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thrive professionally., the free encyclopedia that anyone can edit. 110,331 active editors 7,023,426 articles in English Game Boy, platform of Donkey Kong Land Donkey Kong Land by Nintendo for the Game Boy (pictured). Released on June 26, 1995, it condenses the side-scrolling gameplay of
Donkey Kong Country with a different level design and boss fights. The player controls Donkey Kong as they recover their stolen banana hoard from King K. Rool. Development began in 1994: Rare's Game Boy programmer, Paul Machacek, developed Land as an original game rather than a port of Country, believing that it would be a
 better use of resources. Land features pre-rendered graphics converted to sprites through a compression technique. Rare retooled Country's gameplay to account for the lower-quality display, and David Wise and Graeme Norgate converted the soundtrack to the Game Boy's sound chip. Critics praised it as successfully translating Country's gameplay,
 visuals, and music to the Game Boy. Land was rereleased for the Nintendo 3DS and the Nintendo Switch. (Full article...) Recently featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of education in Wales (1701-1870) White dwarf Battle of Groix Archive By email More featured: History of Education in Wales (1701-1870) White dwarf Battle Of Groix Archive By email More featured: History of Education in Wales (1701-1870) White By email More featured 
through hosting weekly house dances from 1975? ... that singer Karin Ann made headlines after performing live on Polish state television wrapped in a rainbow flag? ... that the Diocese of Poreč and Pula was nearly bankrupted over a dispute
with the Italian Benedictines, a case that Dražen Kutleša is credited with quietly resolving? ... that the butch government considered converting the incomplete Java-class cruisers into English Channel ferries? ... that the symbol for equality in mathematics was
not used for 61 years after its introduction, and was later popularized by Isaac Newton? ... that stand-up comedian Dustin Nickerson has said that his children have veto power over any jokes he might tell about them? ... that Saint-Saëns's Phaéton was described by a critic after its premiere as "the noise of a hack coming down from Montmartre"?
Archive Start a new article Nominate an article Trifid and Lagoon nebulae The Vera C. Rubin Observatory in Chile releases the first light images (example shown) from its new 8.4-meter (28 ft) telescope. In basketball, the Oklahoma City Thunder defeat the Indiana Pacers to win the NBA Finals. An attack on a Greek Orthodox church in Damascus, Syria,
kills at least 25 people. The United States conducts military strikes on three nuclear facilities in Iran. In rugby union, the Crusaders defeat the Chiefs to win the Super Rugby Pacific final. Ongoing: Gaza war Iran-Israel war Russian invasion of Ukraine timeline Sudanese civil war timeline Recent deaths: Maria Voce Wes Hildreth Lucien Nedzi Anne
Burrell Frederick W. Smith Ron Taylor Nominate an article June 26 Douglas Skymaster plane Amana 1740 - War of Jenkins' Ear: Spanish troops stormed the British-held strategically crucial position of Fort Mose in Spanish Florida. 1945 - At a conference in San Francisco, delegates from 50 nations signed a charter establishing the United Nations. 1950
- A Douglas DC-4 Skymaster aircraft (pictured) crashed after departing from Perth, becoming the worst peacetime aviation accident in Australia's history, 2010 - A G20 summit, the largest and most expensive security operation in Canadian history, began in downtown Toronto. 2015 - The U.S. Supreme Court ruled in Obergefell v. Hodges that the right
of same-sex couples to marry is guaranteed by the Fourteenth Amendment. Robert the Lotharingian (d. 1095)George IV of the United Kingdom (d. 1830)Walter C. Root (d. 1925)Pavel Belyayev (b. 1925) More anniversaries: June 25 June 26 June 27 Archive By email List of days of the year About Atacamite is a copper halide mineral: a copper(II) chloride
hydroxide with the chemical formula Cu2Cl(OH)3. It was first described in 1802 by Dmitri Alekseyevich Golitsyn from deposits in Chile's Atacama Desert, after which it is named. Atacamite is a comparatively rare mineral, formed from primary copper minerals in the oxidation or weathering zone of arid climates. It has also been reported as a volcanic
 sublimate from fumarole deposits, as sulfide alteration products in black smokers. This photograph shows a specimen of atacamite, on a malachite matrix, from the Mount Gunson Mines in South Australia. The picture was focus-stacked from 42 separate images. Photograph credit: Ivar Leidus Recently featured: Turban Head eagle Springbok Geraldine
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Gregorian calendar and a leap year starting on Tuesday of the Julian calendar, the 1740th year of the 2nd millennium, the 40th year of the 18th century, and the 1st year of the 1740s decade. As of the start of 1740, the Gregorian calendar was 11 days ahead of the Julian
 calendar, which remained in localized use until 1923. Calendar year January 8 - All 237 crewmen on the Dutch East India Company ship Rooswijk are drowned when the vessel strikes the shoals of Goodwin Sands, off of the coast of England, as it is beginning its second voyage to the Indies. The wreckage is discovered more than 250 years later, in 2004.
[1] February 20 - The North Carolina General Assembly incorporates the town of Newton as Wilmington, North Carolina, named for Spencer Compton, 1st Earl of Wilmington and patron of Royal Governor Gabriel Johnston. March 16 - King Edward of the Miskito Indians signs a treaty making his kingdom, located on the coast of modern-day Nicaragua,
a protectorate of Great Britain.[2] March 25 - Construction begins on Bethesda Orphanage for boys near Savannah, Georgia, founded by George Whitefield. April 8 - War of the Austrian Succession: The Royal Navy captures the Spanish ship of the line Princesa off Cape Finisterre and takes her into British service. May 31 - Frederick II becomes King in
 Prussia upon the death of his father, Frederick William I. June 1 - Plantation Act 1740 or Naturalization Act 1740 or Naturalizat
awarded in Prussia as a military honour. June 26 - War of Jenkins' Ear: Siege of Fort Mose - A Spanish column of 300 regular troops, free Black militia and Indian auxiliaries storms Britain's strategically crucial position of Fort Mose, Florida. July 7 - Adam Smith sets out from Scotland to take up a scholarship at Balliol College, Oxford.[3] July 11 -
 Pogrom: Jews are expelled from Little Russia. August 1 - The song Rule, Britannia! is first performed at Cliveden, the country home of Frederick, Prince of Wales, in England.[4] August 17 - Pope Benedict XIV succeeds Pope Clement XII, as the 247th pope. September 8 - Hertford College, Oxford, England, is founded for the first time.[5] October 9-22 -
 Batavia Massacre: Troops of the Dutch East India Company massacre 5,000-10,000 Chinese Indonesians in Batavia.[6] October 20 - Maria Theresa inherits the hereditary dominions of the Pragmatic Sanction of 1713 on the death of her father, Charles VI.
Her succession to the Holy Roman Empire is contested widely because she is a woman, but she will reign for 40 years. November 6 - Samuel Richardson's popular and influential epistolary novel, Pamela; or, Virtue Rewarded, is published anonymously in London. November 14 - The University of Pennsylvania is officially established. December 16 -
 Frederick II of Prussia invades the Habsburg possession of Silesia, starting the War of the Austrian Succession. Enfield, North Carolina, is founded. Spain begins construction on Fort Matanzas in the Beast by French novelist Gabrielle-Suzanne
 Barbot de Villeneuve was published. February 4 - Carl Michael Bellman, Swedish poet, composer (d. 1813) February 15 - Juan Andrés, Spanish Jesuit (d. 1817) February 16 - Giambattista Bodoni, Italian publisher and engraver (d. 1813) February 17 - John Sullivan, American General in the American Revolutionary War, delegate in the Continental
Congress (d. 1795) March - Johann van Beethoven, German musician, father of Ludwig van Beethoven (d. 1785) April 14 - Anna Strong, Patriot spy
during the American Revolutionary War (d. 1812) May 7 - Nikolai Arkharov, Russian police chief (d. 1814) June 24 - Juan Ignacio Molina, Spanish-Chilean Jesuit priest, naturalist, historian, translator, geographer, botanist, ornithologist and linguist (d. 1829)
June 27 - James Woodforde, English clergyman and diarist (d. 1803) July 27 - Jeanne Baré, French explorer (d. 1803) August 23 - Emperor Ivan VI of Russia (d. 1764) August 23 - Emperor Ivan VI of Russia (d. 1810) September 12 - Johann Heinrich Jung, German writer (d. 1817) September 23 - Empress Go-Sakuramachi of Japan (d. 1810) September 12 - Johann Heinrich Jung, German writer (d. 1817) September 23 - Empress Go-Sakuramachi of Japan (d. 1818) September 12 - Johann Heinrich Jung, German writer (d. 1818) September 23 - Empress Go-Sakuramachi of Japan (d. 1818) September 25 - Johann Heinrich Jung, German writer (d. 1818) September 25 - Johann Heinrich Jung, German writer (d. 1818) September 26 - Johann Heinrich Jung, German writer (d. 1818) September 27 - Jeanne Baré, French explorer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 28 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann Heinrich Jung, German writer (d. 1818) September 29 - Johann H
1813) September 25 - Hercules Mulligan, tailor and spy during the American Revolutionary War (d. 1825) October 31 - Philip James de Loutherbourg, English artist (d. 1812) December - Elisabeth Olin, Swedish opera singer (d. 1828) Ali Pasha of Ioannina, Albanian ruler (d. 1822) Margaret
 Bingham, Countess of Lucan, born Margaret Smith, English portrait miniature painter and writer (d. 1814)[7] John Milton, American politician and officer of the Continental Army (d. 1817) (earliest estimated date of birth) Septimanie d'Egmont, French salonist (d. 1773) Pope Clement XII Frederick William I, King in Prussia Saint Theophilus of Corte
Charles VI, Holy Roman Emperor Anna, Empress of Russia January - Louise Élisabeth de Joybert, politically active Canadian governors' wife (b. 1673) January 17 - Matthias Buchinger, German artist (b. 1674) January 20 - Niccolò Comneno Papadopoli, Italian jurist of religious law and historian (b.
1655) January 21 - Nicholas Trott, colonial magistrate, South Carolina Chief Justice (b. 1663) January 29 - Richard Lumley, 2nd Earl of Scarbrough (b. 1686) February 6 - Pope Clement XII (b. 1652)[8] February 23 - Massimiliano Soldani Benzi, Italian artist (b. 1656)
February 29 - Pietro Ottoboni, Italian cardinal (b. 1667) March 23 - Olof Rudbeck the Younger, Swedish scientist and explorer (b. 1680) April 28 - Bajirao I, Great Maratha warrior and Prime Minister of Maratha warrior and Prime Minister of Maratha warrior and Prime (b. 1681) May 31
- Frederick William I, King in Prussia (b. 1688) June 1 - Samuel Werenfels, Swiss theologian (b. 1657) June 6 - Alexander Spotswood, British governor of Virginia Colony (b. 1676) June 17 Theophilus of Corte, Italian Roman Catholic priest, preacher and missionary, canonized (b. 1676) William Wyndham, English politician (b. 1687) June 18 - Piers Butler,
 3rd Viscount Galmove, Anglo-Irish nobleman (b. 1652) July 2 - Thomas Baker, English antiquarian (b. 1656) October 5 - Johann Philipp Baratier, German scholar (b. 1679) October 20 - Charles VI, Holy Roman Emperor (b. 1685) October 28 - Anna.
 Empress of Russia (b. 1693) December 1 - John Abernethy, Irish Protestant minister (b. 1680) December 20 - Richard Boyle, 2nd Viscount Shannon, British military officer and statesman (b. 1675) December 30 - John Senex, English geographer (b. ca. 1678)[9] Nendy van Duivenvoorde, Dutch East India Company Shipbuilding: The Archaeologica
 Study of Batavia and Other Seventeenth-Century VOC Ships (Texas A&M University Press, 2015) p145 ^ "Mosquito Coast", in Historical Dictionary of the British Empire, ed. by Kenneth J. Panton (Rowman & Littlefield, 2015) p384 ^ "On this day in 1740..." Adam Smith Institute. July 7, 2010. Retrieved November 19, 2019. ^ Williams, Hywel (2005)
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November 12, 2006. ^ This article incorporates text from a publication now in the public domain: Stephen, Leslie, ed. (1886). "Bingham, Margaret". Dictionary of National Biography. Vol. 5. London: Smith, Elder & Co. ^ "Clement XII | pope". Encyclopedia Britannica. Retrieved April 22, 2021. ^ "The Historical Theater in the Year 400 AD, in Which
Both Romans and Barbarians Resided Side by Side in the Eastern Part of the Roman Empire". World Digital Library. 1725. Retrieved July 27, 2013. Retrieved From "30ne hundred years, from 1601 to 1700 Millennia 2nd millennium Century 17th century 17th century 17th century 17th century 17th century 17th century 18th century 17th century 18th century 18th century 17th century 18th cen
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 and in that continent (whose impact on the world was increasing) was characterized by the Baroque cultural movement, the latter part of the Spanish Golden Age, [1] the French Grand Siècle dominated by Louis XIV, the Scientific Revolution, the world's first public company and megacorporation known as the Dutch East India
Company, and according to some historians, the General Crisis. From the mid-17th century, European politics were increasingly dominated by the Kingdom of France of Louis XIV, where royal power was solidified domestically in the civil war of the Fronde. The semi-feudal territorial French nobility was weakened and subjugated to the power of an
absolute monarchy through the reinvention of the Palace of Versailles from a hunting lodge to a gilded prison, in which a greatly expanded royal court could be more easily kept under surveillance. With domestic peace assured, Louis XIV caused the borders of France to be expanded. It was during this century that the English monarch became
increasingly involved in conflicts with the Parliament - this would culminate in the English civil war and an end to the dominance of the English monarchy. A scene on the ice, Dutch Republic, first half of the 17th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the 27th centuryBy the end of the English monarchy. A scene on the ice, Dutch Republic, first half of the 27th centuryBy the end of the 27th centuryBy the 27th c
gravitation, Newton's Laws of Motion, air pressure, and calculating machines due to the work of the first scientists of the Scientific Revolution, including Galileo Galilei, Johannes Kepler, René Descartes, Pierre Fermat, Blaise Pascal, Robert Boyle, Christiaan Huygens, Antonie van Leeuwenhoek, Robert Hooke, Isaac Newton, and Gottfried Wilhelm
 Leibniz. It was also a period of development of culture in general (especially theater, music, visual arts and philosophy). Some of the greatest inventions took place in this century. It was during this period that the European colonization of the silver deposits, which resulted in bouts of inflation
as wealth was drawn into Europe, [2] Also during this period, there would be a more intense European presence in Southeast Asia (such as the colonization of Taiwan). These foreign elements would contribute to a revolution in Ayutthaya. The Mataram Sultanate and the Aceh Sultanate would be the major powers of the region, especially
during the first half of the century.[2] In the Islamic world, the gunpowder empires - the Ottoman, Safavid, and Mughal - grew in strength as well. The southern half of India would colonize Ceylon and endure hostilities with Kandy. The end of the 17th
century saw the first major surrender of Ottoman territory in Europe when the Treaty of Karlowitz ceded most of Hungary to the Habsburgs in 1699. In Japan, Tokugawa shogunate at the beginning of the century, beginning the Edo period; the isolationist Sakoku policy began in the 1630s and lasted until the 19th
century. In China, the collapsing Ming dynasty was challenged by a series of conquests led by the Manchu warlord Nurhaci, which were consolidated by his grandson, the Shunzhi Emperor, founder of the Qing dynasty. [3] Qing China spent decades of this century with economic problems (results of civil
 Timeline of the 17th century. Main articles: 1600s, 1610s, 1620s, 1630s, and 1640s Persian Ambassador during his entry into Kraków for the wedding ceremonies of Kinsale, England defeats Irish and Spanish forces, driving the Gaelic aristocracy out of Ireland and
destroying the Gaelic clan system. 1601-1603: The Russian famine of 1601-1603 kills perhaps one-third of Russia.[6] 1602: Matteo Ricci produces the Map of the Myriad Countries of the World (坤輿萬國全圖, Kūnyú Wànguó Quántú), a world map that will be used throughout East Asia for centuries. 1602: The Dutch East India Company (VOC) is
established by merging competing Dutch trading companies.[7] Its success contributes to the Dutch Golden Age. 1603: Elizabeth I of England dies and is succeeded by her cousin King James VI of Scotland, uniting the crowns of Scotland, uniting the crowns of Scotland and England. 1603: Tokugawa Ieyasu takes the title of shogun, establishing the Tokugawa shogunate. This begins
reign of Mughal emperor Jahangir after the death of emperor Akbar. 1606: The Long Turkish War between the Ottoman Empire and Austria is ended with the Peace of Zsitvatorok—Austria abandons Transylvania. 1606: Treaty of Vienna ends an anti-Habsburg uprising in Royal Hungary. 1606: Willem Janszoon captained the first recorded European
landing on the Australian continent, sailing from Bantam, Java, in the Duyfken. 1607: Flight of the Earls (the fleeing of most of the native Gaelic aristocracy) occurs from County Donegal in the west of Ulster in Ireland. 1607: Iskandar Muda becomes the Sultan of Aceh for 30 years. He will launch a series of naval conquests that will transform Aceh into a
great power in the western Malay Archipelago. 1610: The Polish-Lithuanian Commonwealth army defeats combined Russian-Swedish forces at the Battle of Klushino and conquers Moscow. 1610: King Henry IV of France is assassinated by François Ravaillac. 1611: The Pontifical and Royal University of Santo Tomas, the oldest existing university in Asia,
is established by the Dominican Order in Manila[8] 1611: The first publication of the King James Bible. 1612: The first Cotswold Olympic Games, an annual public celebration of games and sports begins in the Cotswold Olympic Games, an annual public celebration of games and sports begins in the Cotswold Olympic Games, an annual public celebration of games and sports begins in the Cotswolds, England. 1613: The Time of Troubles in Russia ends with the establishment of the House of Romanov, which rules until 1917. 1613-
1617: Polish-Lithuanian Commonwealth is invaded by the Tatars dozens of times.[9]James I of England and VI of Scotland ruled in the first quarter of the 17th century 1613: The Dutch East India Company is forced to evacuate Gresik due to the Mataram siege in neighboring Surabaya. The dutch negotiates with Mataram and is allowed to set up a
 trading post in Jepara. 1614-1615: The Siege of Osaka (last major threat to Tokugawa shogunate) ends. 1616: English poet and playwright William Shakespeare dies. 1618: The Defenestration of Prague. 1618: The Bohemian Revolt precipitates
the Thirty Years' War, which devastates Europe in the years 1618-48. 1618: The Manchus start invading China. Their conquest eventually topples the Ming dynasty. 1619: European slaving reaches America when the first Africans are brought to the present-day United States. 1619: The Dutch East India Company storm Jayakarta and withstand a
months-long siege by the combined English, Bantenese and Jayakartan forces. They are relieved by Jan Pieterszoon Coen and a fleet of ships from Ambon. The dutch destroys Jayakarta and builds its new headquarters, Batavia, on top of it. 1620-1621: Polish-Ottoman War over Moldavia. 1620: Bethlen Gabor allies with the Ottomans and an invasion of it.
 Moldavia takes place. The Polish suffer a disaster at Cecora on the River Prut. 1620: The Mayflower sets sail from Plymouth, England to what became the Plymouth Colony in New England. The Battle of Chocim: Poles and Cossacks under Jan Karol
Chodkiewicz defeat the Ottomans. 1622: Jamestown massacre: Algonquian natives kill 347 English settlers outside Jamestown, Virginia (approximately one-third of the colony's population)[10][11] and burn the Henricus settlement. 1624-1642: As chief minister, Cardinal Richelieu centralises power in France. 1626: St. Peter's Basilica in the Vatican
completed. 1627: Aurochs go extinct.[12] 1628-1629: Sultan Agung of Mataram launches a failed campaign to conquer Dutch Batavia. 1629: Abbas I, the Safavids king, died. 1629: Cardinal Richelieu allies with Swedish Protestant forces in the Thirty Years' War to counter Ferdinand II's expansion. 1630: Birth of Shivaji at Shivneri fort, in present day
Maharashtra, India, who later founded Maratha Empire in year 1674.[13] 1631: Mount Vesuvius erupts. 1632: Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death of king of Sweden Gustav II Adolf. Battle of Lützen, death 
 Sweden and their German allies 1632: Taj Mahal building work started in Agra, India. 1633: Galileo Galilei arrives in Rome for his trial before the Inquisition. 1636: Harvard University is founded in Cambridge, Massachusetts. 1637: Shimabara
Rebellion of Japanese Christians, ronin and peasants against Edo. 1637: The first opera house, Teatro San Cassiano, opens in Venice. 1637: Qing dynasty attacked the Joseon dynasty attacked the Joseon dynasty attacked the Joseon dynasty.
and Barberini Pope Urban VIII escalate into the Wars of Castro and last until 1649. 1639-1651: Wars of the Three Kingdoms, civil wars throughout Scotland, Ireland, and England. 1640-1668: The Portuguese Restoration War led to the end of the Iberian Union. The inauguration of the Royal Academy of Turku in 1640. 1641: The Irish Rebellion, by Irish
Catholics who wanted an end to discrimination, greater self-governance, and reverse ownership of the plantations on First Philosophy. 1642: Beginning of English Civil War, conflict will end in 1649 with the execution of King Charles I, the abolition of the
 monarchy and the establishment of the supremacy of Parliament over the king. 1643: L'incoronazione di Poppea, Monterverdi 1644: The Mauritanian Thirty-Year War. 1645-1669: Ottoman war with Venice. The Ottomans invade Crete and
capture Canea. 1647-1652: The Great Plague of Seville. 1648: The Peace of Westphalia ends the Eighty Years' War and the Ei
 Khmelnytsky Uprising - a Cossack rebellion in Ukraine which turned into a Ukrainian war of liberation from Poland. 1648-1669: The Ottomans capture Crete from the Venetians after the Siege of Candia. 1649: King Charles I is executed for high treason, the first and only
English king to be subjected to legal proceedings in a High Court of Justice and put to death. 1649-1653: The Cromwellian conquest of Ireland. Main articles: 1650s, 1660s, 1690s, and 1700s The Night Watch or The Militia Company of Captain Frans Banning Cocq, 1642. Oil on canvas; on display at the Rijksmuseum, Amsterdam 1651:
English Civil War ends with the Parliamentarian victory at the Battle of Worcester. 1655-1661: Mehmed Köprülü is Grand Vizier. 1655-1661: Mehmed Köprülü is Grand Vizier. 1655-1661: The Northern Wars cement Sweden's rise as a Great Power. 1657: Sambhaji, the second King of Maratha Empire and eldest son of King Shivaji was born at Purandar Fort on 14 May.[citation needed] 1658: After
his father Shah Jahan completes the Taj Mahal, his son Aurangzeb deposes him as ruler of the Mughal Empire. 1659: King Shivaji killed Adil Shahi dynasty's general Afzal Khan at Pratapgad fort on 9 November.[14] 1660: The Royal Society is
founded. 1660: The Bruneian Civil War begins 1661: The reign of the Kangxi Emperor of China begins. 1663: Ottoman war against Habsburg Hungary. 1664: The Peace of Vasvar - intended to keep the peace for 20 years. 1665: Maratha King Shivaji signed the Treaty of
Purandar with Mughal general Jai Singh I after Battle of Purandar.[citation needed] 1665: Robert Hooke discovers cells using a microscope. 1665: Robert Hooke discovers cells using a microscope. 1665: Robert Hooke discovers cells using a microscope. 1665: Portugal defeats the World 1665-1667: The Second Anglo-Dutch War fought
between England and the United Provinces. 1666: The Great Fire of London. 1666: Shivaji visited Aurangzeb at Agra Fort and forced him into house arrest. Shivaji later escaped and returned to the Maratha kingdom.[citation needed] 1667: The Raid on the Medway during the Second Anglo-Dutch War. 1667-1668: The War of Devolution: France invades
the Netherlands. The Peace of Aix-la-Chapelle (1668) brings this to a halt. 1667-1699: The Great Turkish War halts the Ottoman Empire's expansion into Europe. 1672-1674: The Third Anglo-Dutch War fought
between England and the United Provinces 1672-1676: Polish-Ottoman War. French invasion of the Netherlands, which Louis XIV initiated in 1672, starting the Franco-Dutch War 1672-1678: Franco-Dutch W
Chatrapati of the empire. 1676-1681: Russia and the Ottoman Empire commence the Russo-Turkish Wars. 1678: The Treaty of Nijmegen ends various interconnected wars among France, the Dutch Republic, Spain, Brandenburg, Sweden, Denmark, the Prince-Bishopric of Münster, and the Holy Roman Empire. Claiming Louisiana for France in 1682
1680: The Pueblo Revolt drives the Spanish out of New Mexico until 1692. 1680: Prince Sambhaji crowned himself as the second Chatrapati of Maratha Empire 20 July.[citation needed] 1682: French explorer Robert La Salle claims all the land east of the Mississippi River.[15] 1683: China conquers the Kingdom of Tungning and annexes Taiwan. 1683:
The Ottoman Empire is defeated in the second Siege of Vienna. 1683-1699: The Great Turkish War leads to the conquest of most of Ottoman Hungary by the Habsburgs. 1687: Isaac Newton publishes Philosophiae Naturalis Principia Mathematica. 1688: Siamese revolution
of 1688 ousted French influence and virtually severed all ties with the West until the 19th century. 1688-1689: The Glorious Revolution starts with the Dutch Republic invading England, England becomes a constitutional monarchy. 1688-1691: The War of the Two Kings in Ireland. 1688-1697: The Grand Alliance sought to stop French expansion during
the Nine Years' War. 1689: The Battle of Killiecrankie is fought between Jacobite and Williamite forces in Highland Perthshire. 1689: The Karposh is killed, and the rebels are defeated. The Battle of Vienna (1683) marked the historic end of the
expansion of the Ottoman Empire into Europe 1689: Bill of Rights gains royal consent. 1690: The Battle of the Boyne in Ireland. 1692: Port Royal in Jamaica is struck by an earthquake and a tsunami. Approximately 2,000 people die and 2,300 are injured.
1692-1694: Famine in France kills two million.[16] 1693: College of William & Mary is founded in Williamsburg, Virginia, by a royal charter. 1694: The Bank of England is established. 1695: The Mughal Empire nearly bans the East India Company in response to pirate Henry Every's capture of the trading ship Ganj-i-Sawai. 1696-1697: Famine in
 Finland wipes out almost one-third of the population.[17] 1697-1699: Grand Embassy of Peter the Great to Western Europe. 1699: Thomas Savery demonstrates his first steam engine to the Royal Society. Catholic general Albrecht von Wallenstein (1583-1634), supreme commander of the armies of the Imperial Army during the Thirty Years War Jar
Pieterszoon Coen (1587-1629), the founder of Batavia, was an officer of the Dutch East India Company (VOC), holding two terms as its Governor-General of the Dutch East India Company (VOC), who served as the chief minister to the kings of France Louis XIII
and Louis XIV Mughal Emperor Aurangzeb (1618-1707), who ruled over almost the entire Indian subcontinent for a period of 49 years Chhatrapati Shivaji (1630-1680) founder of Maratha Empire is widely regarded as one of the greatest Hindu rulers Kangxi Emperor (1661-1722) one of the most influential emperors of the Qing dynasty Shōgun
 Tokugawa Ieyasu was the founder of Japan's final shogunate, which lasted well into the 19th century See also: Timeline of historic inventions § 17th century Major changes in philosophy and science take place, often characterized as the Scientific Revolution. Banknotes reintroduced in Europe. Ice cream. Tea and coffee become popular in Europe
Central Banking in France and modern Finance by Scottish economist John Law. Minarets, Jamé Mosque of Isfahan, 
1608: Refracting telescopes first appear. Dutch spectacle-maker Hans Lippershey tries to obtain a patent on one, spreading word of the invention. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of France. 1610: The Orion Nebula is identified by Nicolas-Claude Fabri de Peiresc of Fabri
first published. 1612: The first flintlock musket likely created for Louis XIII of France by gunsmith Marin Bourgeois. 1614: John Napier introduces the logarithm to simplify calculations. 1616: Niccolò Zucchi describes experiments with a bronze parabolic mirror trying to make a reflecting telescope. 1620: Cornelis Drebbel, funded by James I of England
builds the first 'submarine' made of wood and greased leather. 1623: The third English Dictionarie, is published by Henry Cockeram, listing difficult words with definitions. 1637: Teatro San Cassiano, the first
public opera house, opened in Venice. 1637: Pierre de Fermat formulates his so-called Last Theorem, unsolved until 1995. 1637: Although Chinese naval mines were earlier described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing describes naval mines were earlier described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing describes naval mines were earlier described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing describes naval mines were earlier described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing describes naval mines were earlier described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing, the Tian Gong Kai Wu book of Ming dynasty scholar Song Yingxing described in the 14th century Huolongjing described in the 14th century Huolong
 ambusher pulling a rip cord on the nearby shore that triggers a steel-wheel flint mechanism. 1642: Blaise Pascal invents the mechanical calculator called Pascal's calculator. 1643: Evangelista Torricelli of Italy invents the mercury barometer. 1645: Giacomo Torelli of Venice, Italy
 invents the first rotating stage. 1651: Giovanni Riccioli renames the lunar maria. 1656: Christiaan Huygens describes the true shape of the rings of Galilei. 1659: Christiaan Huygens first to observe surface details of Mars. 1662: Christopher
 Merret presents first paper on the production of sparkling wine. 1663: James Gregory publishes designs for a reflecting telescope is built by Isaac Newton. 1676: Antonie van Leeuwenhoek discovers Bacteria. 1676: First measurement of the speed of light. 1679: Binary system developed by
Gottfried Wilhelm Leibniz. 1684: Calculus independently developed by both Gottfried Wilhelm Leibniz and Sir Isaac Newton and used to formulate classical mechanics. ^ "Exchange History NL - 400 years: the story". Exchange History NL - 400 years: the story". Exchange History NL - 400 years: the story".
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 Asia (1977). Spence, J. D. The Death of Woman Wang: Rural Life in China in the 17th Century (1978). Clark, George. The Seventeenth Century Philosophers, Selected, with Introduction and Interpretive Commentary (1961). Hugon, Cécile (1997) [1911]. "Social Conditions in 17th.
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edit) 1662 (links | edit) 1740s (links | edit) 1740
next 50) (20 | 50 | 100 | 250 | 500) Retrieved from "WhatLinksHere/17th century" IRR, or internal rate of return, is a metric used in financial analysis to estimate the profitability of potential investments. IRR is a discount rate that makes the net present value (NPV) of all cash flows equal to zero in a discounted cash flow analysis. IRR calculations rely
 on the same formula as NPV does. Keep in mind that IRR is not the actual dollar value of the project. It is the annual return that makes the NPV equal to zero. Generally speaking, the higher an internal rate of return, the more desirable an investment is to undertake. IRR is uniform for investments of varying types and, as such, can be used to rank
multiple prospective investments or projects on a relatively even basis. In general, when comparing investment options with other similar characteristics, the investment value (NPV), except it sets the NPV equal to zero. The ultimate goal
of IRR is to identify the rate of discount, which makes the present value of the sum of annual nominal cash inflows equal to the initial net cash outlay for the investment. IRR is ideal for analyzing capital budgeting projects to understand and compare potential rates of annual return over time. In addition to being used by companies to determine which
capital projects to use, IRR can help investors determine the investment return of various assets. Investopedia / Julie Bang Subscribe to "Term of the Day" and learn a new financial term every day. Stay informed and make smart financial decisions. Sign up now. The formula used to determine IRR is as follows: 0 = NPV = \( \sum t = 1 \text{ T C t (1 + I R R) t - C } \)
0 where: C t = Net cash inflow during the period t C 0 = Total initial investment costs I R R = The internal rate of return t = The number of time periods \begin{aligned} &\text{0} = \text{NPV} = \sum {t=1}^{T} \frac{C t}{\left(1 + IRR \right)^{T} \frac{C t}{\left(1 + IRR \right)^{T}}} = 0
investment costs}\\ &IRR=\text{The internal rate of return}-\ &t=\text{The internal rate of return}-The number of time periods The manual calculation of the IRR metric involves the following
steps: Using the formula, one would set NPV equal to zero and solve for the discount rate, which is the IRR. Note that the initial investment is always negative because it represents an outflow. Each subsequent cash flow could be positive or negative, depending on the estimates of what the project delivers or requires as a capital injection in the future.
Because of the nature of the formula, IRR cannot be easily calculated analytically and instead must be calculated iteratively through trial and error or by using software programmed to calculated analytically and instead must be calculated iteratively through trial and error or by using software programmed to calculated analytically and instead must be calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculated iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through trial and error or by using software programmed to calculate iteratively through the calculate iteratively through the calculate iteratively through the calculate iteratively through the calculate
you are seeking to find. Enter Cash Flows: In an Excel spreadsheet, list all the cash flows associated with the investment or project. These cash flows in chronological order, with the initial investment (usually a negative value) at the beginning and
subsequent cash flows listed in the order they occur. Use IRR Function: In a cell where you want the IRR function is: =IRR(values)The "values" are the range of cells containing the cash flows. Make sure to select all cash flows including the initial investment. Example: Let's say your cash flows
are in cells A1 through A5, where A1 represents the initial investment and A2 through A5 represent subsequent cash flows. You would input the following formula in a cell where you want the IRR displayed: =IRR(A1:A5) Here is a simple example of an IRR analysis with cash flows that are known and annually periodic (one year apart). Assume a
company is assessing the profitability of Project X. Pr
functions that can be used in IRR calculations; the XIRR, and the MIRR, XIRR is used when the cash flow model does not exactly have annual periodic cash flows. The MIRR is a rate-of-return measure that includes the integration of the cost of capital and the risk-free rate. The ultimate goal of IRR is to identify the rate of discount, which makes
the present value of the sum of annual nominal cash inflows equal to the initial net cash outlay for the investment. Several methods can be used when seeking to identify an expected return, but IRR is often ideal for analyzing the potential return of a new project that a company is considering undertaking. Think of IRR as the rate of growth that an
investment is expected to generate annually. Thus, it can be most similar to a compound annual growth rate (CAGR). In reality, an investment will usually not have the same rate of return each year. Usually, the actual rate of return each year. Usually, the actual rate of return that a given investment will usually not have the same rate of return each year. Usually, an investment will usually not have the same rate of return each year.
IRR is comparing the profitability of establishing new operations with that of expanding existing operations. For example, an energy company may use IRR in deciding whether to open a new power plant or to renovate and expanding existing operations.
prescribed by IRR. Note that because IRR does not account for changing discount rates, it's often not adequate for longer-term projects with discount rates that are expected to vary. IRR is also useful for corporations in evaluating stock buyback programs. Clearly, if a company allocates substantial funding to repurchasing its shares, then the analysis
must show that the company's own stock is a better investment—that is, has a higher IRR—than any other use of the funds, such as creating new outlets or acquiring other companies. Individuals can also use IRR when making financial decisions—for instance, when evaluating different insurance policies using their premiums and death benefits. The
consensus is that policies that have the same premiums and a high IRR are much more desirable. Note that life insurance has a very high during the early days of the policy because if you made only one monthly premium payment and then
suddenly died, your beneficiaries would still get a lump sum benefit. Another common use of IRR is in analyzing investment returns. In most cases, the advertised return will assume that any interest payments or cash dividends are reinvested back into the investment. What if you don't want to reinvest dividends but need them as income when paid? And
if dividends are not assumed to be reinvested, are they paid out, or are they paid out, 
The MWRR helps determine the rate of return needed to start with the initial investment amount factoring in all of the changes to cash flows during the investment period, including sales proceeds. Most IRR analyses will be done in conjunction with a view of a company's weighted average cost of capital (WACC) and NPV calculations. IRR is typically a
relatively high value, which allows it to arrive at an NPV of zero. Most companies will require an IRR calculation to be above the WACC. WACC is a measure of a firm's cost of capital in which each category of c
included in a WACC calculation. In theory, any project with an IRR greater than its cost of capital should be profitable. In planning investment projects, firms will often establish a required rate of return (RRR) to determine the minimum acceptable return percentage that the investment in question must earn to be worthwhile. The RRR will be higher
than the WACC. Any project with an IRR that exceeds the RRR will likely be deemed profitable, although companies will not necessarily pursue a project on this basis alone. Rather, they will likely be the most profitable, IRR may also be compared against prevailing
rates of return in the securities market. If a firm can't find any projects with an IRR greater than the returns that can be generated in the financial markets, then it may simply choose to invest money in the market. Market returns can also be a factor in setting an RRR. The CAGR measures the annual return on an investment over a period of time. The
IRR is also an annual rate of return; however, the CAGR typically uses only a beginning and ending value to provide an estimated annual rate of return. IRR differs in that it involves multiple periodic cash flows—reflecting that cash inflows and outflows often constantly occur when it comes to investments. Another distinction is that CAGR is simple
enough that it can be calculated easily. Companies and analysts may also look at the return on investment (ROI) when making capital budgeting decisions. ROI tells an investor what the annual growth rate is. The two numbers normally would
be the same over the course of one year but won't be the same for longer periods. ROI is the percentage increase of an investment from beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end. It is calculated by taking the difference between the current or expected future value and the original beginning to end.
can be calculated for nearly any activity into which an investment has been made and an outcome can be measured. However, ROI is not necessarily the most helpful for lengthy time frames. It also has limitations in capital budgeting, where the focus is often on periodic cash flows and returns. IRR is generally ideal for use in analyzing capital budgeting.
projects. It can be misconstrued or misinterpreted if used outside of appropriate scenarios. In the case of positive ones, the IRR may have multiple values. Moreover, if all cash flows have the same sign (i.e., the project never turns a profit), then no discount rate will produce a zero NPV. Within
its realm of uses, IRR is a very popular metric for estimated figure that provides an annual return value based on estimates. Since estimates of IRR
and NPV can differ drastically from actual results, most analysis with scenario analysis with scenario analysis. Scenarios can show different possible NPVs based on varying assumptions. As mentioned, most companies do not rely on IRR and NPV analyses alone. These calculations are usually also studied in conjunction with a company's
WACC and an RRR, which provides for further consideration. Companies usually compare IRR analysis to other tradeoffs. If another project has a similar IRR with less up-front capital or simpler extraneous considerations, then a simpler investment may be chosen despite IRRs. In some cases, issues can also arise when using IRR to compare projects of
different lengths. For example, a project of a short duration may have a low IRR, making it appear to be an excellent investment. Conversely, a longer project may have a low IRR, earning returns slowly and steadily. The ROI metric can provide some more clarity in these cases, although some managers may not want to wait out the longer time frame.
The internal rate of return rule is a guideline for evaluating whether to proceed with a project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the cost of capital, then the project or investment is lower than the cost of capital, then the project or investment is greater than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is greater than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the cost of capital, then the project or investment is lower than the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital, then the project or investment is lower than the minimum RRR—typically the cost of capital than the minimum RRR—typical than the minimum RRR—typical than th
of capital, then the best course of action may be to reject it. Overall, while there are some limitations to IRR, it is an industry standard for analyzing capital budgeting projects. Assume a company is reviewing two projects. Management must decide whether to move forward with one, both, or neither. Its cost of capital is 10%. The cash flow patterns for
each are as follows: Project A Initial Outlay = $5,000Year one = $1,500Year four = $00Year four = $0
be negative. Solving for IRR is an iterative process using the following equation: \$0 = \Sigma CFt \div (1 + IRR)t where: CF = net cash flowIRR = internal rate of returnt = period (from 0 to last period) -or- \$0 = (\text{initial outlay} * -1) + \text{CF1} \div (1 + \text{IRR}) \times (1 + \text{IRR}) 
each project as: IRR Project A \$0 = (-\$5,000) + \$1,700 \div (1 + IRR) + \$700 \div (1 + IRR) + \$1,500 \div (1 + IRR) + \$1,
that the company's cost of capital is 10%, management should proceed with Project A and reject Project B. The internal rate of return (IRR) is a financial metric used to assess the attractiveness of a particular investment opportunity. When you calculate the IRR for an investment, you are effectively estimating the rate of return of that investment after
accounting for all of its projected cash flows together with the time value of money. When selecting among several alternative investments, the investor's minimum threshold. The main drawback of IRR is that it is heavily reliant on projections of future cash flows,
which are notoriously difficult to predict. Although IRR is sometimes referred to informally as a project's "return on investment," it is different from the way most people use that phrase. Often, when people refer to ROI, they are simply referring to the percentage return generated from an investment in a given year or across a period. However, that
type of ROI does not capture the same nuances as IRR, and for that reason, IRR is generally preferred by investment professionals. Another advantage of IRR is that its definition is mathematically precise, whereas the term ROI can mean different things depending on the context or the speaker. Whether an IRR is good or bad will depend on the cost of
capital and the opportunity cost of the investor. For instance, a real estate investor might pursue a project with a 25% IRR if comparable alternative real estate investments offer a return of, say, 20% or lower. However, this comparison assumes that the riskiness and effort involved in making these difficult investments are roughly the same. If the
investor can obtain a slightly lower IRR from a project that is considerably less risky or time-consuming, then they might happily accept that lower-IRR project. In general, though, a higher IRR is better than a lower one, all else being equal. The internal rate of return (IRR) is a metric used to estimate the return on an investment. The higher the IRR, the
better the return of an investment. As the same calculation applies to varying investments, it can be used to rank all investments to help determine which is the best investment tool for companies in determining where to invest their capital. Companies have a variety of
options to help grow their business. These include building out new operations, improving existing operations, making acquisitions, and so on. IRR can help determine which option to choose by showing which will have the best return. Computing the internal rate of return (IRR) for a possible investment is time-consuming and inexact. IRR calculations
must be performed via guesses, assumptions, and trial and error. Essentially, an IRR calculation begins with two random guesses are necessary. 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 opportunity costs. A financial statistician would say that it links the present value of money and the future value of money for a given investment. This shouldn't be confused
with the return on investment (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
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investment. One possible algebraic formula for IRR is: IRR = R1 + (NPV1 × (R2 - R1)) { (NPV_1 - NPV_2)}\ &\text{fwhere:}\ &R_1, R2 = randomly selected discount rates NPV 1 = higher net present value NPV 2 = lower net present value NPV 2 = lower net present value NPV_2|\text{higher net present value}\ &NPV 1 = higher net present value NPV_2|\text{higher net present value}\ &NPV 1 = higher net present value NPV_2|\text{higher net present value}\ &NPV 1 = higher net present value}\ &NPV_2|\text{higher net present value}\ &

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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 periods. 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, NPV 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 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 developing the ...
the project budget. Costs are estimated for the first time at the beginning of a project or even before a project tost is repeated on an ongoing basis to ... Estimating Cost of a Project stated. Subsequently, the (re-)estimation of the project cost is repeated on an ongoing basis to ... Estimating Cost of a Project stated. Subsequently, the (re-)estimation of the project cost is repeated on an ongoing basis to ... Estimating Cost of a Project stated. Subsequently, the (re-)estimation of the project stated stated and project stated stat
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 areas that receive a lot of attention by project sponsors, steering committees and other stakeholders, given that the budget is often 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 areas that receive a lot of attention by project.
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
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challenging yet important tasks of a project manager. However, there tools and techniques such as the stakeholder engagement matrix that facilitate and improve a project's stakeholder engagement matrix that facilitate and improve a project's stakeholder engagement matrix that facilitate and improve a project management technique to document desired and ...
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Knowledge). It is therefore also relevant for the Projects (or parts of a project) is estimated, the accuracy of these estimates depends on various factors. These include but are not limited to the availability and quality of information and
the estimation technique used. The available options and data to estimate costs typically vary among the phases of a project, ... Definitive Estimate vs. ROM/Rough Order of Magnitude (+ Calculator) Read More » When you need to schedule the activities of a project you might want to consider using a project schedule network diagram. This is a proven
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into your custom web portal to make tax compliance a breeze. Source materials globally and track raw material supplier onboarding. Manufacturing and Wholesale Our fast, secure, cost-effective payments help you attract and retain the best talent and improve
the quality of your network. Music Royalties Solutions Connect your mission-critical systems to your payments engine, including ERPs and performance tracking systems. Our end-to-end payables automation solutions Connect your mission-critical systems to your payments using
multiple currencies. Take control of cash flow and stay on top of compliance. Our payment solutions will help you attract and retain top agents, simplify operations, and build a stellar industry solutions. No more delays, errors, or high fees—just smooth and secureeucies.
payments. The internal rate of return (IRR) is frequently used by companies to analyze profit centers and decide between capital projects. But this budgeting metric can also help you evaluate certain financial events in your own life, like mortgages and investments. The IRR is the interest rate (also known as the discount rate) that will bring a series of
cash flows (positive and negative) to a net present value (NPV) of zero (or to the current value of cash invested). Using IRR to obtain net present value is known as the discounted cash flow method of financial analysis. The internal rate of return (IRR) is the interest rate that will bring the net present value of a series of cash flows to zero. Corporations
use IRR to estimate the present value of future cash flows from a potential investment. IRR calculations can be very complex, but can easily be calculated using accounting software or spreadsheet programs like Excel. As we mentioned above, IRR is a key tool in corporate finance. For example, a corporation will evaluate investing in a new plant versus
extending an existing plant based on the IRR of each project. In such a case, each new capital project must produce an IRR that is higher than the company's cost of capital. Once this hurdle is surpassed, the project must produce an IRR that is higher than the company's cost of capital.
evaluating stock buyback programs. Clearly, if a company's own stock is a better investment—that is, has a higher IRR—than any other use of the funds, such as creating new outlets or acquiring other companies. The IRR formula can be very complex
depending on the timing and variances in cash flow amounts. Without a computer or financial calculator, IRR can only be computed by trial and error. The Excel IRR function can help you accomplish this task much easier. One of the disadvantages of using IRR is that all cash flows are assumed to be reinvested at the same discount rate, although in the
real world, these rates will fluctuate, particularly with longer-term projects. IRR can be useful, however, when comparing projects of equal risk, rather than as a fixed return projects. IRR can be useful, however, when comparing projects of equal risk, rather than as a fixed return projects. IRR can be useful, however, when comparing projects of equal risk, rather than as a fixed return projects.
(1 + IRR)n where: CF0 = Initial investment/outlay CF1, CF2, ..., CFn = Cash flows n = Each period NPV = Net present value IRR = Internal rate of return \begin{aligned} 0 &= CF 0 + \frac{CF 1}{(1 + IRR)^2} + \dotso + \frac{CF 1}{(1 + IRR)^2} + \dotso + \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \frac{CF n}{(1 + IRR)^n} \ &= NPV = \sum^N {n = 0} \ &= NPV = \sum^N {
\{(1 + IRR)^n\} \ \&\text{Er}_0 = \text{Each period} \ \&N = \text{Each period} 
where:CF0=Initial investment/outlayCF1,CF2,...,CFn=Cash flowsn=Each periodNPV=Net present valueIRR=Internal rate of return IRR calculations do not account for the riskiness of a proposed investment. The simplest example of computing an IRR is by taking one from everyday life: a mortgage with even payments. Assume an
initial mortgage amount of $200,000 and monthly payments of $1,050 for 30 years. The IRR (or implied interest rate) on this loan annually is 4.8%. Because the stream of payments at a 4.8% interest rate, which will produce a net present value of $200,000.
Alternatively, if the payments are raised to, say $1,100, the IRR of that loan will rise to 5.2%. Here's how the above formula for IRR works using this example: The initial payment (CF1) is $200,000 (a positive inflow)Subsequent cash flows (CF2, CF3, CFn) are negative $1,050 (negative because it is being paid out)Number of payments (N) is 30 years x
12 = 360 monthly payments/Initial Investment is $200,000IRR is 4.8% divided by 12 (to equate to monthly payments) = 0.400% IRR is also useful in demonstrating the power of compounding. For example, if you invest $50 every month in the stock market over a 10-year period, that money would turn into $7,764 at the end of the 10 years with a 5% IRR
which is more than the current 10-year Treasury (risk-free) rate. In other words, to get a future value of $7,764 with monthly payments of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will bring that flow of payments to a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years, the IRR that will be a net present value of $50 per month for 10 years,
$7,764 with an IRR of 5%, you would have to invest $4,714 today, in contrast to the $6,000 invested in the $50-per-month plan. So, one way of comparing lump-sum investments versus payments over time is to use the IRR. IRR analysis can be useful in dozens of ways. For example, when the lottery amounts are announced, did you know that a $100 invested in the $50-per-month plan.
million pot is not actually $100 million? It is a series of payments that will eventually lead to a payout of $100 million but does not equate to a net present value of $100 million. In some cases, advertised payouts or prizes are simply a total of $100 million over a number of years, with no assumed discount rate. In almost all cases where a prize winner is
given an option of a lump-sum payment versus payment will be the better alternative. Another common use of IRR is in the computation of portfolio, mutual fund or individual stock returns. In most cases, the advertised return will include the assumption that any cash dividends are reinvested in the
 portfolio or stock. Therefore, it is important to scrutinize the assumptions when comparing returns of various investments. What if you don't want to reinvested, are they paid out or are they left in cash? What is the assumed return on the cash? IRR and other
 assumptions are particularly important on instruments like whole life insurance policies and annuities, where the cash flows can become complex. Recognizing the differences in the assumptions is the only way to compare products accurately. The internal rate of return can sometimes give a distorted view of capital returns, especially when viewed
without considering the context of each investment. One major assumption is that any interim cash flows from a project can be invested at the same IRR as the original project, which may not necessarily be the case. In addition, IRR does not account for risk—in many cases, investors may prefer a project with a slightly lower IRR to one with high returns the context of each investment.
and high risk. There's no fixed rule for what makes a "good" internal rate of return, except that a company's IRR for a project should exceed its cost of capital. Typical returns from a capital investment will vary depending on the industry and the type of investment. Using the real estate industry as a very general example, an IRR of 10% would be
acceptable for very conservative projects, while risky ones might require an IRR greater than 20%. The internal rate of return tells you how much a project or investment needs to make in order to break even, accounting for the cost of capital and the net present value of future cash flows. In other words, it is the interest rate that makes the present
value of the expected income streams equal to the cost of the investment. As the number of trading methodologies, alternative investment to be aware of IRR and how the assumed discount rate can alter results, sometimes dramatically. Many accounting
software programs now include an IRR calculator, as do Excel and other programs. A handy alternative for some is the good old HP 12c financial calculator, which will fit in a pocket or briefcase. If you are working on a cost-benefit analysis, you will almost inevitably come across ROI and IRR. Return on Investment (ROI) and Internal Rate of Return
(IRR) are among the most popular success measures for projects and investments. They are also mentioned in the Project Management Institute's Body of Knowledge (source: PMBOK®, 6th ed., part 1, ch. 1.2.6.4, p. 34) In this article, we will introduce both methods, incl. their calculation, and compare their pros and cons. ROI is a ratio (or a rate, if
annualized) that sets the net returns generated by an investment or project in relation to the investment amounts. Besides the simple ratio, there is a modified return on investment indicator for multiple year investments. This method involves annualizing the
total returns and calculating an average return rate per year. Learn more about the different ROI methods and their calculation in our dedicated article: The internal rate of return is an indicator of the profitability of a series of cash flows. It is the discount rate that would lead to a net present value of 0 (source). The IRR is technically determined in an
iterative calculation, i.e. applying different interest rates to a series of cash flows multiple times until it is solved for an IRR with a net present value (NPV) equal to 0.A similar yet for the user less visible approach is also taken by calculators and calculation applications such as Excel. The IRR is the discount rate that leads to an NPV of 0. The IRR is
therefore calculated as a compounded discount rate for cash flows. It is usually determined in an iterative computation in which the correct IRR is approximated by re-performing the NPV calculation over again until the NPV is 0. You can read on to learn how to perform this calculation in Excel or visit our IRR Calculator: IRR Calculator: Internal
Rate of Return (IRR) of ProjectsThe IRR is typically calculated using a calculation program with a respective function. Excel and Google Sheets are typical examples of spreadsheet applications that are able to determine the IRR. The calculation of the Internal Rate of Return in Excel is comparatively straight forward: Create a spreadsheet in Excel and
copy the cash flow forecast into the sheet. Columns typically represent the periods or years while rows contain the cash flows for every period to calculate the internal rate of return, hence this is the minimum granularity of the estimates needed. In practice, cash flow projections often come in various
levels of granularity. To make sure that Excel is able to calculate the IRR, you need to determine the net cash flows (or costs) from the projected inflows (or benefits and earnings) for each period. Select an empty cell and write "=IRR(". Excel will
automatically provide advice on the parameters needed to perform this function. For the internal rate of return function, the input is an ordered list of net cash flows. It starts with the investment, typically a negative cash flows for all subsequent periods and is followed by positive (inflows; at least one required) and negative cash flows for all subsequent periods and is followed by positive (inflows; at least one required) and negative cash flows.
(source). You can also add a "guess" to facilitate the application's iterative process, however, this is not a required parameter. If you prefer to be on the safe side, check the results by calculating the present value of each net cash flow, using the calculated IRR as the discount rate. Add a row under the net cash flow row, link the year 0 value and calculated IRR as the discount rate.
the present value for all subsequent periods using the formula: net cash flow / (1+IRR)^period, where IRR refers to the calculated internal rate of return. The sum to avoid confusing presentation on insignificant small numbers. If the sum
deviates significantly from 0, an error has occurred and you will need to review the previous data input. Return rate allows for comparisons irrespective of time, calculation leverages the preparation work performed for the NPV assessment, IRR is Easy to
understand and communicate, it can be used to compare project options and investment alternatives with different characteristics. IRR has the implicit assumption that inflows and liquidity can be reinvested at the IRR, it is also assumed that the discount rate should be identical for all periods and cash flow types, differences in the riskiness of investment
alternatives and project options not considered, it does not indicate the magnitude of investments or returns, calculation programs are needed to determine the IRR. The main difference between both approaches is the treatment of returns or inflows. The IRR method implicitly assumes that they are re-invested at the same interest rate as all other funds
the IRR - and that the same discount rate is applicable to all cash flows and for all periods. The multiple-period ROI, on the other hand, follows a different approach: Returns occurring during the interest rate was 0 - or subject to a separate calculation
where the value at the end of the projection's time horizon is determined. This future value can then be calculated with an interest rate that deviates from the return rate of the investment over multiple periods. In the latter case, it is therefore a ratio
annualized return rates for comparison purposes. If cash flows occur between the start and end period, the IRR typically leads to more accurate results as it takes into account that earlier cash flows are more valuable than those in late periods. While the multi-period ROI and the IRR indicate the same rate if the investment has only one single inflow,
IRR is the method of choice for a series of even or uneven cash flows. The following table summarizes the differences between the three methods. Internal Rate of Return on Investment for Multiple Period (basic ROI) Result type Discount rate for an NPV = 0 Ratio of returns to
investment Annual or periodic rate of return Calculation Iterative process (NPV = 0, solved for the discount rate) Assumptions Constant rate of returns for all periods; re-investment assumption analogous NPV If
multiple returns occur, they are treated as a single cumulative inflow in the last period (alternatively, their future value can be determined for the last period). Typical Uses Series of even or uneven cash flows, Comparison of investment alternatives or project
options Financial instruments with a fixed tenor, comparison of investment or project options with identical time horizon and a single return in the last period Financial instruments with a fixed tenor, comparison of investment or project options with different tenors and a single return in the last periodA project manager is asked to determine and
compare the ROI and IRR of three different project options. Cash flow projections have been prepared with the input of subject matter experts. This example is derived from the example introduced in the overall cost-benefit analysis article and has also been used to illustrate the calculation and results of other success measures. The following cash flows
have been estimated for the comparison of three different project options: Option 1 Now Year 1 Year 2 Year 3 Year 4 Year 5 Year 6 Investment -5000 -1000 -5000 -5000 -1000 -5000 -1000 Benefits and Earnings (inflows) 0 0 3000 5000 5000 4000 4000 4000
 Net Cash Flow -5000 -5000 -5000 -5000 2000 4500 4500 3000 3000 3000 3000 3000 3000 3000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 5000 500
500 3000 3500 2500 2500 For the detailed ROI calculation, refer to the step-by-step ROI calculation example in this article. The IRR has been determined using Excel following the above guidance. The screenshots shown above refer to Option 1 of this example. The results of the ROI and IRR calculations are summarized in the following table: Calculation
and Results Option 1 Option 2 Option 3 Total Investment -9000 -15000 -8000 Total net returns 7000 7500 6000 Basic ROI ROI = 75.00% Annualized Return on Investment (r) r = 10.06\% r = 6.99\% r = 9.78\% Calculation of annualized ROI (1 + r) ^{\circ} 6 - 1 = 77.78% (1 + r) ^{\circ} 6 - 1 = 77.78% (1 + r) ^{\circ} 6 - 1
= 50.00% (1 + r) ^ 6 - 1 = 75.00% Internal Rate of Return (IRR) IRR = 16.76% IRR = 10.68% The calculation of the IRR as discount rate - the sum of discounted cash flows (i.e. the net present value) is supposed to be 0. The respective check looks like this:Option 1: NPV
(with IRR as discount rate) = -5000 - 5000*1/(1+16.76\%)^1 + 2000*1/(1+16.76\%)^2 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^3 + 4500*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000*1/(1+16.76\%)^4 + 3000
characteristics of the 3 project options. The projection refers to a long time horizon of 6 years while significant cash flows occur throughout all periods. Under these conditions, the ROI method produces inaccurate results due to its methodological constraints. Cost-Benefit Analysis for Business Cases (Definition, Steps, Example) IRR is a catchy indicator
of the profitability of investments and project options. It can be calculated using a spreadsheet application or an IRR calculation tool. While it does not consider the magnitude of an investment volume, repayment characteristics and tenor. However, it implies a re-
investment assumption by treating inflows as if they were subject to the IRR rate as in a compounded instrument. In practice, this may or may not be appropriate for comparing project options, depending on the overall assumptions and the individual use of the measures. If you are conducting a cost-benefit analysis, you will also want to use additional
methods to assess profitability given that other measures help evaluate an option from other angles. Internal rate of return (IRR) is the minimum discount rate that management uses to identify what capital investments or future projects will yield an acceptable return and be worth pursuing. The IRR for a specific project is the rate that equates the net
present value of future cash flows from the project to zero. In other words, if we computed the present value of future cash flows from a potential project using the internal rate as the discount rate and subtracted out the original investment, our net present value of the project would be zero. Definition - What is the Internal Rate of Return Ratio? This
sounds a little confusing at first, but it's pretty simple. Think of it in terms of capital investing like the company's management would. They want to calculate what percentage return as the interest percentage that company has to
achieve in order to break even on its investment in new capital. Since management wants to do better than break even, they consider this the minimum acceptable return on an investment to zero. Since we are dealing with
an unknown variable, this is a bit of an algebraic equation. Here's what it looks like: As you can see, the only variable in the internal rate of return equation that management won't know is the IRR. They will know how much capital is required to start the project and they will have a reasonable estimate of the future income of the investment. This means
we will have solve for the discount rate that will make the NPV equal to zero. Example of Calculating IRR It might be easier to look at an example than to keep explaining it. Let's look at Tom's Machine Shop. Tom is considering purchasing a new machine, but he is unsure if it's the best use of company funds at this point in time. With the new $100,000
machine, Tom will be able to take on a new order that will pay $20,000, $30,000, $40,000 in revenue. Let's calculate Tom's minimum rate. Since it's difficult to isolate the discount rate unless you use an excel IRR calculator. You can start with an approximate rate and adjust from there. Let's start with 8 percent. As you can see, our ending
NPV is not equal to zero. Since it's a positive number, we need to increase the estimated internal rate. Let's increase it to 10 percent and recalculate. As you can see, Tom's internal return rate on this piece of equipment or
investment the money in another venture. Internal Rate of Return Analysis Remember, IRR is the rate at which the net present value of the expected future revenues of the investment. Management can use this return rate to compare other investments and decide what capital projects should be
funded and what ones should be scrapped. Going back to our machine shop example, assume Tom could purchase three different pieces of machinery. Each would be used for a slightly different job that brought in slightly different amounts of cash flow. Tom can calculate the internal rate of return on each machine and compare them all. The one with
the highest IRR would be the best investment. Since this is an investment calculation, the concept can also be applied to any other investment. For instance, Tom can compare the return rates of investment. Since this is an investment calculation, the concept can also be applied to any other investment.
received in the future, but this represents a starting point for management to base their purchase and investment decisions on. Interest Coverage RatioNet Income Share — copy and redistribute the material for any purpose, even
commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit, provide a link to the licensor endorses you or your use. ShareAlike — If you remix,
transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the
public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. In the commercial real estate (CRE) industry, the
target IRR on a property investment tends to be set around 15% to 20%. The investment strategies, of course, are much more diverse in the commercial real estate (CRE) industry, since properties like office buildings are purchased, rather than companies. However, one commonality between the two industries is the reliance on leverage to fund the
purchase price. Furthermore, the hold period can last from five to ten years in the CRE industry, whereas the standard holding period in the private equity industries, the IRR metric is the most benchmarked marketing metric to measure fund performance and an influential factor in the
ability for firms to meet (or surpass) their capital raising efforts for their next fund from existing and new limited partners (LPs). Excel XIRR function as it has more flexibility by not being restricted to annual periods. Under XIRR, daily compounding is assumed
and the effective annual rate is returned. But for the IRR function, the interest rate is returned assuming a stream of equally spaced cash flows.=XIRR(values, dates, [guess]) The drawback to the Excel IRR function in Excel, the XIRR function can handle
complex scenarios that require taking into account the timing of each cash inflow and outflow (i.e. the volatility of multiple cash flows). =IRR(values, [guess])The following factors are the main contributors which drive the internal rate of return (IRR): Positive IRR Levers Earlier Extraction of Exit Proceeds (e.g., Dividend
Lower Exit Multiple than Purchase Multiple) Regardless, the internal rate of return (IRR) and MoM are both different pieces of the same puzzle, and each comes with its respective shortcomings. Of course, the magnitude by which an investment grows matters, however, the pace at which the growth was achieved is just as important. What are the
 Limitations of Internal Rate of Return? The internal rate of return (IRR) cannot be singularly used to make an investment decision, as in most financial metrics. Timing of Cash Flows \rightarrow The internal rate of return (IRR) metric is imperfect and cannot be used as a standalone measure due to being highly sensitive to the timing of the cash flows. Thus, the
IRR can be misleading in its portrayal of returns under certain circumstances, wherein a greater proportion of the cash flows are received earlier. Shorter holding period, which caused the returns to be artificially inflated and unsustainable if
the holding period were hypothetically extended longer. Dividend Recap \rightarrow If a private equity firm issued itself a dividend soon after a leveraged buyout (LBO), i.e., a dividend recapitalization (or recap), the payment would increase the IRR to the fund regardless of whether the multiple-of-money (MoM) meets the required return hurdles - which can
cause the IRR to be potentially misleading. IRR Calculator — Excel TemplateWe'll now move on to a modeling exercise, which you can access by filling out the form below. 1. LBO Model Entry AssumptionsSuppose a private equity firm made an equity investment of $85 million in 2022 (Year 0). Year 0 = -$85 million Cash Outflow The value of the initial
investment stays unchanged regardless of which year the firm exits the investment. Since the investment represents an outflow of cash, we'll place a negative sign in front of the figure in Excel. 2. Cash Flow Analysis Example Afterward, the positive cash inflows related to the exit represent the proceeds distributed to the investment represents an outflow of cash, we'll place a negative sign in front of the figure in Excel. 2. Cash Flow Analysis Example Afterward, the positive cash inflows related to the exit represent the proceeds distributed to the investment represent the proceeds distributed to the proceeds distributed to the investment represent the proceeds distributed to the proceeds distributed to the pr
investment (i.e. realization at exit). Here, our assumption is that exit proceeds in Year 3, the proceeds in Year 3, the proceeds come out to
$160 million.3. IRR Calculation ExampleOnce our table depicting the cash outflow in Year 0 (the initial investment) and the cash inflows (the exit proceeds) at different dates in the holding period is done, we can calculate the IRR and MoM metrics from this particular investment. To determine the internal rate of return (IRR) on the LBO investment in
Excel, follow the steps below. Start by listing out the value of all the cash inflows/(outflows) and the corresponding dates of the date of receipt Use the XIRR Excel function ("= XIRR (Range of Cash Flows, Range of Timing)"); the first input requires you to drag the selection box across the range of cash inflows/(outflows) For the second input, do the
same across all the corresponding dates. Press Enter to Calculate the Internal Rate of Return (IRR) For example, if the exit year is assumed to be Year 1, the IRR comes out to 29.4%.=XIRR(G7:L7,$G$4:$L$4)To reiterate from earlier, the initial cash outflow (i.e. sponsor's equity contribution at purchase) must be entered as a negative number since the
investment is an "outflow" of cash. Note that for the formula to work and be dragged down, the date selection must be anchored in Excel, i.e. fixed (Press F4). While the two main factors are the entry investment and exit sale proceeds, other inflows such as dividends or monitoring fees (i.e. the services related to portfolio company consulting) must be
input as positives, as well as any additional equity injections later on in the holding period. 4. Multiple of Money Calculate the multiple-of-money (MoM), or multiple on invested capital (MOIC), we'll calculate the sum of all the positive cash inflows from each holding period. We must then divide that amount by the
cash outflow in Year 0.For instance, assuming a Year 5 exit, the exit proceeds of $2.50 million are divided by -$85 million = 2.5x Therefore, the private equity firm (PE) retrieved $2.50 per $1.00 equity investment.5. LBO Returns Analysis (IRR and MoM)In the final section of
our IRR calculation tutorial in Excel, we'll compute the IRR for each exit year period using the XIRR Excel function. Based on the completed output for our exercise, we can see the implied IRR and MoM at a Year 5 exit - the standard holding period assumption in most LBO models - is 19.8% and 2.5x, respectively. IRR - Exit Year 1 = 29.4% IRR - Exit Year 5 exit - the standard holding period assumption in most LBO models - is 19.8% and 2.5x, respectively. IRR - Exit Year 1 = 29.4% IRR
Year 2 = 26.0% IRR - Exit Year 3 = 23.4% IRR - Exit Year 4 = 21.4% IRR - Exit Year 5 = 19.8% If we were to calculate the IRR using a calculator, the formula would take the future value ($210 million) and divide by the present value ($210 million) and divide by the present value ($210 million) and raise it to the inverse number of periods (1 ÷ 5 Years), and then subtract out one—confirming the
internal rate of return (IRR) in Year 5 is 19.8%. Using IRR to Make Better Investments The Internal Rate of Return (IRR) is a cornerstone metric in investment analysis, offering valuable insights into the profitability and efficiency of financial decisions. By accounting for the cadence and magnitude of cash flows, IRR provides a time-weighted measure that
is indispensable in private equity, commercial real estate, and capital budgeting. While IRR has its limitations, understanding its context and complementing it with other metrics like MoM ensures a more holistic evaluation of investment performance. By applying the principles and examples outlined in this guide, investors and financial professionals
can confidently leverage IRR to make informed decisions and maximize returns. Net present value of cash inflows over a period of time. NPV is used in capital budgeting and investment planning to analyze a project's projected profitability. NPV is the result of
calculations that find the current value of a future stream of payments using the proper discount rate. In general, projects with a positive NPV are worth undertaking, while those with a negative NPV are not. Net present value (NPV) is used to calculate
NPV, you need to estimate the timing and amount of future cash flows and pick a discount rate equal to the minimum acceptable on alternative investment is positive, it means its rate of return will be above
+ i)^t} - \text{initial investment} \\ &\textbf{where:}\\ &i=\text{Required return or discount rate}\\ \&t=\text{Number of time periods}\\ \end{aligned} NPV=(1+i)tCash flow-initial investmentwhere:i=Required return or discount rate}\\ &t=\text{Number of time periods}\\ \end{aligned} NPV=(1+i)tCash flow-initial investmentwhere:i=Required return or discount rate}\\ &t=\text{Number of time periods}\\ \end{aligned}
the project is as follows: N P V = \sum t = 0 n R t (1 + i)t where: R t = net cash inflow-outflows during a single period t i = discount rate or return that could be earned in alternative investments t = number of time periods \begin{aligned} & NPV = \sum_{t = 0}^n \frac{R_t}{(1 + i)^t}\ & \text{ext}{net cash inflow-outflows during a single period}.
single period t \in \text{Single period } t \in \text{
with summation notation, here is an easier way to remember the concept of NPV: N P V = Today's value of the expected cash flows - Today's value of invested cash \begin{aligned}NPV=\text{Today's value of the expected cash flows}-\text{Today's value of invested cash}\end{aligned}
NPV=Today's value of the expected cash flows-Today's value of money and can be used to compare a projected rate of return with the hurdle rate required to approve an investment. The time value of money is represented in the NPV formula by the new and can be used to compare a projected rate of return with the hurdle rate required to approve an investment.
corporate securities, the net present value calculation is often called discounted cash flow (DCF) analysis. It's the method used by Warren Buffett to compare the NPV of a company's future DCFs with its current price. The discount rate is central to the formula. It accounts for the fact that, as long as interest rates are positive, a dollar today is worth
more than a dollar in the future. Inflation erodes the value of money over time. Meanwhile, today's dollar can be invested in a safe asset like government bonds; investments riskier than Treasuries must exceed to be
worthwhile. For example, an investor could receive $100 today or a year from now. Most investors would not be willing to postpone receiving $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could choose to receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year? The 5% rate of return might be worthwhile if comparable investor could receive $100 today or $105 in one year?
period. If, on the other hand, an investor could earn 8% with no risk over the next year, then the offer of $105 in a year would not suffice. In this case, 8% would be the discount rate reduces the present value of future cash inflows,
leading to a lower NPV. As a result, projects or investments become less attractive because their potential profitability appears diminished when evaluated against a higher required rate of return. A positive NPV indicates that the projected earnings generated by a project or investment—discounted for their present value—exceed the anticipated costs,
also in today's dollars. It is assumed that an investment with a positive NPV will be profitable. An investment with a positive NPV will result in a net loss. This concept is the basis for the net present value rule, which says that only investments with a positive NPV should be considered. In Excel, there is an NPV function that can be used to easily
yellow cells) + blue cell = NPV(C3, C6:C10) + C5 Imagine a company can invest in equipment that would cost $1 million and is expected annual return of 8%. Management views the equipment and securities as
comparable investment risks. There are two key steps for calculation. No elapsed time needs to be accounted for, so the immediate expenditure of $1 million doesn't need to be discounted. Identify the number of
periods (t): The equipment is expected to generate monthly cash flow for five years, which means that there will be 60 periods included in the calculation after multiplying the number of years of cash flows by the number of years. However, because the
equipment generates a monthly stream of cash flows, the annual discount rate needs to be turned into a periodic, or monthly, compound rate is 0.64\%. Periodic Rate = ((1 + 0.08)^{112} - 1 = 0.64\%
Periodic Rate=((1+0.08)121)-1=0.64% Assume the monthly cash flows are earned at the end of the month, with the first payment arriving exactly one month after the equipment has been purchased. This is a future payment arriving exactly one month after the equipment has been purchased. This is a future payment arriving exactly one month after the equipment has been purchased. This is a future payment arriving exactly one month after the equipment has been purchased.
calculator. To illustrate the concept, the first five payments are displayed in the table below. Image by Sabrina Jiang © Investopedia 2020 The full calculation could be more complicated if the equipment were expected to have
any value left at the end of its life, but in this example, it is assumed to be worthless. N P V = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,000 + \ge t = 160.25,000.60 | NPV = -\$1,000,0
V = -\$1, 000, 000 + \$1,242,322.82 = \$242,322.82 In this case, the NPV = -\$1,000,000 + \$1,242,322.82 = \$242,322.82 In this case, the NPV is positive; the equipment should be purchased. If the present value of these cash flows had been negative because the discount rate was larger or the net cash flows
were smaller, then the investment would not have made sense. A notable limitation of NPV analysis is that it makes assumptions about future events that may not prove correct. The discount rate value used is a judgment call, while the cost of an investment and its projected returns are necessarily estimates. The NPV calculation is only as reliable as its
underlying assumptions. The NPV formula yields a dollar result that, though easy to interpret, may not tell the entire story. Consider the following two investment options: Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right? How about if Option A with an NPV of $1,000. Easy call, right?
cost $10? The extreme numbers in the example make a point. The NPV formula doesn't evaluate a project's return on investment (ROI), a key consideration for anyone with finite capital. Though the NPV formula doesn't evaluate a project will produce, it doesn't show if it's an efficient use of your investment dollars. The payback period, or
payback method, is a simpler alternative to NPV. The payback method calculates how long it will take to recoup an investment. One drawback periods calculated for longer-term investments have a greater potential for inaccuracy. Moreover, the payback period perio
calculation does not concern itself with what happens once the investment costs are nominally recouped. An investment's rate of return can change significantly over time. Comparisons using payback periods assume otherwise. The internal rate of return (IRR) is calculated by solving the NPV formula for the discount rate required to make NPV equal
zero. This method can be used to compare projects of different time spans on the basis of their project with that of a 10-year project. Although the IRR is useful for comparing rates of return, it may obscure the fact that the rate of return on the
three-year project is only available for three years, and may not be matched once capital is reinvested. A higher value is generally considered better. A positive NPV indicates that the expected costs outweight
the earnings, signaling potential financial losses. Therefore, when evaluating investment opportunities, a higher NPV is a favorable indicator, aligning to maximize profitability and create long-term value. NPV and internal rate of return (IRR) are closely related concepts, in that the IRR of an investment is the discount rate that would cause that
"If I proceed with this investment, what would be the equivalent annual rate of return that I would receive?" NPV uses discounted cash flows to account for the time value of money. As long as interest rates are positive, a dollar today is worth more than a dollar tomorrow because a dollar today can earn an extra day's worth of interest. Even if future
returns can be projected with certainty, they must be discounted because time must pass before they're realized—the time during which a comparable sum could earn interest. Both NPV and ROI (return on investment) are important, but they serve different purposes. NPV provides a dollar amount that indicates the projected profitability of an
investment, considering the time value of money. Conversely, ROI expresses an investment's efficiency as a percentage, showing the return relative to the investment cost. NPV is often preferred for capital budgeting because it gives a direct measure of added value, while ROI is useful for comparing the efficiency of multiple investments. Choosing a
project with a higher NPV is advisable because it indicates greater profitability and value creation. A higher NPV means the project does inflows, discounted to their present value, significantly exceed the initial investment and associated costs. This suggests that the project is likely to generate more wealth, enhancing the business's overall financial
 health and growth prospects. Ultimately, a higher NPV aligns to maximize shareholder value. Net present value (NPV) compares the value of future cash flows to the initial cost of investment. This allows businesses and investment will be
while a negative NPV suggests it will incur a loss. Businesses can use NPV when deciding between different projects while investment opportunities. The Internal Rate of Return is a good way of judging an investment investment opportunities. The Internal Rate of Return is a good way of judging an investment opportunities.
Net Present Value zero OK, that needs some explaining, right? It is an Interest Rate. We find it by first quessing what it might be (say 10%), then work out the Net Present Value is how much the investment is worth in today's money (we find how to calculate it later) Then keep quessing (maybe 8%? 9%?) and calculating, until we
get a Net Present Value of zero. Example: Sam is going to start a small bakery! Sam gets a Net Present Value of $2000 But the Net Present Value should be zero, so Sam tries 8% interest: At 8% Sam gets a Net Present Value of -$1600 Now it's
negative! So Sam tries once more, but with 7% interest: At 7% Sam gets a Net Present Value of $15 Close enough to zero, Sam doesn't want to calculating the Net Present Value! Read Net Present Value ... or this quick summary: An investment has
money going out (invested or spent), and money coming in (profits, dividends etc). We hope more comes in than goes out, but future values must be brought back to today's values. Why? Because money now is more valuable than money later on. So
$1,000 now earns $1,000 x 10% = $100 in a year. Your $1,000 now becomes $1,100 in a year's time. (In other words: $1,100 next year (at 10% interest).
The Present Value of $1,100 next year is $1,000 Present Value FV is Future Value FV is Fu
Value (using a 10% interest rate)? The Future Value (FV) is $900, The interest rate (r) is 10%, which is 0.10 as a decimal, and The number of years is: PV = FV/(1+r)n PV = $900 / 1.103 PV = $676.18 (to nearest cent) Notice that $676.18 is a lot less than $900. It is saying that
$676.18 now is as valuable as $900 in 3 years (at 10%). The interest rate (r) is now 6%, which is 0.06 as a decimal: PV = $755.66 (to nearest cent) When we only get 6% interest, then $755.66 now is as valuable as $900 in 3 years. Net Present Value (NPV) Now we are equipped to calculate the
Net Present Value. For each amount (either coming in, or going out) work out its Present Values you receive Subtract the Present Value, then: Add the Present Value you receive Subtract the Present Value you receive Subtract the Present Value you now, so PV = -\$570.00 Money In: \$570 next year PV = \$570.00 Money III.
Net Amount is: Net Present Value = $518.18 - $500.00 = $18.18 So, at 10% interest, that investment has NPV = $500.00 Money In: $570 next year: PV = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1+0.15)1 = $570 / (1
Amount: Net Present Value = $495.65 - $500.00 = -$4.35 So, at 15% interest, that investment has NPV = -$500.00 Money In: $570 now, so PV = -$500.00 Money In: $570 now, so PV = -$500.00 Money In: $570 now, so PV = -$570 / (1+0.14)1 = $570 / 1.14 investment has NPV = -$4.35 So, at 15% interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interesting ... what Interest Rate can make the NPV exactly zero? Let's try 14%: Money Out: $500 now, so PV = -$500.00 Money In: $570 now, so PV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest, that investment has NPV = -$4.35 It has gone negative! Now it gets interest.
PV = $500 (exactly) Work out the Net Amount: Net Present Value = $500 - $500.00 = $0 Exactly zero! At 14% interest NPV = $0 And we have discovered the Internal Rate of Return is the interest rate that makes the Net Present
Value zero. And that "guess and check" method is the common way to find it (though in that simple case it could have been worked out directly). Let's try a bigger example: Let us try 10% interest: Now: PV = $100 / 1.102 = $82.64 Year 3: PV = $100 / 1.103 = $75.13 Year 3 (final payment): PV =
$2,500 / 1.103 = $1,878.29 \text{ Adding those up gets: NPV} = -$2,000 + $90.91 + $82.64 + $75.13 + $1,878.29 = $126.97 \text{ Let's try a better guess, say } 12\% \text{ interest rate: Now: PV} = -$2,000 + $90.91 + $82.64 + $75.13 + $1,878.29 = $126.97 \text{ Let's try a better guess, say } 12\% \text{ interest rate: Now: PV} = -$2,000 + $90.91 + $82.64 + $75.13 + $1,878.29 = $1,878.29 = $1,878.29 \text{ Let's try a better guess, say } 12\% \text{ interest rate: Now: PV} = -$2,000 + $90.91 + $82.64 + $75.13 + $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 = $1,878.29 =
Adding those up gets: NPV = -\$2,000 + \$89.29 + \$70.124 = \$88.97 Year 2: PV = \$100 / 1.1243 = \$70.42 Year 3 (final payment): PV = \$2,500 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$89.29 + \$70.42 Year 3 (final payment): PV = \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$1,760.52 Adding those up gets: NPV = -\$2,000 + \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100 / 1.1243 = \$100
$88.97 + $79.15 + $70.42 + $1,760.52 = -$0.94 That is good enough! Let us stop there and say the Internal Rate of Return (IRR) The IRR is a good way of judging different investments. First of all, the IRR should
be higher than the cost of funds. If it costs you 8% to borrow money, then an IRR of only 6% is not good enough! It is also useful when investments are quite different. Or maybe one has high costs at the start, and another has many small costs over time. etc... I did this one in a spreadsheet, and found that
10% was pretty close: At 10% interest rate NPV = -$3.48 So the Internal Rate of Return is about 10% And so the other investment (where the IRR was 12.4%) is better. Doing your calculations in a spreadsheet is great as you can easily change the interest rate until the NPV is zero. You also get to see the influence of all the values, and how sensitive the
results are to changes (which is called "sensitivity analysis"). Copyright © 2023 Rod Pierce The compound annual growth rate (CAGR) measures investment over a certain period of time. The internal rate of return (IRR) also measures investment over a certain period of time.
situations. The most important distinction between CAGR and IRR is that CAGR is straightforward enough that it can be calculated by hand. In contrast, more complicated investments and projects, or those that have many different cash inflows and outflows, are best evaluated using IRR. To back into the IRR, a financial calculator, Excel, or portfolio
accounting system is ideal. The most important distinction between CAGR and IRR is that CAGR is straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand. The concept of CAGR is relatively straightforward enough that it can be calculated by hand.
and periods—reflecting the fact that cash inflows and outflows often constantly occur when it comes to investment's beginning value, its ending value, and the time period. Online tools, including CAGR calculators, will spit out the CAGR when
entering these three values. An example of a CAGR calculation follows. Initial Value = 1,000Final Value = 1,
limited in that it assumes a smoothed return over the time period measured, only taking into account an initial and a final value when, in reality, an investment usually experiences short-term ups and downs. CAGR is also subject to manipulation, as the variable for the time period is input by the person calculating it and is not part of the calculation
itself. The CAGR helps frame an investment's return over a certain period of time. It has its benefits, but there are definite limitations with multiple cash flows, the IRR approach is usually considered to be better than CAGR. IRR is uniform for investments of varying types and, as such, IRR can be used to
rank multiple prospective projects on a relatively even basis. The IRR is also a rate of return (RoR) metric, but it is more flexible than CAGR. While CAGR simply uses the beginning and ending values, IRR considers multiple cash flows and periods—reflecting the fact that cash inflows often constantly occur when it comes to investments.
IRR can also be used in corporate finance when a project requires cash outflows upfront but then results in cash inflows as an investment Example Time Period Cash Flow 0 -1,000 1 400 2 500 3 600 4 700 In the above case, using the Excel function "IRR," the rate is 36.4%. The IRR is classified as
a discount rate that utilizes net present value (NPV), making all cash flows equal to zero in a discounted cash flow (DCF) analysis. In most situations, the higher the IRR, the better the investment option. IRR is often used by companies when they must choose which project is best among many options. A project that has an IRR above its cost of capital is
one that will be profitable. In reality, investments experience volatility. There is never a continuously smooth market cycle that experiences linear growth. When running a business or expecting any sort of cash inflow, it is important for a business or investor to understand this so that they can successfully manage their cash. For example, if a company
makes an investment that provides $5,000 a month, which covers their debt payments and working capital, they may expect by using CAGR that every month for the life of the project or investment will result in a continuous cash stream of $5,000. However, some months may result in market or business volatility, where the investment return will be
less than $5,000, or even zero. This would impact their ability to make debt payments or fund working capital. The CAGR assumes that any profits
were reinvested at the end of each period of the investment's life span. Internal rate of return (IRR) is a metric used in financial analysis to estimate the profitability of potential investment's life span. Internal rate of growth
that an investment is expected to generate, with the ultimate goal of identifying the rate of discount rate that makes the net present value (NPV) of all cash flows equal to zero often requires repeatedly adjusting the discount rate until the NPV reaches zero—a time-
consuming, tedious trial-and-error process. CAGR is easier to calculate because it uses a simple formula based on the beginning value, and the time period. It is more conservative and accurate to use IRR than CAGR when seriously evaluating any investment options, as it will take into consideration true market volatility and the
realities of the financial world. An Analyst's Guide to IRR Over 2 million + professionals use CFI to learn accounting, financial analysis, modeling and more. Unlock the essentials of corporate finance with our free resources and get an exclusive sneak peek at the first module of each course. Start Free The Internal Rate of Return (IRR) is the discount
rate that makes the net present value (NPV) of a project zero. In other words, it is the expected compound annual rate of return that will be earned on a project or investment. When calculating IRR, expected cash flows for a project or investment are given and the NPV equals zero. Put another way, the initial cash investment for the beginning period
will be equal to the present value of the future cash flows of that investment. (Cost paid = present value = 0). Once the internal rate of capital. If the IRR is greater than or equal to the cost of capital, the company
would accept the project as a good investment. (That is, of course, assuming this is the sole basis for the decision. In the example below, an initial investment of $50 has a 22% IRR. That is equal to earning a 22% compound annual growth rate. In reality, there are many other quantitative and qualitative factors that are considered in an investment
decision.) If the IRR is lower than the hurdle rate, then it would be rejected. What is the IRR formula? The IRR formula is as follows: Calculating the internal rate of return can be done in three ways: Using the IRR or XIRR function in Excel or other spreadsheet programs (see example below) Using a financial calculator Using an iterative process where
the analyst tries different discount rates until the NPV equals zero (Goal Seek in Excel can be used to do this) Practical Example Here is an example of how to calculate the Internal Rate of Return. A company is deciding whether to purchase new equipment that costs $500,000. Management estimates the life of the new asset to be four years and expects
it to generate an additional $160,000 of annual profits. In the fifth year, the company is making the best use of its cash.
To make a decision, the IRR for investing in the new equipment is calculated below. Excel was used to calculate the IRR of 13%, using the function, =IRR(). From a financial standpoint, the company should make the purchase because the IRR is both greater than the hurdle rate and the IRR for investing in the new equipment is calculated below. Excel was used to calculate the IRR is both greater than the hurdle rate and the IRR for investing in the new equipment is calculated below.
and email in the form below and download the free calculator/template now! Companies take on various projects to increase their revenues or cut down costs. A great new business idea may require, for example, investments.
The internal rate of return is one method that allows them to compare and rank projects based on their projects based on their
of a business and a cash flow at the end through an IPO or sale of the business. Thorough investment analysis requires an analyst to examine both the net present value (NPV) and the internal rate of return, along with other indicators, such as the payback period, in order to select the right investment. Since it's possible for a very small investment to
have a very high rate of return, investors and managers sometimes choose a lower percentage return but higher absolute dollar value opportunity. Also, it's important to have a good understanding of your own risk tolerance, a company's investment needs, risk aversion, and other available options. What IRR Really Means (Another Example) Let's look
at an example of a financial model in Excel to see what the internal rate of return number really means. If an investor paid $463,846 (which is the negative cash flows shown in cells D178 to J178, the IRR they would receive is 10%. This means the net present value of all these cash flows (including
the negative outflow) is zero and that only the 10% rate of return is earned. If the investors paid less than $463,846 for all the same additional cash flows, then their IRR would be lower than 10%. The above screenshot is from CFI's M&A Modeling Course.
Disadvantages of IRR Unlike net present value, the internal rate of return doesn't give you the return on the initial investment in terms of $10,000 or $10,000. Using IRR exclusively can lead you to make poor investment decisions, especially if comparing two
projects with different durations. Let's say a company's hurdle rate is 12%, and one-year project A has an IRR of 25%, whereas five-year project B has an IRR of 15%. If the decision is solely based on IRR, this will lead to unwisely choosing project A over B. Another very important point about the internal rate of return is that it assumes all positive cash
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flows of a project will be reinvested at the same rate as the project instead of the company's cost of capital. Therefore, the internal rate of return may not accurately reflect the profitability and cost of a project. A smart financial analyst will alternatively use the modified internal rate of return (MIRR) to arrive at a more accurate measure. Thank you for

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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: When a company decides whether a project is worth the costs that will be incurred in undertaking it, it
may evaluate it by comparing the internal rate of return (IRR) on the project to the hurdle rate, or the minimum acceptable rate of return (MARR). Under this approach, if the IRR is equal to or greater than the hurdle rate, also called the minimum acceptable rate of
return, is the lowest rate of return that the project must earn in order to offset the costs of the investment. Projects are also evaluated by discounting future cash flows to the present value of cash inflows and the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows and the present value of cash inflows to the present value of cash inflows to the present value of cash inflows and the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value of cash inflows to the present value of cash inflows and the present value
cash outflows. The hurdle rate is the minimum rate of return on an investment that will offset its costs. The internal rate of return is the amount above the hurdle rate is the minimum rate of return is the amount above the hurdle rate. Generally, the hurdle rate is
equal to the company's costs of capital, which is a combination of the cost of equity and the cost of debt. Managers typically raise the hurdle rate for riskier projects or when the company is comparing multiple investment opportunities. The internal rate of return is the expected annual amount of money, expressed as a percentage, that the investment
can be expected to produce for the company over and above the hurdle rate. The word "internal" means that the figure does not account for potential external risks and factors such as inflation. IRR is also used by financial professionals to compute the expected returns on stocks or other investments, such as the yield to maturity on bonds. The rate of
return excludes potential external factors, and is therefore an "internal" rate. While it is relatively straightforward to evaluate projects by comparing the IRR to the hurdle rate, or MARR, this approach has certain limitations as an investing strategy. For example, it looks only at the rate of return, as opposed to the size of the return. A $2 investment
returning $20 has a much higher rate of return than a $2 million. IRR can only be used when looking at projects and investments that have different durations. The internal rate of
return (IRR) is a way to find what discount rate would cause the net present value (NPV) of a project to be $0—in other words, to find the highest-yielding project or investment. To calculate IRR in Excel, you can use the Insert Function command to add the IRR function. The syntax for the three different IRR functions in Excel are: =IRR(values, [guess])
 =MIRR(values, finance rate, reinvest rate) =XIRR(values, dates, [guess]) "Guess" is an optional argument, a number you think is close to the IRR function, or XIRR function. The IRR function is used when cash flows are expected at regular intervals. The MIRR
function is used when borrowing and reinvesting. The XIRR function is used for cash flows that are known and consistent (one year apart). Assume a company is assessing the profitability of Project X. Project X requires $250,000 in funding and is expected to
generate $100,000 in after-tax cash flows in the first year and grow by $50,000 for each of the next four years. The IRR function looks like this: =IRR(values, [guess]) The initial investment is always negative because it represents an outflow. You are spending something now and anticipating a return later. Each subsequent cash flow could be positive or
negative—it depends on the estimates of what the project delivers in the future. Most companies compare the weighted average cost of capital (WACC) with the IRR. In this case, the IRR is 57%. If a company assumed a WACC of 10% for this project, it would add value and could be considered a worthwhile investment. The modified internal rate of
return (MIRR) is used when the company expects to borrow and invest. You can also use it to help you calculate when there is a finance rate, such as if the initial outlay for the $250,000 loan; however, it's better to use a risk-free rate of return
of 2% rather than 57% because it's a much more conservative guess. The function in Excel looks like this: =MIRR(values, finance rate, reinvest rate) All values are required in this function. Assuming a WACC of 10%, since the outcome is 33%, this project adds value. The extended internal rate of return (XIRR) function in Excel assumes irregular
payment dates rather than estimates for annual periods. XIRR might be used in projects or investments like mutual funds, which are redeemed and reinvested in at various intervals. The XIRR function looks like this: =XIRR(values, dates, [guess]) "Guess" is your best guess at the return. This is an optional field and doesn't change the result if it is left
out. In this function, the dates must be formatted as a function themselves, or the XIRR function won't work. For example, April 16, 2023, would be entered in the cell like this: =DATE(2023,4,16) Again, this project adds value if the company assumes a WACC of 10% because it yields 60.72%. It means that an investment should return 20% over the
entire period that you hold it. The IRR uses the initial outlay, cash inflows, and the number of periods that an investment is held. Excel's IRR function is programmed to work through 20 iterations to find a value that is accurate to within 0.00001%. If it can't find one, then it returns a #NUM error. Also, ensure you have at least one negative value, that
your other fields are formatted correctly, and that you've selected the right ones. Using Excel to calculate the IRR of multiple potential investments, allowing
you to compare them and choose the one that provides the best return. An investment's internal rate of return (IRR) is how much the investor will make from their investment without accounting for external factors like the economy. In practice, IRR serves as a metric of profitability that allows investors, business owners, and financial analysts to
compare investment options. The internal rate of return, or how much profit the investment will generate. However, the internal return rate doesn't consider external factors like risk or inflation. IRR is often used to choose between investment options
by completing a form of discounted cash flow (DCF) analysis—the investment's net present value (NPV) to zero. An NPV of zero would mean the investment's net present value (NPV) to zero. An NPV of zero would mean the investment's net present value (NPV) to zero.
investment amount. As such, IRR gives the yield rate, or the expected return on investment, shown as a percentage of the investment. For example, a $10,000 investment with a 20% IRR would generate $2,000 in profit. However, IRR is a type of compound annual growth rate, meaning the annual yield from the investment is reinvested (or
compounded). Advise your client on a suitable investment option in this free investment option. Avg. Time: 3 to 4 hours Skills you'll build: M&A screening, cross-team collaboration, company analysis, strategic rationale, M&A process understanding, modelling, DCF, presentation Business owners and executives often use
the internal rate of return to compare each IRR to determine which is a better choice. IRR is also commonly used in corporate finance
settings, such as venture capital and private equity firms, when assessing potential companies to invest in. In the fixed income and equities area of investment banking, analysts may rely on the internal rate of return to understand a bond's yield rate. >> MORE: Learn the differences between venture capital vs. private equity. Analyze a company's
financials as an analyst on the technology team in this free job simulation. Avg. Time: 2 to 3 hours Skills you'll build: Financial analysis, critical thinking, problem solving, Excel, communication Calculation the internal rate of return uses the same formula as discounted cash flow (DCF) or net present value (NPV). However, in this calculation, the net
present value needs to be set to zero. Instead of solving for NPV, the "x" we are solving for NPV formula). It's important to remember that this is a type of compound annual growth rate, so returns from the investment are reinvested annually. In this formula: NPV is set to zero.
Cash flows are the sums of money spent and earned on the investment for a given period of time (e.g., monthly or annually). 1, 2, and n are the periods of time, with n being the number of time intervals. IRR is the intervals. IRR is the intervals. IRR is the interval of time (e.g., monthly or annually).
discounted to present value. This is set to zero for this calculation so we can find the rate of return (IRR) that brings the investment to a break-even point (when NPV equals zero). Cash flows are any money a company or investor spends on or earns from an investment. This includes inflows of cash for profits, revenue, or dividends and outflows for
expenses, interest, or loan payments. The number of periods is how long the investment lasts. For example, a five-year project would have five time periods need to be steady intervals — monthly, quarterly expenses, interest, or loan payments. The number of periods defaults to 10 since that's the average lifespan of a company. When calculating IRR, these time periods need to be steady intervals — monthly, quarterly expenses, interest, or loan payments.
annually — because the internal rate of return is an average across all periods and cannot be easily adjusted to bring them to present value. IRR is also the "x" we need to solve for in this formula. The initial investment is the
upfront cost to start the project or investment. For example, if a company invests $10 million into new machinery for a limited run of products, that $10 million would be the initial investment and would need to be subtracted from the total discounted cash flows. Learn what career path is right for you with our free quiz! Calculating IRR by hand is a
guessing game — you use trial and error to figure out which percentage rate results in a zero net present value. Let's go through a simple calculation by hand using the following details: Initial investment: $4,115 Cash flow for first year: $1,200 Net present value: 0 So, with this
information, we have this for a formula: Generally speaking, it can't be a very high rate of return since the initial investment is not very big and it's only a three-year investment. Each discounted cash flow period (year one, year two, and year three) needs to be more than $1,000 to balance out the initial investment, so the IRR cannot be zero. To find the
actual IRR, we need to plug different percentages in and see each NPV. If the IRR is 5%, the NPV for this equation would be -443. So, the IRR is not 15%, the NPV for this equation would be 0. So, the IRR is 10%. Luckily, IRR is rarely calculated by hand
because it's a time-consuming act of trial and error. Instead, finance professionals typically use an online or proprietary IRR calculator to determine an investment's IRR. They may also use Excel using an IRR or XIRR function. Evaluating whether an internal rate of return is good or bad depends entirely on the company itself. Each company has a
hurdle rate, or the minimum rate of return they need from an investment for it to be worthwhile. For some companies, their hurdle rate is the same as their weighted average cost of capital (WACC), while others may rely on the rate of return expected by shareholders. Generally speaking, an investment would be worth pursuing if it has a higher IRR
than the company's hurdle rate. When comparing two options, companies usually choose the investment with the higher IRR. However, IRR alone is often not enough to fully assess an investment option. Rather, finance professionals consider it in conjunction with other factors like the company's risk tolerance, economic conditions, and the total
duration of the potential investment. Evaluate a prospective investment for your client with Citi's free investment banking job simulation. Avg. Time: 5 to 6 hours Skills you'll build: PowerPoint, enterprise value, company research, Excel, financial modeling, forecasting, valuation, comparison analysis, critical thinking, reading comprehension The skills
section of your resume is a great place to mention IRR. Because IRR is a form of financial modeling and business valuation, you can also list it as a specific example in the description of the job or internship. For example, you
can call out an instance when you calculated and compared the internal rates of return for two potential projects and how your experience with IRR outside of professional spaces. For instance, you can talk about how you compared personal
investment options using specific metrics such as IRR and compound annual growth rates. Business and finance professionals need a wide range of hard skills to excel in their careers. Some skills similar to calculating IRR that these careers can benefit from include: Develop your skill set and get noticed by top companies with Forage's
free finance and banking job simulations. Image credit: minervastock / Depositphotos.com designer491/iStock via Getty Images What Is the Internal factors, such as inflation or the cost of capital, aren't considered. IRR can be used to
measure the actual return on an investment, then either positive or negative cash flows, with a negative cash flow occurring at the time of the initial investment, then either positive or negative cash flows thereafter. By definition: IRR is the
annualized effective compounded return rate that sets the net present value (NPV) of all cash flows from the investment, both positive and negative, equal to zero. NPV is always an amount, and IRR is always a percentage that reflects the interest yield from the investment. Put another way, IRR is: The interest rate at which the net present value of the
future cash flows is equal to the initial investment. The interest rate at which the total present value of costs, or negative cash flows, equals the total present value of money which is a financial concept whereby an amount of money is worth more at the present time than
the same amount of money at a future date. That is, a specific return on investment received at the current time is worth more than the same return received at a later time. In the case of a fixed-income investment, such as a Treasury bond, where a bond is bought once and a specified interest rate is paid every time period, such as yearly, the IRR is
equal to the specified interest rate. IRR Formula for calculating IRR (Wendorf) N = the total number of periods n = the current period, usually in years r = the internal rate of return C = yearly
amount of interest received IRR Example For an initial amount of $12,000 invested over a three-year period with returns of $3,600, $5,400, and $4,800, the expanded IRR formula would look like this: IRR formula with initial investment of $12,000 (Wendorf) What we don't know in the above equation is r, or the IRR. We could try mathematically solving
for r, but a much easier way is by using a spreadsheet such as Excel. How to Calculate IRR Using an initial investment of $45,000. Returns on the first in
17% in the first year and rising to 37% in the fifth and final year. The second investment starts out similarly, returning 18% in its first year, and goes up 36% in its first year, and goes up 36% in its first year. So, which investment provides more bang for the buck? Calculating IRR with a spreadsheet (Wendorf) As we can see, the second investment, while more modest than the first year.
provides a slightly higher internal rate of return. To calculate the IRR using a spreadsheet: Step 1: Add Time Period In Column B Place the amounts starting with the initial amount which is always negative in
an adjacent column. Step 3: Add Descriptions In Column C If you'd like, add descriptions in another column, add an equal sign followed by the IRR function which in most spreadsheets is designated as "IRR", then in parentheses add the
column/row designation of the initial amount and the column/row designation of the last amount. In the examples above, the formulas entered were: =IRR(B2:B7) and =IRR(B12:B17) Purpose & Uses for Internal Rate of Return IRR can be used to analyze: Investment returns: In cases where interest payments or cash dividends aren't reinvested back into
an investment, such as in the case of annuities, IRR can determine the true return on investment. Capital planning: IRR allows companies to compare the profitability of creation of a new widget assembly line versus speeding up its
existing assembly line. The money-weighted rate of return (MWRR): The MWRR determines what rate of return is needed given an initial investment amount and changes to cash flows over the course of the investment amount and changes to cash flows over the course of the investment period. Stock buyback programs: IRR allows a company to evaluate if it is likely more profitable to allocate capital to buy back its
shares rather than use those funds in other ways, such as buying new equipment or expanding its operations. Insurance policies: When comparing the premiums charged by a life insurance company against the amount of its death benefit, an individual can determine those policies that are more beneficial. The IRR is always higher during the early years
of a policy because the insured has paid in a smaller amount of money while receiving the same benefit. IRR vs. ROI & CAGR cannot for compound annual growth rate, and it is a measure of the return on an investment over a given period of time. The difference between IRR and CAGR is that IRR is suitable for more complicated investments and
projects, such as those having differing cash outflows and cash inflows. While IRR is difficult to calculated by hand. The formula for cal
the end of the time period Beginning Value = the value of an individual investment, a portfolio, or a business metric at the beginning of the time period # of years = partial years which can be converted into full years by determining the number of days and then dividing by 365 days per year For example, an initial value of $1,000 and a final value of
$2,000 over the course of four years would yield a CAGR of 21.7\%. Return on investment, or ROI, is the percentage increase of an investment over a given period of time, whereas IRR is measured as an annual rate. The formula for calculating ROI is: ROI = [(Expected amount - initial amount)/initial amount] * 100 For example, an initial
investment of $1,000 that is currently worth $1,400 has a ROI of 40\% [($1,400 - $1,000)/$1,000] * 100 = 40\% Over the course of the first year, ROI and IRR will be almost the same, however, they will begin to differ across longer time periods. IRR Limitations Because IRR simply compares cash flows to the amount of capital outlay that generates those
cash flows, it doesn't take into consideration the size of projects, where larger projects can generate significantly more profit over longer periods of time. Also, the IRR ignores reinvestment rates because while the IRR allows for the calculation of the value of future cash inflows, investments having a high IRR can't always be reinvested at the same rate
as the IRR. Any project having an IRR that is greater than its cost of capital should be a profitable investment. Companies planning capital projects will often determine a required rate of return (RRR) which is the minimum rate of return in order for the investment to be worthwhile. Projects having an IRR that is higher than their RRR will create value.
Internal Rate of Return (IRR) is a financial metric used to measure the profitability of an investment. It is the rate of return that a company can
pay for an investment. This article will explain how to calculate IRR, with examples to illustrate the process. What is Internal Rate of Return (IRR) is a measure of the profitability of an investment. It is the rate of return that makes the net present value (NPV) of all cash flows from a project or
investment equal to zero. In other words, it is the discount rate that makes the present value of the future cash flows associated with the investment. This includes the initial investment, as well as any future cash flows associated with
the investment. Then, you need to calculate the present value of each cash flow. This is done by discounting each cash flow by a certain rate. Finally, you need to solve for the rate that makes the present value of all cash flow by a certain rate.
value of money. It is important to note, however, that IRR does not take into account the risk associated with an investment. As such, it should be used in conjunction with other measures of investment calculating the rate of return on an investment is an
important part of any financial decision. The Internal Rate of Return (IRR) formula is a great tool to help you determine the rate of return on an investment. Here's how to use it: 1. Gather the necessary information. You'll need to know the initial investment amount, the cash flows associated with the investment, and the time period over which the
investment will be held. 2. Calculate the net present value (NPV) of the investment. This is the sum of all the cash flows associated with the investment, discounted to their present value. 3. Calculate the NPV of the investment equal to zero. 4. Compare the IRR to other investments. This will help your
determine which investment is the most profitable. Using the IRR formula is a great way to calculate the rate of return on an investment. It's important to remember, however, that the IRR is only one factor to consider when making a financial decision. Other factors, such as risk and liquidity, should also be taken into account. READ ALSO: Money
Market: definition and its types in financeUnderstanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understand when it comes to investments and financial planning. It is the idea that money in the future due to its potential earning capacity. This is the idea that money is an important concept to understanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understanding the Time Value of Money and How It Affects IRR Calculations The time value of money is an important concept to understand the time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money and How It Affects IRR Calculations The time value of Money 
concept is used to calculate the internal rate of return (IRR) of an investment, which is a measure of the profitability of an investment. The time value of money is based on the idea that money is invested, the more it can earn
and the more valuable it becomes. This is why money today is worth more than money in the future. When calculating the IRR of an investment, the time value of money is taken into account. The IRR is the rate of return that an investment, the time value of money is taken into account.
investment is compared to the future value of the investment. The present value is the amount of money that the investor will have in the future. The time value is the amount of money that the investor will have in the future value is the amount of money that the investor will have in the future.
time. If the money is invested for a longer period of time, it will have the potential to earn more, and thus the IRR will be lower. Understanding the time value of money and how it affects IRR calculations is essential
for any investor. It is important to understand how the potential earning capacity of money over time can affect the profitability of an investment. By taking the time value of money into account, investment and maximize their returns. How to Use Excel to Calculate Internal Rate of Return
Welcome to the world of Excel! Excel is a powerful tool that can help you calculate the IRR of an investment. IRR is a measure of the profitability of an investment and is expressed as a percentage. To calculate the IRR of an investment in Excel, you will need to enter the cash flows associated with the investment. Cash flows are
the amounts of money that are received or paid out at different points in time. For example, if you are investment, any additional investment, and any returns from the investment. Once you have entered the cash flows into Excel, you can use the IRR function to calculate the IRR. To do
this, select the cell where you want the IRR to appear and type "=IRR(". Then, select the range of cells that contain the cash flows occur at the end of the
and Reward of an Investment Using Internal Rate of Return Investing can be a great way to grow your wealth, but it's important to understand the risks and rewards associated with any investment. One way to analyze the risk and rewards associated with any investment to understand the risks and rewards associated with any investment.
return is the amount of money you expect to make from the investment. It's important to note that the rate of return is not guaranteed and can vary depending on the market conditions. Once you have all the necessary information, you can calculate the IRR by using a financial calculator or an online calculator. The higher the IRR, the more profitable
the investment is. The IRR can be a useful tool for analyzing the risk and reward of an investment. It's also important to consider other factors such as the liquidity of the investment and the potential for capital gains or losses. By
understanding the risks and rewards associated with an investment, you can make informed decisions about where to invest ment Opportunity? If
so, you may want to consider using the internal rate of return (IRR) to compare different options. IRR is a measure of the profitable. The IRR is calculated by taking the present value of all cash flows associated with an investment and dividing it by the initial
investment. This calculation will give you a percentage that represents the rate of return on the investment is. READ ALSO: Price Level: Definition and Its Role in the EconomyWhen comparing different investment opportunities, you should look at the IRR of each option. This will help you
determine which one is the most profitable. You should also consider other factors such as the risk associated with the investment, and the expected return. When evaluating different investment, and the expected return. When evaluating different investment, and the expected return.
as the risk associated with the investment, the liquidity of the investment, and the expected return. By using the internal rate of return to compare different investment, and minimize your risks. Understanding the
as the IRR. This is not always the case, as the rate of return on reinvested cash flows may be different than the IRR. This is not always the case, as cash flows may be received at irregular intervals. This can lead to inaccurate results.
Third, IRR calculations assume that cash flows are received in the same amount. This is not always the case, as cash flows may be received in different currencies. This can lead to inaccurate results. Finally, IRR calculations assume that cash flows may be received in different currency.
evaluating the profitability of investments. It is a measure of the rate of return that an investment is expected to generate over its lifetime. By calculating the IRR, investments to pursue. With the help of examples, this article has provided a
total growth, start to finish, of the investment. IRR identifies the annual growth rate. The two numbers should normally be the same over the course of one year (with some exceptions), but they will not be the same for longer periods. Across all types of investments, ROI is more common than IRR, largely because IRR is more confusing and difficult to
calculate. Return on investment (ROI) and internal rate of return (IRR) are performance measurements for investments or projects. ROI indicates total growth, start to finish, of an investment, while IRR identifies the annual growth rate. ROI is more common than IRR, as IRR tends to be more difficult to calculate—although software has made calculating
between the current or expected value and the original value, and multiplied by 100. For example, suppose an investment is 50%: ((300 - 200) / 200) * 100 = 50% This calculation works for any period, but there is a risk in evaluating long-term
investment returns with ROI. That's because an ROI of 80% sounds impressive for a five-year investment, but less impressive for a 35-year investment. While ROI figures can be measured, the outcome of an ROI calculation will vary depending on which
figures are included as earnings and costs. The longer an investment horizon, the more challenging it may be to accurately project or determine earnings, costs, and other factors, such as the rate of inflation or the tax rate. It can also be difficult to make accurate estimates when measuring the monetary value of the results and costs for project-based
programs or processes. An example would be calculating the ROI for a Human Resource department within an organization. These costs may be difficult to quantify in the near term and especially so in the long-term investments.
Before computers, few people took the time to calculate the internal rate of return. The formula for IRR is the following: IRR = NPV = \Sigmat = 1 T Ct (1 + r)t = C0 = 0 where: IRR = Internal rate of return NPV = Net present value \begin{aligned} & IRR=NPV=\sum^T {t=1} \frac{C t}{(1+r)^t}=C0=0 \ & \text{where:} \ & IRR=\text{Internal} \text{Internal} \text{ord} \
rate of return}\\ &NPV=\text{Net present value} \end{aligned} IRR=NPV=t=1\SigmaT(1+r)tCt=C0=0where:IRR=Internal rate of returnNPV=Net present value Where: Ct = Net Cash Inflow During Period t t = Number of Time Periods C0 = Total Initial Investment Cost/Outlay To calculate IRR using the formula, one would set NPV equal to zero and solve
for the discount rate (r), which is the IRR. Because of the nature of the formula, however, IRR cannot be calculated analytically and must be calculated either through trial and error or by using software programmed to calculated analytically and must be calculated either through trial and error or by using software programmed to calculated analytically and must be calculated either through trial and error or by using software programmed to calculated either through trial and error or by using software programmed to calculated either through trial and error or by using software programmed to calculated either through trial and error or by using software programmed to calculate IRR.
cash inflows equal to the initial net cash outlay for the investment. Before calculating IRR, the investor should understand the concepts of discount rate and net present value (NPV). Consider the following problem: a man offers an investor should understand the concepts of discount rate and net present value (NPV).
today to receive that $10,000 in a year? In other words, the investor must calculate the present value equivalent of a guaranteed $10,000 in one year. This calculation. For example, using a 10% discount rate, $10,000 in one year.
would be worth $9,090.90 today (10,000 / 1.1). The IRR equals the discount rate that makes the NPV of future cash flows equal to zero. The IRR indicates the annualized rate of return for a given investor needs $100,000 for a project, and the
project is estimated to generate $35,000 in cash flows each year for three years. The IRR is the reinvested at the discount rate, which is not always the case. If the reinvestment rate is not as robust, IRR will make a project look
more attractive than it actually is. That is why there may be an advantage in using the modified internal rate of return (MIRR) instead. Companies use both metrics when budgeting for capital, and the decision of whether to undertake a new project often comes down to the projected ROI or IRR. Return on investment is more commonly used because it is
the better-known of the two measurements, and because IRR is more confusing and difficult to calculate. However, there is now financial software that makes calculating IRR much easier. As a result, deciding which metric to use usually comes down to which additional costs need to be considered. Return on investment (ROI) is the same as rate of
return (ROR). They both calculate the net gain or loss of an investment or project over a set period of time. This metric is expressed as a percentage of the initial value. The modified internal rate of return (MIRR) allows you to adjust the assumed rate of reinvested growth at different stages of a project or investment. It is more accurate than IRR
because it avoids overstating the potential value of a project due to variations in cash flows. When it comes to investments, an average ROI of 7% is considered good. However, it's important to keep in mind that this is an average ROI of 7% is considered good. However, it's important to keep in mind that this is an average ROI of 7% is considered good.
Return on investment (ROI) and internal rate of return (IRR) are ways to measure the performance of investments or projects. ROI shows the total growth rate. Over the course of a year, the two numbers are roughly the same. However, they will likely be different over longer periods of
time. ROI is more commonly used as a measurement of performance because it is simpler to calculate. An Analyst's Guide to IRR Over 2 million + professionals use CFI to learn accounting, financial analysis, modeling and more. Unlock the essentials of corporate finance with our free resources and get an exclusive sneak peek at the first module of each
course. Start Free The Internal Rate of Return (IRR) is the discount rate that makes the net present value (NPV) of a project or investment. When calculating IRR, expected compound annual rate of return that will be earned on a project or investment are given and the NPV equals zero. Put
another way, the initial cash investment for the beginning period will be equal to the present value of that investment. (Cost paid = present value = 0). Once the internal rate of return is determined, it is typically compared to a company's hurdle rate or cost of capital. If the
IRR is greater than or equal to the cost of capital, the company would accept the project as a good investment. (That is, of course, assuming this is the sole basis for the decision. In the example below, an initial investment of $50 has a 22% IRR. That is equal to earning a 22% compound annual growth rate. In reality, there are many other quantitative
and qualitative factors that are considered in an investment decision.) If the IRR formula? The IRR formula? The IRR formula is as follows: Calculating the internal rate of return can be done in three ways: Using the IRR formula? The IRR formula? The IRR formula is as follows: Calculating the internal rate of return can be done in three ways: Using the IRR formula? The IRR form
Using a financial calculator Using an iterative process where the analyst tries different discount rates until the NPV equals zero (Goal Seek in Excel can be used to do this) Practical Example Here is an example of how to calculate the Internal Rate of Return. A company is deciding whether to purchase new equipment that costs $500,000. Management
estimates the life of the new asset to be four years and expects it to generate an additional $160,000 of annual profits. In the fifth year, the company plans to sell the equipment for its salvage value of $50,000. Meanwhile, another similar investment option can generate a 10% return. This is higher than the company's current hurdle rate of 8%. The goal
is to make sure the company is making the best use of its cash. To make a decision, the IRR for investing in the new equipment is calculated below. Excel was used to calculate the IRR is both greater than the hurdle rate and the IRR
for the alternative investment. IRR Calculator Enter your name and email in the form below and download the free calculator/template now! Companies take on various projects to increase their revenues or cut down costs. A great new business idea may require, for example, investing in the development of a new product. In capital budgeting, senior
leaders like to know the estimated return on such investments. The internal rate of return is one method that allows them to compare and rank projects based on their projected yield. The investments for private equity and venture
investment. Since it's possible for a very small investment to have a good understanding of your own risk tolerance, a company's investment needs, risk aversion, and other available
options. What IRR Really Means (Another Example) Let's look at an example of a financial model in Excel to see what the internal rate of return number really means. If an investor paid $463,846 (which is the negative cash flow shown in cell C178) for a series of positive cash flows as shown in cells D178 to J178, the IRR they would receive is 10%. This
means the net present value of all these cash flows (including the negative outflow) is zero and that only the 10% rate of return is earned. If the investors paid less than $463,846 for all the same additional cash flows, then their IRR would be lower than 10%. The
above screenshot is from CFI's M&A Modeling Course. Disadvantages of IRR Unlike net present value, the internal rate of return doesn't fil you if it's 30% of $10,000 or 30% of $10,000. Using IRR exclusively can lead you to
make poor investment decisions, especially if comparing two project A has an IRR of 15%, whereas five-year project A over B. Another very important point about
the internal rate of return is that it assumes all positive cash flows of a project will be reinvested at the same rate of return may not accurately reflect the profitability and cost of a project. A smart financial analyst will alternatively use the modified internal rate of return
(MIRR) to arrive at a more accurate measure. Thank you for 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)
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 model, or
CAPM, is a financial model that calculates the expected return on both 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 its issues, 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 risk and expected return. Jessica Olah / Investopedia 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 (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) where: E R i = expected return of investment (E R m - R f) wher
\text{risk-free rate} \\ &\beta i = \text{beta of the investment} \\ &(ER m - R f) = \text{market risk premium 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 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 is consistent with its likely return. The CAPM seeks to gauge whether a stock is riskier than the market, it will have a beta
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 broad market portfolio (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\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%) The expected return of the stock based on the CAPM formula is 9.5\% = 3\% + 1.3 \times (8\% - 3\%).
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 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 over the expected holding period.
reality. Modern financial theory rests on two assumptions: Securities markets are very competitive and efficient (that is, relevant information about the companies is guickly and universally distributed and absorbed). These markets are dominated by rational, risk-averse investors, who seek to maximize satisfaction from returns on their investments. 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 Sto
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. Including beta in the formula assumes that risk can be measured by a stock's price wolatility. However, price movements in both directions are not equally risky. The
look-back period to determine a stock's volatility is not standard because stock returns (and risk) are not normally distributed. The CAPM also assumes that the interest rate on U.S. Treasury bonds rose to 5% or 6% during the 10-year holding period.
An increase in the risk-free rate also increases the cost of the capital used in the investment and could make the stock look overvalued. The period when the CAPM was conceived. The market risk premium is only a theoretical value and is not an asset that can be purchased or invested in as an alternative to the stock.
Most of the time, investors will use a major stock index, like the S&P 500, to substitute for the market, which is an imperfect comparison. The most serious critique of the CAPM is the assumption that future cash flows can be estimated for the discounting process. If an investor could estimate the future return of a stock with a high level of accuracy,
then the CAPM would not be necessary. Using the CAPM to build a portfolio's return relative to risk, it would exist on a curve called the efficient frontier, as shown in the following graph. Image by Julie Bang © Investopedia 2022
The graph shows how greater expected returns (y axis) require greater expected return of a portfolio that fits on the capital market line (CML) is better than any possible portfolio to the right of that line,
but, at some point, a theoretical portfolio can be constructed on the CML with the best return for the amount of risk being taken. The CML and the efficient frontier may be difficult to define, but they illustrate an important concept for investors: There is a tradeoff between increased return and increased risk. Because it isn't possible to perfectly build a
portfolio that fits on the CML, it is more common for investors to take on too much risk as they seek additional return. In the following chart, you can see two portfolios that have been constructed to fit along the efficient frontier. Portfolio B is expected to return
10% per year but has a 16% standard deviation. The risk of Portfolio B rose faster than its expected returns. Image by Julie Bang © Investopedia 2022 The efficient frontier, it would provide maximal return for its level of risk.
However, it is impossible to know whether a portfolio exists on the efficient frontier graph can be rearranged to illustrate the tradeoff for individual assets. In the following chart, you can see that the CML is now called the
analysis of individual, daily share price returns compared with the market's daily returns over precisely the same period. A higher beta means more risk, but a portfolio of high-beta stocks could exist somewhere on the CML where the tradeoff is acceptable, if not the theoretical ideal. The value of these two models is diminished by assumptions about
beta and market participants that aren't true in the real markets. For example, beta does not account for the relative riskiness of a stock that is more volatile than the market with a high frequency of downside shocks compared with another stock with an equally high beta that does not experience the same kind of price movements to the downside.
Considering the critiques of the CAPM and the assumptions behind its use in portfolio construction, it might be difficult to see how it could be useful. However, using the CAPM as a tool to evaluate the reasonableness of future expectations or to conduct comparisons can still have some value. Imagine an advisor who has proposed adding a stock to a
portfolio with a $100 share price. The advisor uses the CAPM to justify the price with a discount rate of 13%. The advisor's investment manager can take this information and compare it with the company's performance over
the last few years was a little better than 10%, while this stock had consistently underperformed, with 9% returns. The investment manager shouldn't take the advisor's recommendation without some justification for the increased expected return. The CAPM can help generate ideas and reassess holdings but shouldn't be the only method used to value
stocks. An investor also can use the concepts from the CAPM and the efficient frontier to evaluate their portfolio or individual stock performance vs. the rest of the market. For example, assume that an investor's portfolio has returned 10% per year for the last three years with a standard deviation of returns (risk) of 10%. However, the market averages
have returned 10% for the last three years with a risk of 8%. The investor could use this observation to reevaluate how their portfolio is to the right of the CML. If the holdings that are either dragging on returns or have increased the portfolio's risk
disproportionately can be identified, then the investor can make changes to improve returns. Not surprisingly, 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 early 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 time period to evaluate information. There is 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. 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 "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 return distributions, and market fundamentals that don't match reality.
decisions about adding securities to a portfolio.
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