2020 Level II Fact Sheet

Key Facts & Formulas for the CFA® Exam

Approved Prep Provider CFA Institute

Ethical and Professional Standards

I(A) Knowledge of the law: comply with the strictest law; disassociate from violations.
I(B) Independence and objectivity: do not offer, solicit or accept gifts; but small token gifts are ok.
I(C) Misrepresentation: do not guarantee performance; avoid plagiarism.
I(D) Misconduct: do not behave in a manner that affects your professional reputation or integrity.
II(A) Material nonpublic information: do not act or help others to act on this information; but mosaic theory is not a violation.
II(B) Market manipulation: do not manipulate prices/trading volumes to mislead others; do not spread false rumors.
III(A) Loyalty, prudence, and care: place client's interest before employer's or your interests.
III(B) Fair dealing: treat all client's fairly; disseminate investment recommendations and changes simultaneously.
III(C) Suitability: in advisory relationships, understand client's risk profile, develop and update an IPS periodically; in fund/index management, ensure investments are consistent with stated mandate.
III(D) Performance presentation: do not misstate performance; make detailed information available on request.
III(E) Preservation of confidentiality: maintain confidentiality of clients; unless disclosure is required by law, information concerns illegal activities, client permits the disclosure.
IV(A) Loyalty: do not harm your employer; obtain written consent before starting an independent practice; do not take confidential information when leaving.
IV(B) Additional compensation arrangements: do not accept compensation arrangements that will create a conflict of interest with your employer; but you may accept if written consent is obtained from all parties involved.
IV(C) Responsibilities of supervisors: prevent employees under your supervision from violating laws.
V(A) Diligence and reasonable basis: have a reasonable and adequate basis for any analysis, recommendation or action.
V(B) Communication with clients and prospective clients: distinguish between fact and opinion; make appropriate disclosures.
V(C) Record retention: maintain records to support your analysis.
VI(A) Disclosure of conflicts: disclose conflict of interest in plain language.
VI(B) Priority of transactions: client transactions come before employer transactions which come before personal transactions.
VI(C) Referral fees: disclose referral arrangements to clients and employers.
VII(A) Conduct as participants in CFA Institute programs: don't cheat on the exams; keep exam information confidential.
VII(B) Reference to CFA Institute, the CFA designation, and the CFA program: don't brag, references to partial designation not allowed.

Quantitative Methods

Simple linear regression: regression equation

$Y_i = b_0 + b_1X_i + \varepsilon_i,\ i = 1, \ldots, n$

Confidence interval for regression coefficients

$$\widehat{b_1} \pm t_c s_{\widehat{b_1}}$$

$$t = \frac{\widehat{b_1} - b_1}{s_{\widehat{b_1}}}$$

Prediction interval for regression equation:

$\hat{Y} \pm t_c s_f$

s_f = Standard deviation of prediction error

R-squared (coefficient of determination) measures the fraction of the total variation in the dependent variable that is explained by the independent variable.

$$R^2 = \frac{\text{explained variation}}{\text{total variation}}$$

Total variation = unexplained variation + explained variation

F-statistic tests whether all the slope coefficients in a linear regression are equal to 0.

$$F = \frac{RSS/1}{SSE/(n-2)} = \frac{\text{Mean regression sum of squares}}{\text{Mean squared error}}$$

Standard error of estimate (SSE) measures how well a given linear regression model captures the relationship between the dependent and independent variables.

$$SEE = \left(\frac{\sum_{i=1}^{n}\left(Y_i - \hat{b}_0 - \hat{b}_0X_i\right)^2}{n-2}\right)^{\frac{1}{2}} = \left(\frac{\sum_{i=1}^{n}(\hat{e}_i)^2}{n-2}\right)^{\frac{1}{2}}$$

SEE = Square root of mean square error.
Test for serial correlation: DW ≈ 2 (1 – r)

Multiple regression: regression equation

$$Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + \varepsilon_i$$

Violations of regression assumptions

- Heteroskedasticity: Variance of error term is conditional on X. Solution: Robust standard errors. Detect with Breuch-Pagan test: F-test is unreliable Standard error for coefficients will be underestimated; t-stat will be inflated. Solution: Generalized least squares.
- Serial correlation: Errors correlated across observations. Solution: Hansen Method. Detect by the DW test DW ≈ 2 (1 – r): t-stat and F-stat too high Solution: Modify the regression equation
- Multicollinearity: Two or more independent variables are highly correlated with each other high R^2, significant F-stat, inflated standard error, low t-stat for coefficients. Solution: Omit one or more of the "X" variables.

Trend models

- Linear trend model: dependent variable changes at a constant rate with time. The independent variable is time: Y = b0+ b1t + εi , t = 1, 2, …, T.
- Log-linear trends work well in fitting time series that have exponential growth.
- An autoregressive model (AR) is a time series where a given variable is regressed on its own past values.

$$X_t = b_0 + b_1X_{t-t} + \varepsilon_t$$

- For AR models to work the time series must be covariance-stationary: Constant expected value, variance and covariance.
- Durbin-Watson does NOT work for AR models.
- Test whether the autocorrelations of the error term (error autocorrelations) differ significantly from 0. Test-stat = residual autocorrelation / standard error
- Compare the out-of-sample forecasting performance of forecasting models by comparing their root mean squared error (RMSE), which is the square root of the average squared error.
- Mean-reverting level is given by:

$$x_t = \frac{b_0}{(1 - b_1)}$$

- A random walk is a time series in which the value of the series in one period is the value of the series in the previous period plus an unpredictable random error.

$$x_t = x_{t-1} + E(\varepsilon)_t = 0$$

- With a random walk b1 = 1, so MRL is undefined. This is called the unit root problem. Solution is to use first differencing.

Supervised machine learning algorithms: penalized regression, support vector machine (SVM), K-nearest neighbour (KNN), classification and regression tress (CART), random forest classifier, ensemble learning

Unsupervised machine learning algorithms: principal component analysis (PCA), K-means algorithm, hierarchical clustering

Neural networks: deep learning nets (DLNs), reinforcement learning (RL)

Data prep & wrangling involves data cleansing and data pre-processing. The steps vary based on whether we are working with structured data or unstructured data.

Data exploration includes three steps: exploratory data analysis (EDA), feature selection, and feature engineering.

Model training consists of three major tasks: method selection, performance evaluation, and model tuning.

The following metrics are used to evaluate a **confusion matrix**:
Precision (P) = TP / (TP + FP)
Recall (R) = TP / (TP + FN)
Accuracy = (TP + TN) / (TP + FP + TN + FN)
F1 score = (2 * P * R) / (P + R)

Types of risk

Risk Approach	Discrete / Continuous	Correlated / Independent	Sequential / Concurrent	Complements for Risk-adjusted value	Substitutes for Risk-adjusted value
Decision tree	Discrete	Independent	Sequential	Yes	No
Scenario analysis	Discrete	Correlated	Concurrent	Yes	Yes
Simulations	Continuous	Either	Either	Yes	Yes

Economics

Bid-ask spread is impacted by:
- Currency pair
- Time of day
- Market volatility
- Size of transaction

Cross rates: A/B = 2.0000/2.0006 and B/C = 4.0000/4.0008
Implied A/C cross rate = 8.0000/8.0036

Forward exchange rates are quoted in terms of points to be added to the spot exchange rate. Forward points represent the difference between the forward rate and the spot rate. If the points are positive (negative), the base currency is trading at a forward premium (discount).

International parity conditions

Covered interest rate parity = $F_f / d = S_f / d \left(\frac{1+ i_f\left[\frac{Actual}{360}\right]}{1+ i_d\left[\frac{Actual}{360}\right]}\right)$

Uncovered interest rate parity: Expected % change in spot rate (P/B) ≈ ip – iB

- If covered interest rate parity and uncovered interest rate parity hold then forward rates are unbiased estimates of future spot rates.
- Ex ante purchasing power parity: Expected % change in spot rate (P/B) ≈ Πp – ΠB
- International Fisher effect assumes that uncovered interest rate parity and ex ante purchasing power parity hold. If so: ip - iB = Πp – ΠB

Balance of payments and exchange rates
For the most part, countries that run persistent current account deficits will see their currencies weaken over time. Similarly, countries that run persistent current account surpluses will tend to see their currencies appreciate over time.

Monetary policy and Mundell-Fleming
- In the Mundell–Fleming model, monetary policy affects the exchange rate primarily through the interest rate sensitivity of capital flows, strengthening the currency when monetary policy is tightened and weakening it when monetary policy is eased. The more sensitive capital flows are to the change in interest rates, the greater the exchange rate's responsiveness to the change in monetary policy.
- Countries that pursue overly easy monetary policies will see their currencies depreciate over time.
- Under conditions of high capital mobility, countries that simultaneously pursue expansionary fiscal policies and relatively tight monetary policies should see their currencies strengthen over time.

Economic growth and investment decisions
$P = GDP \left(\frac{E}{GDP}\right)\left(\frac{P}{E}\right)$
P represented aggregate price (value) of stocks; E represents aggregate earnings;

Growth accounting: $\frac{\Delta Y}{Y} = \frac{\Delta A}{A} = \alpha\frac{\Delta K}{K} + (1-\alpha)\frac{\Delta L}{L}$
Growth rate in potential GDP = Long-term growth rate of labor force + Long-term growth rate in labor productivity

Neo-classical model:
Growth rate of output per capita = $\frac{\theta}{1-\alpha}$
Growth rate of output = $\frac{\theta}{1-\alpha} + n$
- Θ is growth rate of TFP
- α is the share of GDP paid out to the suppliers of capital
- n is the growth rate of labor

Labor productivity:
$y = Y/L = A\,(K/L)^{\alpha}\,(L/L)^{1-\alpha} = Ak^{\alpha}$

Regulatory intervention is required because of the presence of informational frictions and externalities.

Regulators can be classified as: legislative bodies, government backed regulator bodies, and courts.

Regulations can be classified as: statutes, administrative regulations, and judicial law.

Self-regulatory bodies are private organizations that both represent and regulate their members. If a self-regulatory body is given recognition and authority by a government body or agency, it is called a **self-regulatory organization** (SRO).

Theories of regulatory interdependence include: regulatory capture, regulatory competition, and regulatory arbitrage.