is greater than total committed equity .OR. the portfolio grows to some specific value, 20% usually.
5. Tag-along, drag-along clauses: Anytime, the acquirered offer should be extended to all shareholders.
6. No-fault divorce: Fire a GP if a supermajority of the LPs agree.
7. Removal for cause: Fire the GP or terminate a fund given sufficient cause.
8. Investment restrictions
9. Co-investment: allows the LPs to invest in other funds of the GP at low or no management fees.

Net Asset Value (NAV): Private equity investments are difficult to value, the

1. 6 Ways to determine NAV
  1. At cost, adjusting for subsequent financing and devaluation
  2. At the minimum of cost or market value
  3. Revaluing a portfolio company when there's new financing
  4. At cost, with no adjustment until exit
  5. By using a discount factor for restricted securities
  6. Less frequently, by applying illiquidity discounts to values based on public companies.
2. Issues in calculating NAV
  1. NAV is only adjusted when there are subsequent financing
  2. No definitive method to calculate NAV
  3. Undrawn LP capital are not included in NAV, but it's actually liability
  4. Different stages will use different value methods
  6. It's the GP who values the fund usually.

Due diligence

1. Private equity funds tend to persist historical returns.
2. Duration is usually shorter than expected, though the term is longer.

### 38.7 Explain risks and costs of investing in private equity.

1. Difference between investing private/public firms
  - In private equity, the commitment equity are committed first, THEN drawn down to be invested to portfolio companies.
  - Returns in private investment follows J-curve: negative first, then positive when exiting.

Risks of Investing in Private Equity:

-General Risk Factors:

1. Liquidity Risk
2. Unquoted investment risk: do not have a publicly quoted price
3. Competitive environment risk
4. Agency risk: Managers of private equity portfolio companies may not act in the best interest of the private equity firm and investors.
5. Capital risks: Increases in business risk may result in capital withdrawal.

6. Regulatory risk: Portfolio companies products and services may be adversely affected by government regulation.
7. Tax risks
8. Valuation risk: subjective valuation of private equity investments
9. Diversification risk
10. Market risk: long-term changes in interest rates, exchange rates, and other market risks

#### Costs of Private Equity

1. Transaction costs
2. Investment vehicle fund setup costs: costs of setting up the fund are amortized.
3. Administrative costs
4. Audit costs
5. Management and performance costs: 2% for the management and 20% for performance
6. Dilution Costs
7. Placement fees: placement agents who raise funds will charge fees.

### 38.8 Interpret and compare financial performance of private equity funds from the perspective of an investor.

#### IRR:

1. NOTE: IRR assumes that intermediate cash flows are reinvested at the IRR.
2. Gross IRR: relevant for the cash flows between the fund and portfolio companies.
3. Net IRR: IRR that net of management fees, carried interests, and other compensation to the GP. Relevant for the cash flows between the fund and LPs.

#### Multiples:

1. NOTE: Multiples ignore the time value of money.
2. Quantitative Measures
  - PIC(Paid-in capital): ratio between the paid-in capital to the committed capital; .OR. the cumulative capital utilized
  - DPI(distributed to paid-in capital.): Cumulative distributions paid to LPs divided by the cumulative invested capital. Net of mg fees and carried interests.
  - RVPI(Residual value to paid-in capital): LP's unrealized return. The value of the LP's holdings divided by the cumulative invested capital. Net of management fees and carried interest.
  - TVPI(total value to paid-in capital)=DPI+RVPI
3. Qualitative Measures
  - The realized investments, with evaluation of success and failure
  - Unrealized investments, with evaluation of exit horizons and potential problems.
  - Cash flow projections at the fund and portfolio company level
  - Fund valuation, NAV, and financial statements.

Benchmarks: We should compare private funds with similar vintage and strategy.

### 38.9 Calculate management fees, carried interest, net asset value, distributed to paid in(DPI), residual value to paid in (RVPI), and TVPI of a private equity fund.

Check examples.

### 38.10 Calculate pre-money valuation, post-money valuation, ownership fraction, and price per share Applying to the venture capital method 1) with single and multiple financing rounds and 2) in terms of IRR.

Valuation of an investment using Venture Capital Method.

1. Post-money value: PV(exit value) after a new investment in the company.
2. Pre-money value:  $PRE = POST - INV$
3. New shares issued to the venture capital firm
  - NPV method:

$$f = \frac{INV}{POST}, POST = \frac{\text{exit value}}{(1+r)^n}$$

- IRR method

$$f = \frac{FV(INV)}{\text{exit value}}$$

Share for the VC

$$\text{Shares}_{VC} = \text{Shares}_{\text{founder}} \frac{f}{1-f}$$

The price per share

$$\text{Price} = \frac{INV}{\text{Shares}_{VC}}$$

Second round of VC financing ( $INV_2$ )

1.  $f_2 = INV_2 / POST_2$
2.  $POST_2 = \text{exit value} / (1+r_2)^{n_2}$
3.  $PRE_2 = POST_2 - INV_2$
4.  $POST_1 = PRE_2 / (1+r_1)^{n_1}$
5.  $\text{SHARE}_{VC2} = (\text{SHARE}_{VC1} + \text{SHARE}_{\text{Founders}}) * f_2 / (1-f_2)$

### 38.11 Demonstrate alternative methods to account for risk in venture capital

Input variables should be adjusted because projections by entrepreneurs are typically overly optimistic and based on assumptions that the company will not fail.

1. Adjusting the Discount Rate

$$r^* = \frac{1+r}{1-q} - 1$$

Where  $q$  is the probability of failure.

2. Adjusting the Terminal Value using Scenario Analysis  
Really depends on assumptions.

## **39 Reading 46: Commodity and Commodity Derivatives: An Introduction**

### **39.1 Compare characteristics of commodity sectors.**

Classifications of Commodities

1. Energy: crude oil, natural gas, and refined products
  - (a) Crude oil - Drilling technology - Economic cycles - alternative sources - Political risk
  - (b) Refined products - seasonal factors: gasoline, heating oil
  - (c) Natural gas - Transportation cost
2. Industrial metals - GDP growth - Business cycles - Political factors: strike
3. Grains - Droughts, hail, floods, pests
4. Livestock: hogs, sheep, cattle - Depends on the price of grain
5. Precious metals
6. Softs: coffee, sugars

### **39.2 Compare the life cycle of commodity sectors from production through trading or consumption.**

1. Crude Oil:
  - Drill - Store for a few months - Refining
2. Natural gas: minimal process; year-round delivery
3. Industrial metals
  - smelt the extracted ore
  - Mining and smelting operations are most efficient running near their capacity, so producers are hesitant to reduce production.
4. Soft: 4 years to generate coffee beans from coffee plants. Use futures market to hedge risk.

### **39.3 Contrast the valuation of commodities with the valuation of equities and bonds.**

Commodities has no cash flows, incur storage and transportation costs. Spot price can be seen as the PV of future selling price.

### **39.4 Describe types of participants in commodity futures market.**

Types

1. Hedgers
2. Traders
3. Investors
4. Exchanges
5. Analysts

## 6. Regulators

AND

1. Informed investors
  - Traders
  - Speculators
2. Arbitrageurs
3. Commodity exchanges
4. Commodity market analysts
5. Commodity regulators
  - US: CFTC, Commodities Futures Trading Commission

### 39.5 Analyze the relationship between spot prices and expected futures prices in markets in contango and markets in backwardation.

Difference in price

1. Basis of a particular contract = Spot price - Futures price
2. Calendar spread = Future price (nearer) - Future price (distant)

Market condition

1. Contango: futures price are higher at dates further  
 Basis  $< 0$ , Calendar spread  $< 0$   
 Futures price is greater than spot price. Short future is good.
2. backwardation  
 Basis, calendar spread  $> 0$   
 Futures price lower than spot price, long future is good

### 39.6 Compare theories of commodity futures returns.

Three theories

1. Insurance theory  
 The desire of commodity PRODUCERS to reduce their price risk drives commodity futures returns: drives down futures prices.  
 Not supported by empirical data.
2. Hedging pressure hypothesis  
 Adding hedging behavior of commodity consumers to the insurance theory. Consumer pressures will drive up the future price  $\rightarrow$  contango.  
 -Shortcomings: the producer has more risk than consumers; hedging risk is not observable.
3. Theory of storage  
 - The market is in backwardation or contango depends on the relationship BETWEEN cost of storing the commodity for future use AND the benefits of holding physical inventory.  
 - Convenience yield: benefits of having physical inventory available.  
 Futures price = Spot price + Storage costs - Convenience yield

### 39.7 Describe, calculate, and interpret the components of total return for a fully collateralized commodity futures contract.

1. Total return on a fully collateralized long futures position = Collateral return + Price return + Roll return
2. Collateral return/collateral yield: return from collateral.
3. Price return/spot yield: the change of spot price  

$$\text{Price return} = (\text{current price} - \text{previous price}) / \text{previous price}$$
4. Roll return
  - The process of rolling over: close the expiring futures position and reestablish a new position.
  - $$\text{Roll return} = (\text{price of expiring futures contract} - \text{price of new futures contract}) / (\text{price of expiring futures contract})$$

### 39.8 Contrast roll return in markets in contango and markets in backwardation.

1. Contango  $\rightarrow$  Roll return  $< 0$
2. Backwardation  $\rightarrow$  Roll return  $> 0$

### 39.9 Describe how commodity swaps are used to obtain or modify exposure to commodities.

1. Swaps: increase/decrease exposure to commodities risk.
2. Total return swap: the swap buyer receives periodic payments based on the change in the price of a commodity, in return for a series of fixed payments.
3. Excess return swap: Buy it, and receive periodic payments of any percentage by which the commodity price exceeds some benchmark value. If price  $<$  fixed value, no payments are made.
4. Basis swap: Based on difference between the prices of two commodities. Usually, one has liquidly traded futures for hedging, the other with no liquid futures contracts.
5. Commodity volatility swap: the underlying factor is the volatility of the commodity's price. When the volatility of the price is higher than the expected value, the swap buyer receives payment; when the volatility is lower than specific value, the swap seller receives money.

### 39.10 Describe how the construction of commodity indexes affects index returns.

1. Which commodities are included
2. Weighting
3. Method of rolling contracts: passive, or active
4. Method of rebalancing portfolio weights.
  - Frequency of rebalancing
  - Rebalancing portfolio weights will result in mean-reverting.



## **40 Reading 47: The Portfolio Management Process and the Investment Policy Statement.**

Warm-up: Elements of Portfolio Management

1. Evaluating investor and market characteristics
2. Developing an investment policy statement(IPS)
  - Constraints, objectives
  - market expectations
3. Determining an asset allocation strategy.
4. Measuring and evaluating performance.
  - After a stated time period, performance should be determined.
5. Monitoring dynamic investor objectives and capital market conditions.

### **40.1 Explain the importance of the portfolio perspective.**

Principle: only systematic risk is priced.

### **40.2 Describe the steps of the portfolio management process and the components of those steps.**

Steps

1. Planning
2. Execution
3. Feedback

### **40.3 Explain the role of the investment policy statement in the portfolio management process and describe the elements of an investment policy statement.**

Roles of IPS

1. Easily transportable and implemented
2. Promote long-term discipline
3. Protect against short-term shifts when market environments or portfolio performance cause panic/overconfidence.

Elements of IPS

1. Client description
2. Purpose of IPS with respect to policies, objectives, goals, restrictions and limitations
3. Identifications of duties/responsibilities
4. Formal statement of objectives and constraints
5. Calendar schedule of review
6. Asset allocation ranges regarding flexibility and rigidity
7. Guidelines for portfolio adjustments and rebalancing

#### **40.4 Explain how capital market expectations and investment policy statement help influence the strategic asset allocation decision and how an investor's investment time horizon may influence the investor's strategic asset allocation.**

Strategic asset allocation:

1. Combine IPS and market expectations
2. Should allow flexibility in response to short-term capital mkt expectations

Three common approaches

1. Passive investment strategies: Indexing, buy-and-hold
2. Active investment
3. Semi-active, risk-controlled active/enhanced index strategies

#### **40.5 Define investment objectives and constraints and explain and**

Investment objectives: what the investor wants to accomplish with the portfolio, Risk-return Risk objectives: willingness/ability to take risk - Risk tolerance. Factors to be noticed

1. Required spending needs: related to short-term inconvenience
2. Long-term wealth target: How much variation can the investor tolerate
3. Financial strength: can investor increase savings if the portfolio is insufficient to meet spending needs
4. Liabilities:

Two class of risk objectives

1. Absolute risk objectives: total return
2. Relative risk objectives: deviations from an underlying index

Two class of return objectives: return objective should be from TOTAL return perspective.

1. Desired return
2. Required return

Investment Constraints(5 main classes)

1. Liquidity
2. Time horizon
3. Tax constraints
4. Legal and regulatory factors
5. Unique circumstances

#### **40.6 Constrats the types of investment time horizons, determine the time horizon for a particular investor, and evaluate the effects of this time horizon on portfolio choice.**

Time horizon affects abilities to take risks.

## 40.7 Justify ethical conduct as a requirement for managing investment portfolios.

Managers have more knowledge than clients.

## 41 Reading 48: An Introduction to Multifactor Models.

### 41.1 Describe arbitrage pricing theory(APT), including its underlying assumptions and its relation to multifactor models.

Assumptions

1. unsystematic risk can be diversified.
2. RReturns are generated using a factor model.
3. No arbitrage opportunities exist.

The APT Equation

1.

$$E(R_p) = R_F + \beta_{P,1}\lambda_1 + \beta_{P,2}\lambda_2 + \beta_{P,3}\lambda_3 + \dots$$

### 41.2 Define arbitrage opportunity and determine whether an arbitrage opportunity exists.

Notes

1. Portfolio beta = weighted average of individual asset betas
2. APT assumes no market imperfections.

### 41.3 Calculate the expected return on an asset given an asset's factor sensitivities and the factor risk premiums.

Just solve the APT equations.

### 41.4 Describe and compare macroeconomic factor models, fundamental factor models, and statistical factor models.

Classifications of models

1. Macroeconomic factor models: returns are due to the SURPRISE in macroeconomic models.
2. Fundamental factor models: Firm specific factors
3. Statistical factor models:
  - Factor analysis: covariance
  - Principal component models: variance

Macroeconomic Factor Models

1. Model

$$R_i = E(R_i) + b_{i1}F_{GDP} + b_{i2}F_{QS} + \varepsilon_i$$

where  $E(R_i)$  = Expected return of asset i,  $F_{GDP}$  is the surprise in the GDP rate,  $F_{QS}$  = the surprise in the credit quality yield(BB-rated - Treasury bond yield).

2. Priced Risk Factors
  - unsystematic risks will be rewarded.
  - GDP rate and credit quality risks are systematic risks.
3. Factor sensitivities
  - Can be estimated by regressing historical asset returns on the corresponding historical macroeconomic factors.

#### Fundamental Factor Models

1. Model

$$R_i = a_i + b_{i1}F_{P/E} + b_{i2}F_{SIZE} + \varepsilon_i$$

Where

$$(a) \quad b_{i1} = \frac{(P/E)_i - \overline{P/E}}{\sigma_{P/E}}$$

Average P/E is calculated over all stocks, as well as the standard deviation.

#### The Macroeconomic Factor Model vs. the Fundamental Factor Model

1. Sensitivities.
  - macroeconomic factor model: sensitivity cannot be calculated
  - fundamental factor: can be calculated
2. Interpretation of factors:
  - macroeconomic: surprise in the macroeconomic variables
  - fundamental: rates associated with factor.
3. Intercept term
  - Macro: expected return
  - Fundamental: just the regression intercept, not the expected return.

### 41.5 Explain sources of active risk and interpret tracking risk and the information ratio.

Active return and risk:

1. Active return = Portfolio Return - Benchmark return
2. Active risk = tracking error =  $\sigma(R_p - R_B)$

#### The Information Ratio

1. Definition: measure a manager's consistency in generating active return
- 2.

$$IR = \frac{\bar{R}_P - \bar{R}_B}{\sigma(R_p - R_B)}$$

### 41.6 Describe uses of multifactor models and interpret the output of analysis based on multifactor models.

Multifactor models can be useful for

1. Return Attribution
  - Active return = factor return + security selection return
  - Factor return =  $\sum_{i=1}^k (\beta_{pi} - \beta_{bi}) \times \lambda_i$
  - Security selection return = active return - factor return

## 2. Risk Attribution

Active risk = tracking error =  $\sigma(R_p - R_B)$

Active risk squared = active factor risk + active specific risk

- (a) Active factor risk: Difference of sensitivities between portfolio factors and benchmark.  
Active factor risk = active risk squared - active specific risk
- (b) Active specific risk: Asset selection. Due to the weights of stocks you use.  
Active specific risk =  $\sum_i^n (W_{pi} - W_b)^2 \sigma_{\varepsilon i}^2$  where  $W_{pi}$  are portfolio weights, and  $\sigma_{\varepsilon i}^2$  = residual risk of the  $i$ th asset.

## 3. Use of Multifactor Models

- (a) For Passive Management: Construct a tracking portfolio, expose to same factors as the benchmark.
- (b) Active management: make specific bets on desired factors while hedging/neutral on other factors.
- (c) Rules-based/algorithmic active management: mechanically tilt factor exposures when constructing portfolios.

## Carhart Model

## 1. Model

$$E(R) = R_F + \beta_1 RMRF + \beta_2 SMB + \beta_3 HML + \beta_4 WML$$

$RMRF$  = return on value-weighted equity index - risk-free rate

$SMB$  = average return on small cap stock - average return on large cap stocks

$HML$  = average return on high book-to-market stocks - average return on low-book-to-market stocks

$WML$  = average returns on past winners - average returns on past losers

### 41.7 Describe the potential benefits for investor in considering multiple risk dimensions when modeling asset returns.

More risk factors can help the investor take advantage in bearing risks he can afford.

## 42 Reading 49: Measuring and Managing Market Risk

### 42.1 Explain the use of value at risk (VaR) in measuring portfolio risk.

Three components

- 1. The probability
- 2. The loss size
- 3. a time frame

Expression

- 1. In value: The monthly 5% VaR is \$25,000 → There is 5% probability that the company will lose at least \$25,000 in any given month
- 2. In percentage: The monthly 5% Var is 3% → There is 5% probability that the portfolio value will lose at least 3%

## 42.2 Compare the parametric (variance-covariance), historical simulation, and Monte Carlo simulation methods for estimating VaR.

## 42.3 Estimate and interpret VaR under the parametric, historical simulation and Monte Carlo simulation methods.

Three methods

### 1. Parametric Method (Variance-covariance method)

- (a) Identify the risk factors related to the portfolio returns: market risk, interest rate risk, or currency risk, etc.
- (b) Assumption:
  - Risk factors are distributed normally
- (c)

$$\sigma_{portfolio}^2 = W_A^2 \sigma_A^2 + W_B^2 \sigma_B^2 + 2W_A W_B Cov_{AB}$$

- Lookback period: time horizon to estimate the mean and standard deviation of returns.

- (d) 1%  $\rightarrow -2.33\sigma$  5%  $\rightarrow -1.645\sigma$  16%  $\rightarrow -1\sigma$

### 2. Historical simulation method

- (a) Based on the actual periodic changes in risk factors over a lookback period.
  - Calculate a daily change, ordering the changes, we will have 5% of losses. No adjustment needed.

### 3. Monte Carlo simulation

- (a) Assume probability distribution for each risk factor. Assume the correlations between risk factor.

## 42.4 Describe advantages and limitations of VaR

Advantage of VaR

1. Simple, easy to explain
2. Help compare risks of different portfolios, asset classes
3. Use for performance evaluation
4. Allocating assets, the risk managers can look at/optimize the allocation of VaR
5. Global banking regulators accept VaR as a measure of financial risk
6. VaR can be verified by backtesting

Disadvantage of VaR

1. VaR estimation requires many choices
2. The assumption of normality  $\rightarrow$  Underestimates of downside risk. Actual return have fatter tails than normal risk.
3. Liquidity falls significantly when asset price fall. VaR does not include this.
4. VaR didn't include that Correlations increase during periods of financial stress.
5. Ignore many risk
6. VaR didn't look at right-hand tail

## 42.5 Describe extension of VaR

Extension of VaR

1. Conditional VaR (CVaR): Expected loss GIVEN the loss is equal or greater than VaR.
2. Incremental VaR (IVaR): Change in VaR from a change in the portfolio allocation weight of a security.
3. Marginal VaR (MVar): The slope of VaR vs. a security's weight
4. Ex ante tracking error, aka Relative VaR: Measures the VaR of the difference between the return on a portfolio and the return on its manager's benchmark portfolio.

## 42.6 Describe sensitivity risk measures and scenario risk measures and compare these measures to VaR

We should use other risk measures that complement VaR.

1. Sensitivity Analysis: Assess the effect on portfolio value given a small change in one risk factor.
  - Provides an estimate of the change in portfolio value due to a small change in a single risk factor.
  - It does not involve any prediction.
2. Scenario analysis
  - Provides an estimate of the effect on portfolio value of a set of changes of significant magnitude in multiple risk factors.

Approaches

- (a) Historical scenario: use a set of changes in risk factors that HAVE occurred.
- (b) Hypothetical scenario: any set of changes in risk factors can be used.
- (c) Stress test: examine the effect on value of a scenario of extreme risk-factor changes.

## 42.7 Demonstrate how equity, fixed income, and options exposure measures may be used in measuring and managing market risk and volatility risk.

Factors used in measurement

1. Equity: beta.  $E(R_i) = \text{Beta}_i[E(R_{MKT}) - R_f]$
2. Fixed income: Modified Duration → How market values are affected by changes in interest rate.  
 Change in price =  $-\text{Duration}(\Delta_Y) + 1/2 \text{Convexity}(\Delta_Y)^2$ 
  - (a) Maculay Duration: Time weighted-average of PV of future cash flows.
  - (b) Modified Duration:  $\partial(\text{Value})/\partial(y)$
  - (c) Compounding methods
    - Continuous compounding: modified = Maculay
    - Period compounding: Modified = Maculay/(1+Yield per period)
3. Options:
  - (a) Delta: Sensitivity of option values to changes in the value of underlying asset.
  - (b) Gamma: Delta changes as the price of the underlying asset changes
  - (c) Vega: Option values to changes in the expected volatility of the price of the underlying asset.

## 42.8 Describe the use of sensitivity risk measures and scenario risk measures.

Uses

1. Sensitivity risk measures: inform a portfolio manager about a portfolio's exposure to various risk factors.
2. Scenario analysis: Often modeled as instant scenario changes. In some case, it's incremental changes, and includes manager's reaction.
3. Reverse stress testing: Decide an unacceptable outcome, then find how likely the related scenario would happen.

## 42.9 Describe advantages and limitations of sensitivity risk measures and scenario risk measures.

VaR, sensitivity analysis, and scenario analysis complement each other.

Advantages

1. VaR provides a probability of loss
2. Sensitivity: relative exposures to different risk Factors
3. Scenario: information about exposure to instant changes

Limitations

## 42.10 Describe risk measures used by banks, asset managers, pension funds, and insurers.

1. Banks: sensitivity(held-to-maturity and foreign exchange risk), scenario and stress testing(full balance sheet), leverage risk measures, and VaR(trading securities)
2. Traditional(long-only) asset managers: relative risk measures, size of positions, sensitivity measures, scenario analysis.
  - Active share: difference between the weight in portfolio and the weight in benchmark.
  - Ex-post tracking error(backward looking), ex-ante tracking error(forward looking): ex-ante tracking error can be used for risk estimation.
3. Hedge funds: Dependes. Sensitivity analysis, leverage measures, scenario analysis, and stress test.
  - If the fund with significantly non-normal returns: Use "Maximum Drawdown"→The largest decrease in value over prior periods of a specific length.
4. Defined benefit pension funds: Use "Surplus-at-risk" →VaR for (plan asset - liability)
5. Insurance companies
  - Property and casualty insurers:
    - (a) Use sensitivities of exposures to market risk factors in investment portfolios for risk managements.
    - (b) Use VaR and capital at risk, scenario analysis, as measures
  - Life insureers:
    - (a) Risks more correlated with the market. Because life insurers invest more. Annuities pay over long periods into the future.



#### 42.11 Explain constraints used in managing market risks, including risk budgeting, position limits, scenario limits, and stop-loss limits.

1. Risk budgeting: Determine the acceptable total risk, then allocate them to different activities, strategies, assets.
2. Position limits: Ensure minimum level of diversification by limiting risk exposures.
3. Scenario limits: limits on expected loss for a given scenario
4. Stop-loss limits: require risk exposures be reduced if losses exceed a specified amount.

#### 42.12 Explain how risk measures may be used in capital allocation decisions.

Capital allocation: how the capital of a firm is used to fund its business.

1. No risk management: maximize the companies' expected return.
2. With risk exposures: One way is to limit the overall risk of all the activities.

### 43 Economics and Investment Markets

#### 43.1 Explain the notion that to affect market values, economic factors must affect one or more of the following: (1) default-free interest rates across maturities, (2) the timing and/or magnitude of expected cash flows, and (3) risk premiums

The value of any asset will change if

1. expected cash flow change
2. discount rate change
  - Real risk-free discount rate
  - Expected inflation ( $\pi$ )
  - Risk premium reflecting the uncertainty about the cash flows

#### 43.2 Explain the role of expectations and changes in expectations in market valuation.

Expectations will change if new information is acquired. The impact of new information will depend on current expectation.

#### 43.3 Explain the relationship between the long-term growth rate of the economy, the volatility of the growth rate, and the average level of real short-term interest rates.

Real risk-free rate of interest derives from the inter-temporal rate of substitution

- 1.

$$\text{inter-temporal rate of substitution} = m_t = \frac{\text{marginal utility of consuming 1 unit in the future}}{\text{marginal utility of current consumption of 1 unit}} = \frac{u_t}{u_0}$$

2. Current price of a zero-coupon, inflation-indexed, risk-free bond pay \$1 at time  $t$

$$P_0 = E(m_t)$$

$$R = \frac{1 - P_0}{P_0} = \frac{1}{E(m_t)} - 1$$

3. Some key points

- (a) If investors expect high income in the future, they will save less, consume more → High utility of current consumption, high interest
- (b) low income in the future → less consumption, high savings, low interest
- (c) Investor increase their savings when i) Expected returns are high or ii) when uncertainty about their future income increases.

#### Risky Cash Flows and Risk premiums

1. Risk premium: if the expected cash flows are uncertain, premium is needed.
2. Risk-aversion: investor experiences a LARGER loss of utility for a loss, SMALLER gain in utility for an equivalent gain in wealth.  
Risk-aversion declines with wealth. Wealthier people are less risk averse.  
For a risk-free, inflation-indexed, zero-coupon bond that an investor will sell prior to maturity:

$$P_0 = \frac{E(P_1)}{1 + R} + \text{cov}(P_1, m_1)$$

where  $E(P_1)$  is the expected sell price.

$\text{Cov}(P_1, m_1) < 0$ . Because if the expected future price of the asset is high, the marginal utility of future consumption relative to current consumption will be low.

Negative cov → positive risk premium

#### GDP Growth Rates:

1. High GDP → High future income expected → Low utility of future consumption → High interest rate
2. Real interest rate is positively correlated to the GDP Growth rate; also positively correlated with the expected volatility in GDP growth due to higher risk premium.

### 43.4 Explain how the phase of the business cycle affects policy and short-term interest rates, the slope of the term structure of interest rates, and the relative performance of bonds of differing maturities.

Nominal risk-free interest rates should include inflation, as well as the Uncertainty of inflation.

1. Short-term, uncertainty about inflation is negligible.

$$r(\text{short-term}) = R + \pi$$

2. Long-term,:

$$r(\text{long-term}) = R + \pi + \theta$$

$\pi$  is the expected inflation.  $\theta$  is the risk premium for uncertainty about inflation.

#### Taylor Rule

1. Model:

$$r = R_n + \pi + 0.5(\pi - \pi^*) = 0.5(y - y^*)$$

Where  $R_n$  is the neutral REAL policy interest rate,  $\pi^*$ ,  $y^*$  are the targeted inflation rate and targeted sustainable output.

#### Business Cycle and Slope of the Yield Curve

1. Recession → Low policy rates
2. Economy comes out of recession → Improved expectations about future GDP growth → Higher long-term rates → Positive slope of the yield curve.
3. Expectations of a decline in GDP growth results in a negatively sloped yield curve.
4. Term spread: difference between the yield on a longer-term bond yield and the yield on a short-term bond. Normally positive. Since larger uncertainty in inflation.

### 43.5 Describe the factors that affect yield spreads between non-inflation-adjusted and inflation-indexed bonds

#### Break-even inflation rate (BEI)

1. BEI = yield on non-inflation-indexed bond - yield on inflation-indexed bond
2. BEI =  $\pi + \theta$

### 43.6 Explain how the phase of the business cycle affects credit spreads and the performance of credit-sensitive fixed-income instruments

#### Required rate of return for credit risky bonds

1.  $= R + \pi + \theta + \gamma$

Where  $\gamma$  = additional risk premium for credit risk = credit spread

### 43.7 Explain how the characteristics of the market for a company's products affect the company's credit quality.

Credit spreads differs among industrial sectors, due to products, service, and different financial leverage.

### 43.8 Explain how the phase of the business cycle affects short-term and long-term earnings growth expectations

Cyclical industries (durable goods, consumer discretionary) are more sensitive to the phase. Non-cyclical industries are immune to fluctuations, earnings relatively stable.

### 43.9 Explain the relationship between the consumption-hedging properties of equity and the equity risk premium.

1. Discount rate for equity =  $R + \pi + \theta + \gamma + \kappa$ , where  $\kappa$  = additional risk premium relative to risky debt for an investment in equities.  
 $\lambda$  = equity risk premium =  $\gamma + \kappa$
2. - Consumption hedging property: Higher payoff during economic downturns. → Reduce the risk premium  
 - Equity: high value when economic expansions, and the marginal utility of consumption is lower. Risk premium is positive.

**43.10 Describe cyclical effects on valuation multiples.**

1. Multiples are positively correlated with expected earnings growth rates and negatively correlated to required returns. Price multiples increase with a decrease in components of required return (real rate, expected inflation, risk premium for inflation uncertainty, equity risk premium.)
2. Equity risk premium decline during expansion.
3. Shiller's CAPE (real cyclically adjusted P/E) = volatility of unadjusted P/E ratio - (real price/10-yr real earnings)

**43.11 Describe the implications of the business cycle for a given style strategy. (Value, growth, small Cap, large Cap)**

1. Growth stock: high P/E, low dividend, immature markets
2. Value stocks: low P/E, high yield, mature markets.

**Strategy**

1. Growth strategy: investing in growth stocks. Good during expansion.
2. Value: investing in value stocks. Good during recession.
3. small/mid/large cap: small cap → higher volatility, high risk-premium

**43.12 Describe how economic analysis is used in sector rotation strategies.**

Choose right sector to invest in different phase of economic cycles.

**43.13 Describe the economic factors affecting investment in commercial real estate.****Commercial real estate investments**

1. Bond-like: steady rental income, credit quality for tenants
2. Equity-like: value of estates is influenced by many factors. Uncertain terminal value.
3. Illiquidity

**Valuation**

Discount rate for equity =  $R + \pi + \theta + \gamma + \kappa + \phi$ , where  $\phi$  = risk premium for illiquidity.

**44 Reading 51: Analysis of Active Portfolio Management****44.1 Describe how value added by active management is measured.****Active Return**

1. Define: value added by active management.
2. Ex-ante active return:  $E(R_A) = E(R_P) - E(R_B)$  = Expected return of actively managed portfolio -
3. Active weights: Difference between a security's weight in an actively managed portfolio - its weight in the benchmark portfolio
4. For N securities  
-  $E(R_A) = \sum \Delta w_i E(R_i)$ , where  $\Delta w_i$  = active weight

5. For investments with multiple asset classes

$$E(R_P) = \sum w_{p,j} E(R_{p,j}), E(R_B) = \sum w_{B,j} E(R_{B,j}), E(R_A) = \sum w_{p,j} E(R_{p,j}) - \sum w_{B,j} E(R_{B,j})$$

6. Active return = Asset allocation return (from deviation of asset class weights) + security selection return

$$E(R_A) = \sum \Delta w_j E(R_{p,j}) + \sum w_{P,j} E(A, j)$$

#### 44.2 Calculate and interpret the information ratio (ex post and ex ante) and contrast it to the Sharpe ratio.

Definitions

1. Sharpe Ratio:  $SR = \frac{R_P - R_F}{\sigma_P}$   
Its not affected by leverage.
2. Information Ratio  $IR = \frac{R_P - R_B}{\sigma(R_P - R_B)} = \frac{R_A}{\sigma(R_A)}$
3. Important points
  - We are consider ex-ante information ratio
  - A closet index fund: closely tracks the underlying benchmark index. Low IR.
  - Fund with zero systematic risk: Use risk-free ratio as benchmark. Has information ratio = Sharpe ratio. Active return = Total return - risk-free return. Active risk = Total risk.
  - IR will change with leverage.
  - IR will not change with ACTIVE weights → Triple active weights, active return and active risk will triple → IR not change

Optimal amount of risk

1. optimal active:  $\sigma_A^* = \frac{IR}{SR_B} \sigma_B$
2. Corresponding SR:  $SR_P = \sqrt{SR_B^2 + IR^2}$
3. Total risk of the portfolio  $\sigma_P^2 = \sigma_B^2 + \sigma_A^2$

#### 44.3 State and interpret the fundamental law of active portfolio management including its component terms – transfer coefficient, information coefficient, breadth, and active risk (aggressiveness).

Three factors of the information ratio

1. Information coefficient(IC): measure of a manager's skill. It's the ex-ante, risk-weighted correlation between active returns and forecasted active returns.
2. Transfer coefficient(TC): Correlation between actual active weights and optimal active weights.
  - For unconstrained portfolio: Active weights = Optimal weights, TC=1
  - For constrained portfolio:  $TC = \text{CORR}(\mu_i / \sigma_i, \Delta w_i \sigma_i) = \text{CORR}(\Delta w_i^* \sigma_i, \Delta w_i \sigma_i)$ , Correlations between the forecasted active returns and the actual weights adjusted for risk,  $\mu_i$  = the ex-ante active return for security  $i$
3. Breadth: The number of independent active bets taken per year.

Grinold Rule

1.  $\mu_i = IC \sigma_i S_i$ , where  $S_i$  = a standardized score
2.  $E(R_A) = \sum \Delta w_i \mu_i$

3. For Unconstrained portfolio,  $TC=1$ , optimal values are
  - $IR^* = IC\sqrt{BR}$
  - $E(R_A)^* = IC\sqrt{BR}\sigma_A$
4. Constrained portfolio
  - $IR = (TC)IC\sqrt{BR}$
  - $E(R_A)^* = (TC)IC\sqrt{BR}\sigma_A$
  - $\sigma_{CA}^* = TC \frac{IR^*}{SR_B} \sigma_B$ ,  $IR^*$  is the IR of an unconstrained portfolio.
  - $SR_P = \sqrt{SR_B^2 + TC^2 IR^{*2}}$

#### Ex-Post Performance Measurement

1.  $E(R_A|IC_R) = (TC)IC_R\sqrt{BR}\sigma_A$ , where  $IC_R$  is the ex-post information coefficient.

### 44.4 Explain how the information ratio may be useful in investment manager selection and choosing the level of active portfolio risk.

Investors should choose managers with highest IR

The expected active return is  $E(R_A) = IR \times \sigma_A$

### 44.5 Compare active management strategies (including market timing and security selection) and evaluate strategy changes in terms of the fundamental law of active management.

Some definitions

1. Market timing: bet on the direction of the mkt.
  - $IC = 2 * (\%correct) - 1$
2. Sector Rotation: Select best sectors based on market timing.
  - Examples.

### 44.6 Describe the practical strengths and limitations of the fundamental law of active management.

Good

1. Good for security selection, market timing, sector rotation

Limitations

1. Garbage in, garbage out: poor input leads to wrong results.
  - Ex-ante measurement of skill
  - Independence: The bets are not independent.
- (a)  $BR = \frac{N}{1+(N-1)r}$ , where  $r$  is correlation between bets.
2. Intependence can be compromised by
  - Cross-section dependency: stocks have correlations in same sectors.
  - Time-series dependency: sequential operations may dependent.

## 45 Reading 52: Algorithmic Trading and High-Frequency Trading

### 45.1 Define algorithmic trading

Algorithmic Trading: Use a set of rules, and a computer to make decisions and trades thousands of times.

## 45.2 Distinguish between execution algorithms and high-frequency trading algorithms.

Trading algorithms can be broken down into

1. Execution algorithms:
  - Objective: execute large orders with minimal price impact
2. High-frequency Trading Algorithms
  - Objective: analyze real-time market data in search of patterns that can be profitably traded. Securities held for a short time.

## 45.3 Describe types of execution algorithms and high-frequency trading algorithms.

Types of Execution Algorithms

1. Volume-Weighted Average Price Algorithms (VWAP)
  - Based on Historical trading patterns over a typical day, split a large order into pieces proportional to historical distribution.
2. Implementation Shortfall Algorithms
  - Try to obtain a balance to minimize the potential market drift that could happen if the order takes a long time to execute.
3. Market Participation Algorithms
  - Cut larger order into slices that vary proportionally with actual trading volume.

Types of High-frequency Trading Algorithms

1. One class: statistical arbitrage: Find securities that historically moved together but diverged recently.
  - (a) Pairs trading: When prices of two securities diverge, short the outperformed while long the underperformed ones.
  - (b) Index arbitrage: Find the temp difference in price between securities and their belonged sector.
  - (c) Basket trading: apply statistical arbitrage strategies to groups of securities.
    - Trading one basket vs. another basket
  - (d) Spread trading: Take long/short positions in two correlated securities.
    - Intra-market spread: Long in one contract and short in the same futures in another contract month in the same exchange.
    - Inter-market spread: Buy one contract in one market and sell the same contract on the same delivery month in a different market.
    - Inter-exchange spread: Buy a commodity future on one exchange and sell a similar future on a different exchange.
    - Multilegged inter-exchange spread:
      - Crack spread: crude oil vs. petroleum products
      - Spark spread: price of electricity from a gas-fired power plants vs. fuel prices
      - Crush spread: soybean futures vs. soybean oil futures
  - (e) Mean reversion: when the price of a security drifts away from its recent historical mean, its price will move back
  - (f) Delta-neutral strategies: produce a small profit by combining stocks and options. TOTAL Delta of portfolios is zero, thus it will gain when volatility changes.
2. Other algorithms besides Stat arbitrage

- (a) Liquidity aggregation and smart order routing: based on market fragmentation and a liquidity aggregation algorithm.
- (b) Real-time pricing of securities: using algorithmic trading to price in real time based on instantaneous market information.
- (c) Trading on news
- (d) Genetic tuning: using a self-evolving system to test the performance of many different strategies.

#### **45.4 Describe market fragmentation and its effects on how trades are placed.**

1. Market Fragmentation: same security traded in multiple financial markets → different price/liquidity
2. Liquidity aggregators: Sum liquidity for an individual instruments across multiple markets
3. Smart order routing: direct orders to the market with the best combinations of liquidity and price.
4. Low Latency are necessary: latency refers to time lag between market data being released and a corresponding trade being placed.

#### **45.5 Describe the use of technology in risk management and regulatory oversight.**

##### The Use of Technology in Risk Management

1. Real-time pre-trade firewall: i) continuously calculate risk exposures, block those trades that would exceed the limits, block erroneous trades.
2. Back testing and market simulation: test algorithms under various offline scenarios.

##### The use of Technology in Regulation oversight

1. Regulatory Oversight: Real-Time Market Monitoring and Surveillance. Use the same tool to monitor the market.
  - Insider trading
  - Front running: trader has knowledge of large orders. Obtain profit from the price movement.
  - Painting the tape: buy a small quantities of securities to drive up the price, and then sell.
  - Fictitious orders:
    - Quote stuffing: injects many orders and cancel them immediately.
    - Layering: place genuine orders on one side of the market but also put false orders
    - Spoofing: place orders between the bid and ask price and cancel them before they execute. They are intended to create false pessimism/optimism about the security and move the market price.
  - Wash trading: buy/sell same securities repeatedly to create false trading volume.
  - Trader collusion: Multiple traders sway markets together.

#### **45.6 Describe issues and concerns related to the impact of algorithmic and high-frequency trading on securities markets.**

##### Postive Impacts of Algorithmic and High-Frequency Trading

1. Facilitates large trades
2. Increased liquidity
3. Lower costs
4. Tigher bid-ask spreads



5. Improved pricing efficiency
6. Promotes open and competitive markets
7. Increased competition between trading venues

Concerns Regarding the Impacts of Algorithmic and High-Frequency Trading

1. Unfair speed advantages
2. Magnification of market movements
3. Market manipulation
4. Risk of trading errors
5. Out-of-control algorithms
6. Denial-of-service
7. Slowed markets due to excessive orders
8. Increased difficulty of policing the market
9. Unequal access to information