

Mathematics of finance and commerce

[Science](#), [Mathematics](#)



Compound interest is the concept of adding accumulated interest back to the principal, so that interest is earned on interest from that moment on. The act of declaring interest to be principal is called compounding (i. e. , interest is compounded). A loan, for example, may have its interest compounded every month: in this case, a loan with \$100 principal and 1% interest per month would have a balance of \$101 at the end of the first month. Interest rates must be comparable in order to be useful, and in order to be comparable, the interest rate and the compounding frequency must be disclosed.

Since most people think of rates as a yearly percentage, many governments require financial institutions to disclose a (notionally) comparable yearly interest rate on deposits or advances. Compound interest rates may be referred to as annual percentage rate, effective interest rate, Effective Annual Rate, and by other terms. When a fee is charged up front to obtain a loan, APR usually counts that cost as well as the compound interest in converting to the equivalent rate. These government requirements assist consumers to more easily compare the actual cost of borrowing.

Compound interest rates may be converted to allow for comparison: for any given interest rate and compounding frequency, an "equivalent" rate for a different compounding frequency exists. Compound interest may be contrasted with simple interest, where interest is not added to the principal (there is no compounding). Compound interest predominates in finance and economics, and simple interest is used infrequently (although certain financial products may contain elements of simple interest).

Value at Risk (VaR) is defined with respect to a specific portfolio of financial assets, at a specified probability and a specified time horizon. The probability that the mark to market loss on the portfolio over the time horizon is greater than VaR, assuming normal markets and no trading, is the specified probability level. For example, if a portfolio of stocks has a one-day 5% VaR of \$1 million, there is a 5% probability that the portfolio will decline in value by more than \$1 million over the next day, assuming markets are normal and there is no trading.

Such an event is termed a " VaR break. " The 10% Value at Risk of a normally distributed portfolio VaR has five main uses in finance, risk management, risk measurement, financial control, financial reporting and computing regulatory capital. VaR is sometimes used in non-financial applications as well. The confidence interval is the probability (or level of confidence) that the actual maximum loss experienced will not exceed the maximum expected loss (value-at-risk) generated by the model.

For example, using a value-at-risk method, a bank estimates that the maximum potential loss on its financial instrument portfolio will be \$10, 000 for a 99% confidence interval. The 99% confidence interval indicates that the bank is 99% sure that the maximum expected loss on its financial instrument portfolio will not exceed \$10, 000. The last factor used in determining the value-at-risk assessment is the holding period of the instrument or portfolio. This is the period over which the value-at-risk is to be measured.

For illustration purposes, this paper will focus on a holding period of one day. However, value-at-risk calculations can also focus on longer holding periods.

As the holding period increases, it becomes more difficult to estimate the value-at-risk because of the additional complexities that longer time periods have on the model. Annuities differ from ordinary simple and compound interest problems in that payments are made on a regular basis. For example, monthly, quarterly, semi-annual or yearly payments. This topic illustrates future and present value of annuities using several examples.

Also discussed are sinking funds: if a borrower makes periodic deposits that will produce a specified amount on a later specified date, then this borrower has established a sinking fund. Definition (Future Value of an Ordinary Annuity) If R dollars is invested at the end of each period for n periods in an annuity that earns interest at a rate of i per period, the future value of the ordinary annuity will be? Definition (Sinking Fund) if a borrower makes periodic deposits that will produce a specified amount on a later specified date, and then this borrower has established a sinking fund.

Example (Sinking Fund) a small company establishes a sinking fund to discharge a debt of \$30,000 due in 10 years by making semi-annual payments, the first due in 6 months. If the deposits are placed into an account that pays 6%, compounded semi-annual, what is the size of the deposits? Bonds, also known as fixed-income securities, are debt instruments created for the purpose of raising capital. Essentially loan agreements between an issuer and an investor, the terms of a bond obligate the issuer to repay the amount of principal at maturity.

Most bonds also require that the issuer pay the investor a specific amount of interest on a semi-annual basis. The return of a bond is largely determined

by its interest rate. The interest that a bond pays depends on a number of factors, including the prevailing interest rate and the creditworthiness of the issuer, which, of course, is what is assessed by the credit rating companies, such as Standard & Poor's and Moody's. The higher the credit rating of the issuer, the less interest the issuer has to offer to sell its bonds.

The prevailing interest rate—the cost of money—is determined by the supply and demand of money. Like virtually anything else, the greater the supply and the lower the demand, the lesser the interest rate, and vice versa. An often used measure of the prevailing interest rate is the prime rate charged by banks to their best customers. Most bonds pay interest semi-annually until maturity, when the bondholder receives the par value of the bond back. Zero coupon bonds pay no interest, but are sold at a discount to par value, which is paid when the bond matures.