CFA LEVEL I STUDY SHEET · TOPIC 2

Quantitative Methods

Chartered Financial Analyst (CFA®) Program Level I exam

11–14% of the exam · 11 learning modules · 2027 curriculum

Quantitative Methods gives you the tools the rest of the curriculum relies on: measuring returns, discounting cash flows, describing and modelling return data, testing hypotheses, building portfolios, simulating outcomes and fitting a simple regression. Level I questions are often short calculations on a financial calculator, mixed with items on choosing the right measure, test or model and interpreting the result.

You should be able to: You should be able to calculate and compare the main return measures, value cash flows, describe and test return data, compute two-asset portfolio risk, choose a simulation method and read a simple regression.

Every learning module: the key point and the trap

QM.1 What returns are and what investors require

A return has two parts: income (dividends, coupons, rent) and the change in price.

Trap: A rise in an asset's required return with the risk-free rate and inflation unchanged must come from its risk premiums, not from the real rate.

QM.2 Measuring returns in different ways

Holding period return (HPR) = (P1 − P0 + income) / P0, for any length of period.

Trap: Dividing a cumulative return by the number of years, or multiplying a quarterly return by four, ignores compounding.

QM.3 Money-weighted, time-weighted and index returns

The money-weighted return (MWR) is the internal rate of return of the investor's own cash flows: deposits, withdrawals and the ending value.

Trap: MWR rewards or punishes the timing of cash flows, so it is the wrong measure for a manager who has no say over them.

QM.4 Discounting cash flows and no-arbitrage pricing

Present value: PV = FV / (1 + r)^n; future value: FV = PV x (1 + r)^n.

Trap: The Gordon model needs next year's dividend; using the dividend just paid understates the value.

QM.5 Describing return data: centre, spread, shape

Central tendency: arithmetic mean, median (middle value, robust to outliers), mode; trimmed and winsorised means limit the effect of extremes.

Trap: Zero correlation rules out only a linear relationship; it does not prove the returns are independent.

QM.6 Probability models for prices and returns

Expected value = sum of probability x outcome; variance = sum of probability x (outcome − expected value)^2.

Trap: In Bayes' formula the denominator is the total probability of the new information across all states, not the prior.

QM.7 Sampling, confidence intervals and hypothesis tests

The central limit theorem: for large samples (often n of 30 or more) the sample mean is approximately normal with standard error s / sqrt(n), whatever the population's shape.

Trap: Use the standard error, s / sqrt(n), in intervals and tests about the mean, never the standard deviation of the data itself.

QM.8 Portfolio risk, diversification and the CML

Portfolio expected return is the weighted average of asset expected returns.

Trap: Risk aversion decides how much to put in the risk-free asset, not which risky portfolio to hold.

QM.9 Historical, bootstrap and Monte Carlo simulation

Simulation estimates the distribution of outcomes, such as a portfolio's value at risk, when a formula is impractical.

Trap: Drawing from an assumed distribution is Monte Carlo; resampling the data itself with replacement is the bootstrap.

QM.10 Simple regression and the CAPM beta

Simple linear regression fits Y = b0 + b1 X + e by ordinary least squares, minimising the sum of squared residuals; b1 = cov(X, Y) / var(X) and b0 = mean of Y − b1 x mean of X.

Trap: Divide SSE by n − 2, not n or n − 1, for the standard error of the estimate in simple regression.

QM.11 Big data and machine learning in investing

Big data is described by volume (quantity), velocity (speed), variety (types and sources) and veracity (reliability); value is often added.

Trap: Natural language processing names the kind of data handled (text), not whether learning is supervised.

Key terms

Holding period return: Price change plus income, divided by the beginning price, for the period held.

Geometric mean return: The constant compound rate that links the beginning and ending values.

Money-weighted return: The internal rate of return of an investor's own cash flows.

Time-weighted return: Sub-period returns linked geometrically, so the timing of client flows has no effect.

Cash flow additivity: The value of a set of cash flows equals the sum of their present values.

Coefficient of variation: Standard deviation divided by the mean: risk per unit of return.

Excess kurtosis: Kurtosis minus 3; positive values mean fatter tails than the normal distribution.

Standard error: The standard deviation of a sample statistic, for the mean s / sqrt(n).

Power of a test: The probability of correctly rejecting a false null hypothesis, 1 - beta.

Capital market line: Combinations of the risk-free asset and the market portfolio.

Bootstrap: Resampling the observed data with replacement to simulate many samples.

Coefficient of determination: R^2, the share of the variation in Y that the regression explains.

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