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The IRR is the discount rate at which the net present value (NPV) of future cash flows from an investment is equal to zero. Functionally, the IRR is used by investors and businesses to find out if an investment is a good use of their money. An economist might say that they both identify investment opportunities, while a financial statistician would say that it links the present value of money and the future value of money in a given investment. The IRR rule can be confused with the net present value (ROI). Return on investment ignores the time value of money, essentially making it a nominal number rather than a real number. The ROI might tell an investor the actual growth rate from start to finish, but it takes the IRR to show the return necessary to take out all cash flows and receive all of the value back from the investment. One possible algebraic formula for IRR is: $IRR = R_1 + \frac{NPV_1 \times (R_2 - R_1)}{NPV_1 - NPV_2}$ where: R_1, R_2 = randomly selected discount rates NPV_1 = higher net present value NPV_2 = lower net present value $IRR = R_1 + (NPV_1 - NPV_2)(NPV_1 \times (R_2 - R_1))$ where: R_1, R_2 = randomly selected discount rates NPV_1 = higher net present value NPV_2 = lower net present value There are several important variables in play here.

the amount of investment, the timing of the total investment, and the associated cash flow taken from the investment. More complicated formulas are necessary to distinguish between net cash inflow levels. The first step is to make guesses at the possible values for R1 and R2 to determine the net present values. Most experienced financial analysts have a feel for what the guesses should be. If the estimated NPV1 is close to zero, then the IRR is equal to R1. The entire equation is set up with the knowledge that at the IRR, NPV is equal to zero. This relationship is critical to understanding the IRR. There are other methods for estimating IRR. The same basic process is followed for each. However, if NPV is too materially distant from zero, take another guess and try again. IRR can be calculated and used for purposes that include mortgage analysis, private equity investments, lending decisions, expected return on stocks, or finding yield to maturity on bonds. IRR models do not take the cost of capital into consideration. They also assume that all cash inflows earned during the project life are reinvested at the same rate as IRR. These two issues are accounted for in the modified internal rate of return (MIRR). Before you begin developing the schedule of a project, you need to know the expected durations of all activities of a project. Project management frameworks such as the PMI's PMBOK contain different tools and techniques for estimating durations. The expected amount of time for the completion of an activity is the basis for developing the ... Estimating Activity Durations: Definition, Methods, Practical Uses Read More » Estimating cost is an important process in project management as it is the basis for determining and controlling the project budget. Costs are estimated for the first time at the beginning of a project or even before a project has started. Subsequently, the re-estimation of the project cost is repeated on an ongoing basis to ... Estimating Cost of a Project: Techniques and Examples Read More » Managing cost, performance and progress is one of the most important responsibilities of a project manager. In practice, this is usually one of the areas that receive a lot of attention by project sponsors, steering committees and other stakeholders, given that the budget is often one of the relevant constraints of a project. Despite its ... Earned Value Analysis & Management (EVA/EVM) – Definition & Formulae Read More » When you prepare a project in line with PMI or other established project management methodologies, you will have to create a project business case. This business case is usually a study on the expected qualitative and financial benefits of a single project or different project options. An essential part of this process is the cost-benefit ... Cost-Benefit Analysis for Business Cases (Definition, Steps, Example) Read More » Agile project management refers to the management of agile projects, being the counterpart to traditional project management in (relatively) predictive projects. What Is Agile Project Management? Agile project management – originally referred to as "Agile Software Development" – is a set of principles and values rather than a methodology. They have their roots in the ... What is Agile Project Management? Definition & Agile Methodologies Read More » After you have defined the scope of a project and created the scope baseline, you will likely start developing the project schedule. The approved schedule will become the schedule baseline of the project which the basis for the cost baseline and performance measurement. In this article, we will guide you step-by-step through the process of ... How to Create a Project Schedule Baseline (6 Illustrated Steps) Read More » Project managers typically use Gantt-charts, milestones and start/finish dates to measure and report the progress of a project. These are common examples of tools and techniques that help visualize the project schedule and allow for transparent schedule communication and controlling. The schedule baseline is the stakeholder-approved foundation of the schedule of a project. It is ... Project Schedule Baseline: Definition | Purpose | Example Read More »

reading CFI's explanation of the Internal Rate of Return metric. CFI is the official global provider of the Financial Modeling & Valuation Analyst (FMVA)® designation. To learn more and help advance your career, see the following free CFI resources: The capital asset pricing model (CAPM) describes the relationship between systematic risk, or the general perils of investing, and expected return for assets, particularly stocks. It is a finance model that establishes a linear relationship between the required return on an investment and risk. CAPM is based on the relationship between an asset's beta, the risk-free rate (typically the Treasury bill rate), and the equity risk premium, or the expected return on the market minus the risk-free rate. CAPM evolved as a way to measure this systematic risk. It is widely used throughout finance for pricing risky securities and generating expected returns for assets, given the risk of those assets and cost of capital. The capital asset pricing model, or CAPM, is a financial model that calculates the expected rate of return for an asset or investment. CAPM does this by using the expected return on both the market and a risk-free asset, and the asset's correlation or sensitivity to the market (beta). There are some limitations to the CAPM, such as making unrealistic assumptions and relying on a linear interpretation of risk vs. return. Despite this, the CAPM formula is still widely used because it is simple and allows for easy comparisons of investment alternatives. For instance, it is used in conjunction with modern portfolio theory (MPT) to understand portfolio risk and expected return. The formula for calculating the expected return of an asset, given its risk, is as follows: $E R_i = R_f + \beta_i (E R_m - R_f)$ where: $E R_i$ = expected return of investment R_f = risk-free rate β_i = beta of the investment $(E R_m - R_f)$ = market risk premium \ \begin{aligned} &ER_i = R_f + \beta_i(ER_m - R_f) \\ &\textbf{where:} \\ &ER_i = \text{expected return of investment} \\ &R_f = \text{risk-free rate} \\ &\beta_i = \text{beta of the investment} \\ &(ER_m - R_f) = \text{market risk premium} \ \end{aligned} Investors expect to be compensated for risk and the time value of money. The risk-free rate in the CAPM formula accounts for the time value of money. The other components of the CAPM formula account for the investor taking on additional risk. The goal of the CAPM formula is to evaluate whether a stock is fairly valued when its risk and the time value of money are compared with its expected return. In other words, by knowing the individual parts of the CAPM, it is possible to gauge whether the current price of a stock is consistent with its likely return. The CAPM seeks to gauge whether a stock's current price is consistent with its likely return. Beta measures a security or portfolio's volatility or systematic risk to the market. If a stock is riskier than the market, it will have a beta greater than one. If a stock has a beta of less than one, the formula assumes it will reduce the risk of a portfolio. A stock's beta is then multiplied by the market risk premium, which is the return expected from the market above the risk-free rate. The risk-free rate is then added to the product of the stock's beta and the market risk premium. The result should give an investor the required return or discount rate that they can use to find the value of an asset. Imagine an investor is contemplating a stock valued at $100 per share today that pays a 3% annual dividend. Say this stock has a beta compared with the market of 1.3, which means it is more volatile than a broader market (i.e., the S&P 500 Index). Also, assume that the risk-free rate is 3% and this investor expects the market to rise in value by 8% per year. The expected return of the stock based on the CAPM formula is 9.5%: $9.5\% = 3\% + 1.3 \times (8\% - 3\%)$ \begin{aligned}&9.5\% = 3\% + 1.3 \times (8\% - 3\%) \ \end{aligned} 9.5%=3%+1.3×(8%−3%) The expected return of the CAPM formula is used to discount the expected dividends and capital appreciation of the stock over the expected holding period. If the discounted value of those future cash flows is equal to $100, then the CAPM formula indicates the stock is fairly valued relative to risk. Several assumptions behind the CAPM formula have been shown to not hold up in reality. Modern financial theory rests on two assumptions: Securities markets are very competitive and efficient (that is, relevant information about the companies is quickly and universally distributed and absorbed). These markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments. Despite these issues, the CAPM formula is still widely used because it is simple and allows for easy comparisons of investment alternatives. As a result, it's not entirely clear whether CAPM works. The big sticking point is beta. When professors Eugene Fama and Kenneth French looked at share returns on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and Nasdaq, they found that differences in betas over a lengthy period did not explain the performance of different stocks. The linear relationship between beta and individual stock returns also breaks down over shorter periods of time. These findings seem to suggest that CAPM may be wrong. While some studies raise doubts about CAPM's validity, the model is still widely used in the investment community. Although it is difficult to predict from beta how individual stocks might react to particular movements, investors can probably safely deduce that a portfolio of high-beta stocks will move more than the market in either direction, and a portfolio of low-beta stocks will move less than the market. This is important for investors, especially fund managers, because they may be unwilling to or prevented from holding cash if they feel that the market is likely to fall. If so, they can hold low-beta stocks instead. Investors can tailor a portfolio to their specific risk-return requirements, aiming to hold securities with betas in excess of 1 while the market is rising, and securities with betas of less than 1 when the market is falling. Not surprisingly, the CAPM contributed to the rise in the use of indexing, or assembling a portfolio of shares to mimic a particular market or asset class, by risk-averse investors. This is largely due to the CAPM message that it is only possible to earn higher returns than those of the market as a whole by taking on higher risk (beta). The capital asset pricing model (CAPM) was developed in the 1960s by financial economists William Sharpe, Jack Treynor, John Lintner, and Jan Mossin, who built their work on ideas put forth by Harry Markowitz in the 1950s. The following are assumptions made by the CAPM: All investors are risk-averse by nature. Investors have the same period to evaluate information. There is unlimited capital to borrow at the risk-free rate of return. Investments can be divided into unlimited pieces and sizes. There are no taxes, inflation, or transaction costs. Risk and return are linearly related. Many of these assumptions have been challenged as being unrealistic or plain wrong. Because of its criticisms, several alternative models to the capital asset pricing model (CAPM) have been developed to understand the relationship between risk and reward in investments. One of these is arbitrage pricing theory (APT), a model that looks at multiple factors, grouped into macroeconomic or company-specific factors. Another is the Fama-French 3-factor model, which expands on CAPM by adding company-size risk and value risk factors to the market risk factors. In 2015, Fama and French adapted their model to include five factors. Along with the original three factors, the new model adds the concept that companies reporting higher future earnings have higher returns in the stock market, a factor referred to as profitability. The fifth factor, referred to as "investment," relates to the concept of internal investment and returns, suggesting that companies directing profit toward major growth projects are likely to experience losses in the stock market. The international capital asset pricing model (ICAPM) is a financial model that applies the traditional CAPM principle to international investments. It extends CAPM by considering the direct and indirect exposure to foreign currency in addition to time value and market risk included in the CAPM. The CAPM uses the principles of modern portfolio theory to determine if a security is fairly valued. It relies on assumptions about investor behaviors, risk and return distributions, and market fundamentals that don't match reality. However, the underlying concepts of CAPM and the associated efficient frontier can help investors understand the relationship between expected risk and reward as they strive to make better decisions about adding securities to a portfolio.