COMM 308 MIDTERM

CHAPTER 1: AN INTRODUCTION TO FINANCE

Finance: study of how and under what terms savings (money) are allocated between lenders and borrowers.

- Financial securities: financial contract used whenever funds are transferred

Real vs. financial assets:

- **Real assets:** tangible things that compose personal and business assets
- **Financial assets:** a claim that one organization or individual has on another

The financial system: is comprised of a

1. Financial intermediaries: transform the nature of the securities they issue and invest in
2. Market intermediaries: simply make the markets work better; facilitate the working of markets and help provide direction intermediation but do not change the nature of the transaction (also known as brokers)

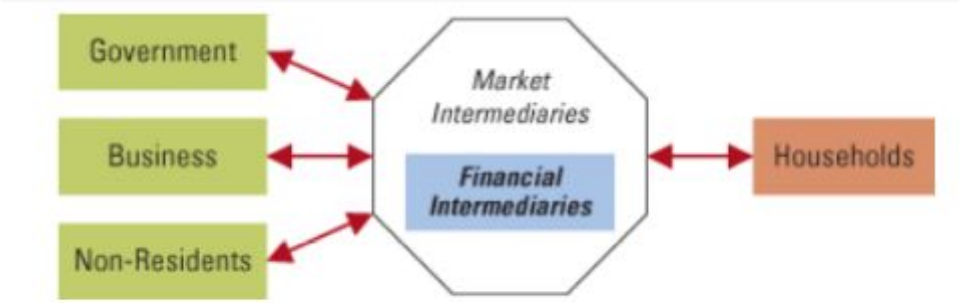


FIGURE 1-2 The Financial System

Channels of intermediation:

- **Intermediation:** the process of transferring funds from lenders to borrowers. 2 ways:
    - Directly: from friends, relatives, acquaintances
    - Indirectly: specialized financial institution; indirectly from individuals who have first loaned their savings to a financial institution, which in turn lends to ultimate borrowers
- 3 basic channels of intermediation:
    - Direct intermediation: lender provides money directly to ultimate borrower without any help from specialist. Non-market transaction because exchange is negotiated directly between borrower and lender
    - Direct intermediation with help to find suitable lenders:
        - Market intermediaries facilitates the working of markets and helps direct intermediation process

- Financial intermediation: financial institution or financial intermediary lends money to ultimate borrowers but raises money itself by borrowing directly from other individuals

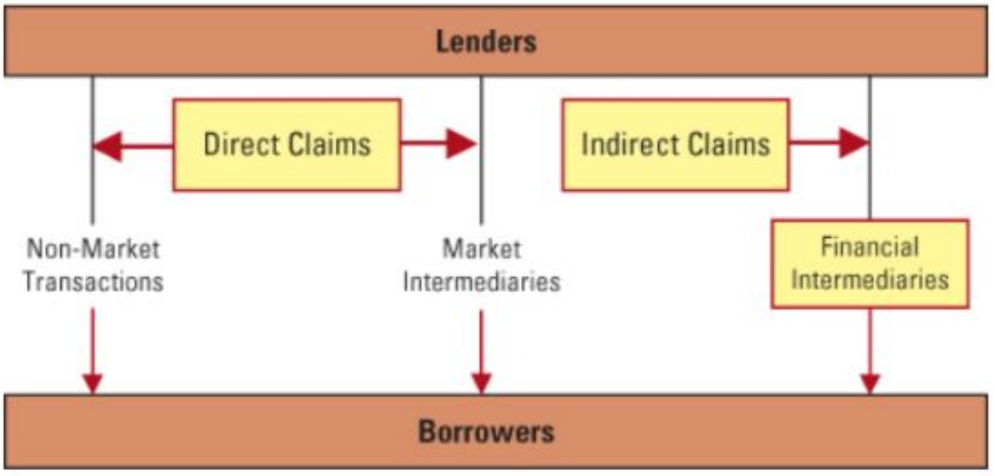


FIGURE 1-3 Channels of Money Transfer

Intermediaries:

- Chartered banks: take in deposits and lend as loans
- Insurance companies: invest proceeds form premiums to earn a good return
- Pension funds
- Mutual funds: perform 2 major functions:
    1. Pool small sums of money so they can make investments that would not be possible for small investors
    2. Offer professional expertise in management of those funds

Major borrowers:

- Governments

Financial instruments and markets:

Financial instruments

- **Debt instruments vs equity instruments:**
    - *Debt instruments:* legal obligations to repay borrowed funds at a specified maturity date and to provide interim interest payments
        - Example: bank loan, commercial paper, bankers' acceptances, T- bills, mortgage loans, bonds and debentures
    - *Equity instruments:* ownership stake in a company

        - Common share: represents part ownership in a company and usually gives voting rights on major decisions affecting the company
        - Preferred share: entitles the owner to fixed dividend payments that must be made before any dividends are paid to common shareholders
- **Non-marketable financial assets vs. marketable financial assets**
    - *Non-marketable:* invested funds that are available on demand in instruments that are not tradable. Example: savings accounts, canadian savings bond
    - *Marketable:* those assets that can be traded among market participants. Example: money market securities (short term debt instruments such as T-bills, commercial paper), capital market securities (debt securities with maturities greater than one year such as bonds, debentures, etc)

Financial markets

Primary and secondary markets

- *Primary markets:* involve the issue of new securities by the borrower in return for cash from investors (or lenders)
    - Brokers: investors in primary markets
- *Secondary markets:* trading environments that allow investors to buy and sell existing securities . 2 major types
    - Exchanges/auction markers
    - Dealer/or over the counter markets: don't have physical location & consists of network of dealers that trade with one another

Stock exchanges

- Canadian stock exchanges 1999:
    - *Toronto stock exchange/TSX*
    - *Montreal exchange (ME)*
    - *Vancouver stock exchange (VSE)*
    - *Winnipeg stock exchange (WSE)*
    - *Alberta stock exchange (ASE)*
- Canadian stock exchanges as of 2000:
    - *TSX Venture exchange*
    - *TSX*
- Other markets
    - *Ontario securities commission (OSC)*
    - *CNSX Markets INC*
- Third & fourth market:
    - *Third:* trading of securities that are listed on organized exchanges in the OTC market
    - *Fourth:* trades that are made directly between investors without involvement of brokers or dealers (usually large institutions)

The global financial community

Global financial markets:

- New york stock exchange (NYSE) is the world's largest stock market

CHAPTER 2: BUSINESS (CORPORATE) FINANCE

Types of business organizations

4 types:	**Pros**	**Cons**
Sole proprietorships: business owned and operated by one person	- Setting one up is easy: no paperwork involved	- Unlimited liability: for not only what is invested in the business but also for any other assets owned - Selling company may be complicated b/c all contacts/relationships are personal and belong to owner
Partnerships: operated by two or more people 1. Limited liability partnerships (LLP) 2. Limited and general partnerships	- Limited partners: Limited liability: liability for only the initial investment	- General partner: unlimited liability
Trusts: a legal organization in which assets are owned by one party and managed/controlled by a different party	- Tax efficient	

Income & royalty trust: set up to invest in the shares and debt obligations of organization		
Corporations: a business organized as a separate legal entity under corporate law with ownership divided into transferable shares	- Limited liability - "Immortal": can borrow using debt that will be paid off in 40-50 years time & transferring/selling asset is easy	- Double taxation - Control

The goals of corporation

FIGURE 2-2 The Firm as an Input-Output Function

The role of management and agency issues

Agency relationship: the relationship between the shareholders who own the company and the managers hired to work on their behalf

Agency problems: problem that arises due to potential divergence of interests among managers, shareholders, and creditors

Agency costs: the costs associated with agency problems. 2 major types:

1. Direct: arise because suboptimal decisions are made by managers when they act in a manner that is not in the best interests of their company's shareholders
2. Indirect costs: which are incurred in an attempt to avoid direct agency costs.

3. Special costs: are “moral hazards” (the fact that individuals' behaviours may change if they are not exposed to the full consequences of their actions)

Corporate governance: a system of principles, policies, procedures, and clearly defined responsibilities and accountabilities used by stakeholders to overcome the conflicts of interest inherent in corporations. Major objective are to:

1. Eliminate or mitigate conflicts of interest, particularly those between managers and shareholders.
2. Ensure the assets of the company are used efficiently and productively and in the best interest of its investors and other stakeholders.

Canadian coalition for good governance (CCGG): The CPPIB (canada pension plan investment board is a member of the CCGG which is a Canadian coalition of large institutional investors who seek to promote good governance practices in the companies they own

Corporate finance

Capital budgeting/capital expenditure analysis: the framework for analyzing investment or asset decisions

Financial management: the process of managing the firm's investment decisions

Corporate finance: the financial management of assets and corporate financing decisions

Corporate financing: the sources of money for a company, which include using debt or equity, retaining earnings or issuing equity, going public, using bank debt or bonds, using the short-term money market, or borrowing from a bank

Finance careers and the organization of the finance function

Positions in non-financial companies

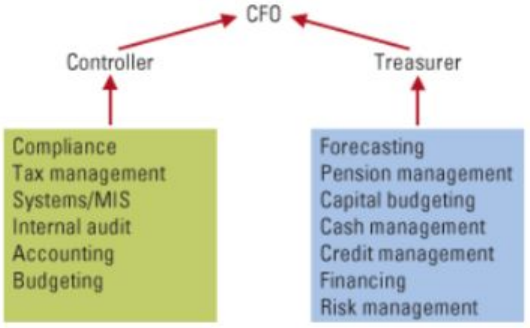


FIGURE 2-3 Finance in a Non-Financial Company

Positions in financial companies

- Analysts: first-level jobs in a financial institution, requiring an undergraduate degree; analysts are usually responsible for gathering and analyzing data, and providing general assistance to associates
- Associates: second-level jobs in a financial institution, requiring an MBA or a professional designation, such as a CFA
- Manager: third-level jobs in a financial institution
- Account manager: people who manage a bank's relationships with companies, extending credit, helping to manage receivables and cash, and directing them to the bank's more specialized services
- Banking associates: people who generate reports on companies, prepare industry reports, and perform background checks on credit applicants
- Security analysts: people who monitor the valuations of companies and make recommendations to buy and sell a company's shares
- sales/trading people: those who execute trades on behalf of their clients and conduct proprietary trading for the dealer itself by using the bank's own capital
- Private bankers/retail brokers: people who help clients, usually people who have large accounts, manage their personal wealth
- financial/investment analysts: people who do research, perform detailed analyses of individual investments, and make recommendations on overall financial strategy
- Portfolio managers: professionals in charge of the overall management of a portfolio
- Fixed income traders or equity traders: people who implement a company's investment strategies and either buy or sell the stakes in companies
- Corporate finance associates and consultants: finance professionals who advise on restructuring, small scale M&A, and corporate financing

CHAPTER 5: TIME VALUE OF MONEY

5.1 Opportunity cost

Time value of money: the idea that a dollar today is worth more than a dollar in the future

Medium of exchange: something that can be used to facilitate transactions

Opportunity cost: of money is the interest rate that would be earned by investing it

Required rate of return/discount rate: the market interest rate of the investor’s opportunity cost

5.2 Simple Interest

Simple interest: is interest paid or received on only the initial investment (the principal)

EXAMPLE 5-1 Simple Interest I

Suppose someone invests $1,000 today for a five-year term and receives 10 percent annual simple interest on the investment. How much money would the investor have after five years?

WORKED SOLUTION

Solution

Annual interest = $1,000 × 0.1 = $100 per year

Year	Beginning Amount	Ending Amount
1	$1,000	$1,100
2	1,100	1,200
3	1,200	1,300
4	1,300	1,400
5	1,400	1,500

$$value\ (time\ n) = P + (n\ x\ P\ x\ k)$$

- P = principal
- n = number of periods
- k = interest

Example: value at end of year 5 = 1,000 + (5 x 1,000 x 0.1) = $1,500

5.3 Compound Interest

Compound interest: earned on the principal amount invested and on the future interest payments.

- Can result in dramatic growth over time
- Money is reinvested
- Growth directly related to length of period & level of return earned

EXAMPLE 5-3 Compound Interest I

Suppose someone invests $1,000 today for a five-year term and receives 10 percent annual *compound* interest. How much would the investor have after five years?

WORKED SOLUTION

Solution

Annual interest is earned on the original $1,000 (principal) *and* on accrued interest.

Year	Beginning Amount	Interest	Ending Amount
1	$1,000	1,000 × 0.1 = $100	$1,100
2	1,100	1,100 × 0.1 = $110	1,210
3	1,210	1,210 × 0.1 = $121	1,331
4	1,331	1,331 × 0.1 = $133.10	1,464.10
5	1,464.10	1,464.10 × 0.1 = $146.41	1,610.51

Future value: $FV_N = PV_0\ x\ (1+k)^n$

- Future value = FV_n
- $(1 + k)^n$ = future value interest factor (PVIF): represents the future value of an investment at a given rate of interest and for a stated number of periods

Discounting (computing present values): finding the present value of a future value by accounting for the time value of money

EXAMPLE 5-5 Discounting

An investor estimates that she needs $1 million to live comfortably when she retires in 40 years. How much does she have to invest today, assuming a 10 percent interest rate on the investment?

WORKED SOLUTION

Solution

To solve this example, first start with what is already known: the future value formula of Equation 5-2.

$$FV_n = PV_0 (1 + k)^n$$

where $FVIF = (1 + k)^n$. With a starting present value, we multiply by the FVIF to get the future value. This means we can divide the future value by the FVIF to get the present value. Rearranging Equation 5-2 to solve for PV we get

$$\boxed{PV_0 = \frac{FV_n}{(1 + k)^n} = FV_n \times \frac{1}{(1 + k)^n}} \quad [5\text{-}3]$$

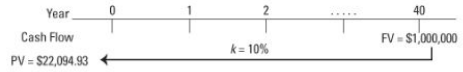
Equation 5-3 is the basic discounting equation, and the last term, $1/(1 + k)^n$, is called the discount factor or present value interest factor (PVIF). Some older textbooks have tables of PVIF and FVIF for various periods and interest rates, although they are simply reciprocals of each other. The use of computers and calculators makes these tables obsolete.

Let's return to our example. If $FV = \$1{,}000{,}000$; $k = 0.1$; and $n = 40$, we get

$$\begin{aligned} PV &= 1{,}000{,}000 \times 1/(1.1)^{40} = 1{,}000{,}000 \times (1/45.259256) \\ &= 1{,}000{,}000 \times 0.02209493 = \$22{,}094.93 \end{aligned}$$

$$= 1{,}000{,}000 \times 0.02209493 = \$22{,}094.93$$

We illustrate this in a timeline.



An investment of $22,094.93 today, earning a 10 percent return per year, has a future value of $1 million in 40 years. With a 10 percent market interest rate, $22,094.93 today and $1 million in 40 years' time are worth the same amount, so the two figures are economically equivalent.

Present value interest factor (PVIF): a formula that determines the present value of $1 to be received at some time in the future (*n)* based on given interest (*k)*

- PVIF < 1 as long as discount rates are positive (k >0): meaning hat future dollars are usually worth less than same dollars today
- PVIF = $\frac{1}{FVIF}$: discount factors are reciprocals of their corresponding compound factors and vice versa; the greater the discount, the greater the FVIF (& future value) and the smaller the PVIF (& present value) & vice versa

How to know which one:

- **Future value problems:** how much will i have in *n* years at *x* percent if I invest $y today
- **Present value:** what is the value today of receiving $z in *n* years if the interest rate is *x* percent
- **IRR problems:** what rate of return will I earn if I invest $my today for *n* years and get $z?
- **Period:** how long do I have to wait to get $z if I invest $y today at x %?

5.4 Annuities and perpetuities

Ordinary annuities:

- **Annuity:** Series of payments or receipts which are known as "cash flows", that are for the same amount and paid at the same interval over a given period (annually, monthly or weekly). Example: car loan, mortgage payment
- **Ordinary annuity:** involve end-of-period payments

Annuities due

- Annuity (such as a lease) for which the payments are made at the **beginning** of each period (instead of the end like an ordinary annuity)

Perpetuities

- Special annuities in that they go on forever, so *n* goes to infinity in the annuity equation

5.5 Growing perpetuities and annuities

Growing perpetuities:

- grow/shrink at a constant rate per period (*g*) forever
- Important points:
    - k > g: otherwise, answer is negative
    - Only future estimated cash flows and estimated growth in these cash flows are relevant
    - Relationship holds only when growth in payments is expected to occur at the same rate indefinitely

Growing annuities

- grow/shrink at a constant rate per period (*g*) over a given period of time, ending at some terminal point (*n)*

5.6 Quoted vs effective rates

Effective rates: for a period is the rate at which a dollar invested grows over that period. Usually stated in % terms based on annual period;

- *k :* effective annual rate
- QR: quoted rate
- *m:* number of compounding intervals per year

Effective rates compounded on a continuous basis:

$k = e^{QR} - 1$

Effective rates for any period

$$k = (1 + \frac{QR}{m})^{\frac{m}{f}} - 1$$

Inputing values in financial calculator:

1. Future value:

EXAMPLE 5-3

Solution Using a Financial Calculator

Input the following variables:

0 → PMT; –1,000 → PV; 10 → I/Y; and 5 → N

Press CPT (compute) and then FV. The answer will be 1,610.51.

PMT here refers to regular payments and will be discussed in a later section; FV is the future value; I/Y is the period interest rate; and N is the number of periods. The PV is entered with a negative sign on this calculator (this is not the case with all calculators) to reflect the fact that investors must pay money now to get money in the future. Alternatively, we could have left it positive. This would produce a negative sign in front of the FV, which we could simply ignore. We will do this in some of the ensuing applications.

2. Present value:

EXAMPLE 5-5

Solution Using a Financial Calculator

Input the following variables:

0 → PMT; –1,000,000 → FV; 10 → I/Y; and 40 → N

Press CPT and then PV. This will give an answer of 22,094.93.

3. Finding interest rate when PV/FV are known

EXAMPLE 5-6

Solution Using a Financial Calculator

Input the following variables:

0 → PMT; 32,000 → FV; –20,000 → PV; and 5 → N

Press CPT and then I/Y. This will give an answer of 9.856 percent. Notice that either FV or PV needs to be input as a negative number, because to "receive" one cash flow (either today or in the future) you need to "pay" (or invest) either today or in the future.

4. Finding "n" when PV/FV are known

EXAMPLE 5-7

Solution Using a Financial Calculator

Input the following variables:

0 → PMT; 32,000 → FV; –20,000 → PV; and 10 → I/Y

Press CPT and then N. This will give an answer of 4.9313 or 4.93 years.

5. Ordinary annuity FV

EXAMPLE 5-8

Solution Using a Financial Calculator

Input the following variables:

153,400 → PMT; 6 → N; 0 → PV; and 8 → I/Y

Press CPT and then FV. This will give you an answer of –1,125,332. Remember that you get a negative value because the calculator is programmed to consider cash outflows and cash inflows.

6. Ordinary annuity PV

Input the following variables:

153,400 → PMT; 6 → N; 0 → FV; and 8 → I/Y

Press CPT and then PV. This will give an answer of −709,150.

7. Effective rates: daily compounding

EXAMPLE 5-15

Solution Using a Financial Calculator

To solve for daily compounding, perform the following keystrokes:

2ND ICONV

2ND CLRWORK

The screen will show NOM = some value.
Make NOM = 12 (this is the nominal rate).

Then ENTER ↓ ↓

This should show C/Y = some value.
For daily compounding, for example, input:
C/Y = 365 (this is the number of compounding periods per year)

Then ENTER ↓ ↓, which should show EFF = some value.

Then CPT, which gives an answer of 12.747 percent.

8. Loan payments

EXAMPLE 5-16

Loan Payments and Amortization Schedule

Determine the required year-end payments for a three-year $5,000 loan with a 10 percent annual interest rate. Complete an amortization schedule.

WORKED SOLUTION ⊕

EXAMPLE 5-16

Solution Using a Financial Calculator

Input the following variables:

0 → FV; 5,000 → PV; 3 → N; 10 → I/Y

Press CPT and then PMT = −2,010.57, or $2,010.57.

9. Principal outstanding

EXAMPLE 5-17

Determining the Principal Outstanding

Determine the principal outstanding on the loan in Example 5-16 after one year, without referring to the amortization schedule found in the solution.

WORKED SOLUTION ⊕

EXAMPLE 5-17

Solution Using a Financial Calculator

0 → FV; 2,010.57 → PMT; 10 → I/Y; 2 → N

Press CPT and then PV = −3,489.42.

CHAPTER 6: BOND VALUATION AND INTEREST RATES

6.1 The basic structure of bonds

Bond: long-term debt instruments that promise fixed payments and have maturities of more than ten years

- *Coupon paying bond:* provides for identical payments at regular intervals (usually semi-annually or annually), with the full principal to be repaid at the stated maturity date.
- *Bullet payment/balloon payment:* a principal payment made in one lump sum at maturity
- Bond known as "fixed-income security" because interest payments and principal repayment are specified/fixed
- Bonds have 2 main aspects:
    - Structure of payments differs from that of the loan or mortgage discussed because it does not involve "blended payments"; instead has interest payments throughout and balloon payment of principal at maturity
    - Can be viewed as 2 separate components:
        - An annuity: consisting of identical and regular interest payments
        - A lump-sum principal payment at maturity

Basic bond terminology:

- *Bond indenture:* a legal document that specifies the payment requirements and all other salient matters relating to a particular bond issue, held and administered by a trust company
- *Collateral:* assets that can serve as security for the bond in case of default
- *Fiduciary:* a third party who acts to ensure that the best interests of bondholders are upheld
- *Covenant provisions:* a clauses within the indenture that lay out the legal rights of the bondholder and the obligations of the issuer
- *Face value/maturity value:* the value of the amount paid at maturity for traditional bonds
- *Term to maturity:* time remaining of the bond until maturity date
- *Interest payments/coupons:* determined by *coupon rate x bond par value*

Security and protective provisions

- Mortgage bonds: debt instruments that are secured by real assets
- Debentures: debt instruments that are similar to bonds but are generally unsecured or are secured by a general floating charge over the company's unencumbered assets

- Collateral trust bonds: bonds secured by a pledge of other financial assets, such as common shares, bonds, or treasury bills
- Equipment trust certificates: a type of debt instrument secured by equipment, such as railway rolling stock
- Protective covenants: clauses in a trust indenture that restrict the actions of the issuer; covenants can be positive or negative

Additional bond features:

- Callable bonds: bonds that give the issuer the option to "call," or repurchase, outstanding bonds at predetermined prices at specified times
- Call prices: prices, generally at a premium over par, at which issuers can repurchase bonds
- Retractable (or putable) bonds: bonds that the bondholder can sell back to the issuer at predetermined prices at specified times earlier than the maturity date
- Extendible bonds: allow the bondholder to extend the maturity dates of the bonds
- Sinking fund provisions: the requirement that an issuer set aside funds each year to be used to pay off the debt at maturity
- Purchase fund provisions: the requirement that a certain amount of debt be repurchased only if it can be repurchased at or below a given price
- Convertible bonds: can be converted into common shares at predetermined conversion prices

6.2 Bond valuation

Price of a bond: $B = I\ x\ \left[\frac{1-\frac{1}{(1+k_b)^n}}{k_b}\right] + F\ x\ \frac{1}{(1+k_b)^n}$

where

B = the bond price
I = interest (or coupon) payments
k_b = the bond discount rate (or market rate)
n = the term to maturity
F = the face (par) value of the bond

Price of bond formula version #2 (simple):

$B = I\ x\ PVAF(k_b, n) + F\ x\ PVIF\ (k_b,\ n)$

Bonds trading at discount vs premium:

- *Discount:* the difference between a bond's par value and the price it trades at when it trades below the par value. This happens because the coupon rate is less than the market interest (discount) rate
- *Premium:* the difference between a bond's par value and the price it trades at when it trades above the par value. if market interest rates are below the coupon rate
- Bond trading at *par* : when market rate = coupon rate

Factors affecting bond prices:

- Interest rates decrease
- Market prices of bonds increase/decrease
- Difference in yields of Canadian government bonds and U.S treasury bonds

2 factors in relationships between bond prices and market rates:

1. **Change in interest rates**:
    a. Interest rates decrease: bond prices will increase
    b. Interest rates increase: bond prices will decrease
2. The longer the time to maturity, the more sensitive the bond price is to changes in market rates.

Important points about bonds:

1. The prices of bonds with higher durations are more sensitive to interest rate changes than are those with lower durations.
2. All else being equal, durations will be higher when (1) market yields are lower, (2) bonds have longer maturities, and (3) bonds have lower coupons

Cash prices vs quoted prices:

1. Cash prices: quoted price plus the accrued interest on the bond
2. Quoted prices: prices reported in the media are typically referred to as "quoted" prices

EXAMPLE 6-6
The Cash Price of a Bond

Consider the bond in Example 6-3, which pays interest semi-annually, has a $1,000 maturity value and a 5-percent coupon rate, and is sold on July 14 at a quoted price of $902. Assume this bond matures on June 30, which implies the semi-annual interest payments on this bond are made on June 30 and on December 31. Calculate the cash price of this bond.

WORKED SOLUTION

Solution

The cash price for this bond would equal $902 plus 14 days of accrued interest at the coupon rate of 5 percent. Each coupon is valued at 2.5 percent of $1,000 or $25. There are a total of 184 days from July 1 to December 31. In other words,

$$\text{Cash price} = \text{Quoted price} + \text{Accrued interest}$$

$$\text{Cash price} = \$902 + (\$1{,}000 \times 0.025 \times [14/184]) = \$902 + \$1.90 = \$903.90$$

Note that we have to choose a convention in terms of how much interest has been earned. Because this is a Canadian bond, we use the Canadian day count, which uses the actual number of days that have elapsed and assumes there are 365 days in a year.

6.3 Bond yields

Yield to maturity: $B = I\ x\ \left[\frac{1-\frac{1}{(1+k_b)^n}}{k_b}\right] + F\ x\ \frac{1}{(1+k_b)^n}$

- Same as price of bond but solve for K_b and B is known

Current yield: $CY = \frac{Annual\ interest}{B}$

Price-Yield Relationships	
Bond Price	**Relationship**
Par	Coupon rate = CY = YTM
Discount	Coupon rate < CY < YTM
Premium	Coupon rate > CY > YTM

6.5 Other types of bonds/debt instruments

Treasury-bills: are short-term government debt obligations that mature in one year or less. Partly because of this short term to maturity, they do not make regular interest payments but are sold at a discount from their par (or face) value, which is paid on the maturity date. The interest earned is the difference between the purchase price and the face value.

Value of the T-bills: $P = \frac{F}{(1+k_{BEY}\ x\ \frac{n}{365})}$

- k_{BEY} = bond equivalent yield
- n = term to maturity express as # of days

Zero coupon bond: a bond that is issued at a discount, pays no coupons, and repays the par value at the maturity date; also commonly referred to simply as a "zero". The return earned represents the difference between the purchase price and the redemption price. Obviously, the lower the price paid for the bond, the higher the return

Value of zero coupon bonds: $B = F\ x\ \frac{1}{(1+k_b)^n}$

Semi-annual rate: $k_b = (\frac{F}{B})^{\frac{1}{n}} - 1$

Floating rate and real return bonds: have adjustable coupons that are usually tied to some variable short-term rate. They differ significantly from traditional fixed-income bonds because the coupon rates increase as interest rates increase and vice versa. Therefore, floaters provide protection against rising interest rates and tend to trade near their par value.

Real return bonds: provided by the Government of Canada that provide investors with protection against inflation

Canada savings bonds: bonds issued by the Government of Canada that cannot be traded and therefore have no secondary market, which means their prices do not change over time

CHAPTER 7: EQUITY VALUATION

7.1 Equity securities

Equity securities: are ownership interests in an underlying entity, usually a corporation. Generally, equity securities have no fixed maturity date. Equities pay dividends from after-tax earnings, so, unlike interest payments, they do not provide the issuer with a tax-deductible expense. However, shareholders pay lower taxes on dividends received from Canadian corporations than they would on interest payments

- Common share: is a type of equity security, which represents a certificate of ownership in a corporation
    - Represent true "owners" of the corporation
    - Residual claimants as in they're entitled to income remaining after all creditors & preferred shareholders have been paid

Preferred shares: are the other major category of equities. These provide the owner with a claim to a fixed amount of equity that is established when the shares are first issued. Most preferred shares have preference over common shares with respect to income and assets (in the event of liquidation), but they rarely have any voting rights.

- Usually have no maturity date but recently do have
- Main difference between bonds: board of directors declared any dividends

Valuation of equity securities: using the discounted cash flow approach which estimates expected future cash flows associated with security and then determines discounted present value of those future cash flows based on discount rate (*k)*

$$k = RF + Risk\ premium$$

k= the required return on an equity security
RF = risk-free rate of return

7.2 Preferred share valuation

The cash flow pattern for a straight preferred share:

- No maturity date and pay dividends of a fixed amount at regular intervals indefinitely
- Preferred shares = fixed income investments
- payment of a fixed dividend amount at regular intervals indefinitely means we can view these investments as "perpetuities"
- Value of preferred shares can be estimated using the following equation which determines present value of perpetuity (P_{ps})

$$P_{ps} = \frac{D_P}{K_P}$$

P_{ps} = market price (or present value)
D_p =dividend amount (or payment)

- Usually based on stated par (or face) value and a stated dividend rate

k_p = required rate of return on preferred shares or discount rate

Equation can be rearranged to find **required rate of return:**

$$k_p = \frac{D_p}{P_{ps}}$$

7.3 Common share valuation: the dividend discount model (DDM)

The basic dividend discount model (DDM): model for valuing common shares; assumes that common shares are valued according to the present value of their expected future cash flows. Based on this premise, today's price can be estimated using following equation, if we have an n-year holding period.

- Assumes the price today is the present value of all future dividends to be received

$$P_0 = \frac{D_1}{(1+k_c)^1} + \frac{D_2}{(1+k_c)^2} + \ldots + \frac{D_n+P_n}{(1+k_c)^n} \rightarrow \sum_{t=1}^{\infty} \frac{D_t}{(1+k_c)^t}$$

P_0 = estimated share price today
D_1 = Expected dividend at the end of year 1
P_n = expected share price after *n* years
k_c = required rate of return on common shares

The constant growth DDM

- Basic dividend discount model can be simplified into a usable formula by assuming that dividends grow at a constant rate g indefinitely. We can then estimate all future dividends, assuming we know the most recent dividend paid D0.
- The basic dividend discount model can be transformed into following:

Constant growth DDM:

$$P_0 = \frac{D_0(1+g)^1}{(1+k_c)^1} + \frac{D_0(1+g)^2}{(1+k_c)^2} \cdots + \frac{D_0(1+g)^\infty}{(1+k_c)^\infty} \rightarrow \frac{D_0(1+g)}{k_c - g} \rightarrow \frac{D_1}{k_c - g}$$

Important conditions for constant growth DDM:

1. $k_c > g$
2. Only future estimated cash flows/estimated growth in these cash flows are relevant
3. Growth in dividends is expected to occur at the same rate indefinitely

Estimating the required rate of return:

$$k_c = \frac{D_1}{P_0} + g$$

Estimating the value of growth opportunities

- The constant growth DDM can also provide a useful assessment of the market's perception of growth opportunities available to a company, as reflected in its market price.
- assuming that a firm with no profitable growth opportunities should not reinvest residual profits in the company, but rather should pay out all its earnings as dividends
- Under these conditions, we have g=0 and D1=EPS1, where EPS1 represents the expected earnings per common share in the upcoming year.
- Unlikely to find company that has exactly 0 growth opportunities
    - Point is we can assume the share price of any common stock that satisfies the assumptions of the constant growth DDM will be made up of two components: its no-growth component and the remainder, which is attributable to the market's perception of the growth opportunities available to that company. We denote this as the present value of growth opportunities PVGO.

$$P_0 = \frac{EPS_1}{k_c} \rightarrow \frac{EPS_1}{k_c} + PVGO$$

Examining the inputs in the constant growth DDM:

- All else remaining equal; the price of common shares (P_0) will increase as a result of:
    - Increase in D_1
    - Increase in g
    - Decrease in k_c
- DDM predicts that common share prices will be higher when profits are high (and expected to grow), when interest rates are lower, and when risk premiums are lower.
- We can usually assume that current dividends D0 are given, so it is the movements in kc and that determine the price of a share (i.e., because kc−g is the denominator, and because D01+g is the numerator).

Estimating DDM inputs:

- Determining company's sustainable growth rate: (*g)* the earnings retention ratio multiplied by return on equity

$g = b \; x \; ROE$

b = firm's earnings retention ratio = $1 - firm's\ dividend\ payout\ ratio$

ROE = return on common equity = $\frac{net\ profit}{common\ equity} =$

$\frac{net\ income}{sales} x \frac{sales}{total\ assets} x \frac{total\ assets}{equity} = net\ profit\ margin\ x\ turnover\ ratio\ x\ leverage\ ratio$

- ROE (& hence *g*) increases with higher profit margins, higher asset turnover and higher debt which = higher risk = higher k_c

The multiple-stage growth version of the DDM

$$P_0 = \frac{D_1}{(1+K_C)^1} + \frac{D_2}{(1+K_C)^2} + \ldots + \frac{D_t+P_t}{(1+K_C)^t}$$

$$P_t = \frac{D_t+1}{k_c-g}$$

Limitations of the DDM

- BEST suited for companies that
    - Pay dividends based on a stable dividend-payout history that they want to maintain in the future
    - growing at a steady and sustainable rate.

Free cash flow approach for discounted cash flow: 2 variations

1. using free cash flows to equity holders and discounting them using the required return to equity holders (as in the DDM)
2. using free cash flows to the firm and discounting them using the firm's weighted average cost of capital

7.4 Using multiples to value shares

The basic approach

- Relative valuation approaches determine the value of common shares by comparing the market prices of similar companies relative to some common variable, such as earnings, cash flow, book value, or sales
- most commonly used relative valuation multiple: the price-earnings ratio
    - the share price divided by the earnings per share; the most commonly used relative valuation multiple
- Relative valuation: valuing the firm relative to other comparable firms.

Basic valuation equation: $P_0 = Estimated\ EPS_1\ x\ justified\ P/E\ ratio = EPS_1\ x\ P_0/E_1$

- P/E ratio based on future earnings (EPS_1) = leading P/E ratio
- EPS_0 = lagging P/E ratios, based on earnings over previous 12 months

Applying the P/E ratio approach:

- Approach one: find *comparable* companies and estimate an appropriate P/E ratio for the company being analyzed based on a comparison of this company with the others in terms of risk and growth opportunities; involves using an industry-average P/E ratio, which is then scaled up or down, based on an assessment of whether the company is above or below average
- Approach two: examine historical averages for the company or the company's industry.

$$\frac{P_0}{EPS_1} = \frac{P}{E} = \frac{D_1/EPS_1}{k_c - g}$$

- The expected dividend payout ratio D_1/EPS_1
- Required rate of return k_c
- Expected growth rate of dividends g

Following relationships should hold, all else being equal:

- The higher the expected payout ratio, the higher the P/E.
- The higher the expected growth rate, g, the higher the P/E.

- The higher the required rate of return, kc, the lower the P/E.

Limitations of P/E ratios

- uninformative when companies have negative, or very small, earnings
- the volatile nature of earnings implies a great deal of volatility in P/E multiples.

22.1 forms of dividend payments

Mechanics of cash dividend payments

- Declaration date: the date on which the board of directors decides that the firm will pay a dividend
- Holder of record date: person who officially owns a share or shares on a given date
- Ex-dividend date: date after which shares trade without the right of the purchaser to receive a dividend
- Special dividend: a dividend over and above a firm's normal dividend that the BOD indicates is not likely to be repeated

Other forms of dividends

- Dividend reinvestment plan (DRIP): a plan that allows investors to use dividends to buy new shares
- Stock dividend: a dividend paid in additional shares rather than cash
- Stock splits: a greater-than-25-percent increase in the number of shares outstanding

Reasons for Stock dividends & Stock splits:

- by increasing the number of shares, the price per share falls, which may be useful if there is an optimal trading range for the share price. This allows the shares to be traded in round lots at a reasonable value

CHAPTER 8 (8.1 to 8.5)

8.1: Measuring returns

Ex post returns vs ex ante returns:

- Ex post returns: past or historical returns (“you have observed”)
- Ex ante returns: future or expected returns (“estimate”)

Income yield: return earning in the form of a periodic cash flow received by investors

Capital gain (or loss): measures the appreciation (or depreciation) in the price of the asset from some starting price (purchase price/price at the start of the year)

Paper losses: capital losses that people do not accept as losses until they actually sell and realize them

Day trader: someone who buys and sells based on intraday price movements

Mark to market: carrying securities at the current market value regardless of whether they are sold

Measuring average returns

Arithmetic mean vs geometric means

1. Arithmetic: sum of all of the returns divided by the total number of observations
   $AM = r_i \div total\ number\ of\ observations$
2. Geometric: measures the compound growth rate over multiple periods.
   $GM = [(1 + r1)(1 + r2)...(1 + rn)^{\frac{1}{n}} - 1]$
   - GM always less than AM, unless the values are all identical
   - The more the returns vary the bigger the difference between AM & GM

8.2: Measuring risk: how common risk measures are calculated & what they mean

Range: difference between maximum and minimum values (of returns)

Standard deviation: a measure of risk over all observations; the square root of the variance, denoted as σ . Bigger S.D = move variable returns

Value at risk (VAR): probability-based measure of loss potential to a firm

- Represents estimated loss (in money terms) that could be exceeded (minimum loss) at a given level of probability.
- Lower probability = higher potential loss, all else being equal

8.3: Expected return and risk for portfolios

Portfolio: collection of securities, such as stocks and bonds, that are combined and considered a single asset.

Modern portfolio theory (MPT): states that securities should be managed within a portfolio, rather than individually, to create risk-reduction gains. Diversification will protect investors against a single negative event

Covariance: (*COV*) a statistical measure, correlation of the fluctuations of the annual rates of return of different investments

Correlation coefficient (ρ_{AB}) : a statistical measure, identifies how security returns move in relation to one another

- 1 = Perfect, positive correlation
- -1.0 = Perfect, negative correlation
- 0 = zero correlation

3 special cases produce simplified versions of the standard deviation of the portfolio's return"

$$\text{If } \rho = 0 \; \sigma_p = \sqrt{(w_A)^2(\sigma_A)^2 + (w_B)^2(\sigma_B)^2}$$

$$\text{If } \rho = +1 \; \sigma_p = \sqrt{(w_A)^2(\sigma_A)^2 + (w_B)^2(\sigma_B)^2 + 2(w_A)(w_B)(\sigma_A)(\sigma_B)}$$

$$\text{If } \rho = -1 \; \sigma_p = \sqrt{(w_A)^2(\sigma_A)^2 + (w_B)^2(\sigma_B)^2 - 2(w_A)(w_B)(\sigma_A)(\sigma_B)}$$

Portfolio that removes all risk (no variability): $\rho = -1$

$$\sigma_p = w\sigma_A - (1 - w)\sigma_B$$

$$w = \frac{\sigma_B}{\sigma_A + \sigma_B}$$

8.4: The efficient frontier

Two-security portfolio combination:

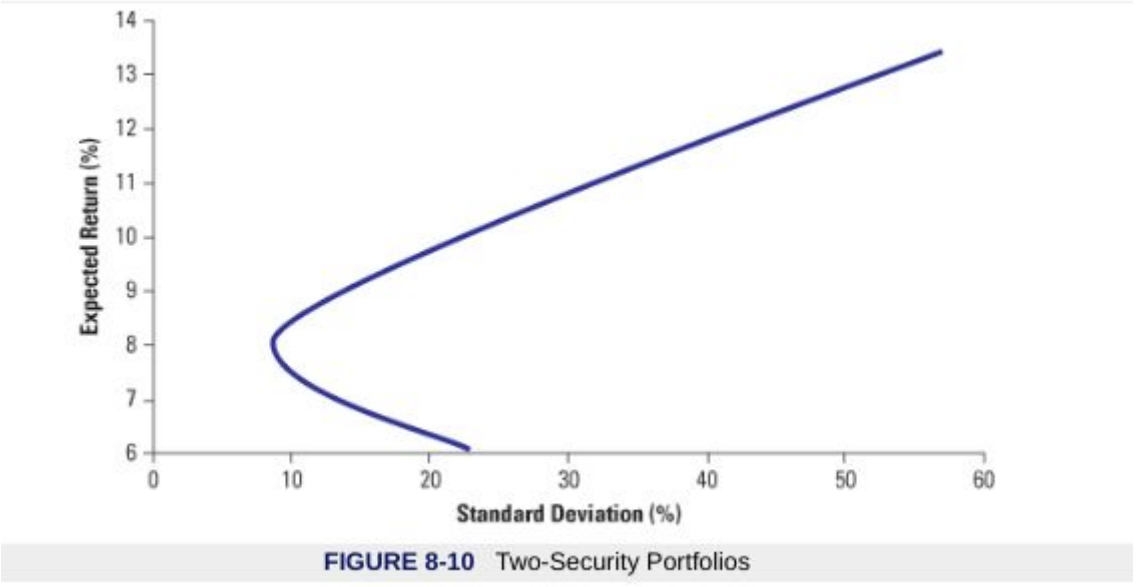


FIGURE 8-10 Two-Security Portfolios

The efficient frontier: 3 assumptions to diversify portfolio, investors...

1. **Rational**: decision-makers
2. **Risk averse:** like expected returns, dislike risk & require compensation to assume additional risk
3. **Preferences**: based on portfolio's expected return and risk (as measured by variance or standard deviation)

Efficient portfolios: offer the highest expected return for a given level of risk or lowest risk

Minimum variance frontier: curve produced when determining the expected return-risk combinations available to investors from a given set of securities by various portfolio weights

Attainable portfolios: portfolios that may be constructed by combining the underlying securities

Minimum variance portfolio (MVP): portfolio that lies on the efficient frontier and has the minimum amount of portfolio risk from any possible combination of available securities

Efficient frontier: the set of portfolios that offer the highest expected return for their given level of risk; the only portfolios that rational, risk-averse investors will want to hold

8.5: Diversification

Diversification: the process of investing funds across several securities, which = reduced risk

Random (naive) diversification: randomly buying securities without considering relevant investment characteristics (company size, industry classification, and so on)

Unique (non-systematic) risk or diversifiable risk:risk that is eliminated by diversification

Market (systematic) risk or non-diversifiable risk: influenced by overall movements in the market or economy, cannot be eliminated by diversification

Total risk: $market\ (systematic)\ risk\ +\ unique\ (non-systematic)\ risk$

CHAPTER 9 (9.1 to 9.3)

9.1: The new efficient frontier with risk-free borrowing and lending

Risk premium:expected payoff that induces a risk-averse person to enter a risky situation

Insurance premium:the payment to get out of a risky situation

Risk-free investing

Tangent portfolio: the risky portfolio on the efficient frontier whose tangent line cuts the vertical axis at the risk-free rate

New (or super) efficient frontier: portfolios composed of the risk-free rate and the tangent portfolio that offer the highest expected rate of return for any given level of risk

Risk-free borrowing:

- Short position: a negative position in an asset; short position is achieved by borrowing part of the asset's purchase price from the stockbroker

The new efficient and the separation theorem

- Separation theorem: the investment decision (how to construct the portfolio of risky assets) is separate from the financing decision (how much should be invested or borrowed at the risk-free rate)
- Market portfolio: a portfolio that contains all risky securities in the market

9.2: The capital asset pricing model (CAPM)

Capital asset pricing model (CAPM): uses **market risk** as the only factor to relate expected returns to risk. Assumptions:

1. Investors have identical expectations: about expected returns, standard deviations, and correlation coefficients for all securities.
2. Investors have the same one-period time horizon.
3. Investors can borrow/lend money at the risk-free rate of return RF.
4. No transaction costs.
5. No personal income taxes: indifferent whether they receive capital gains/dividends.
6. Investors are price takers: There are many investors, and no single investor can affect the price of a stock through their buying/selling decisions.
7. Capital markets are in equilibrium.

The market portfolio and the capital market line (CML)

Capital market line (CML): depicts the highest attainable expected return for any given risk level that includes only efficient portfolios; all rational, risk-averse investors want to be on this line

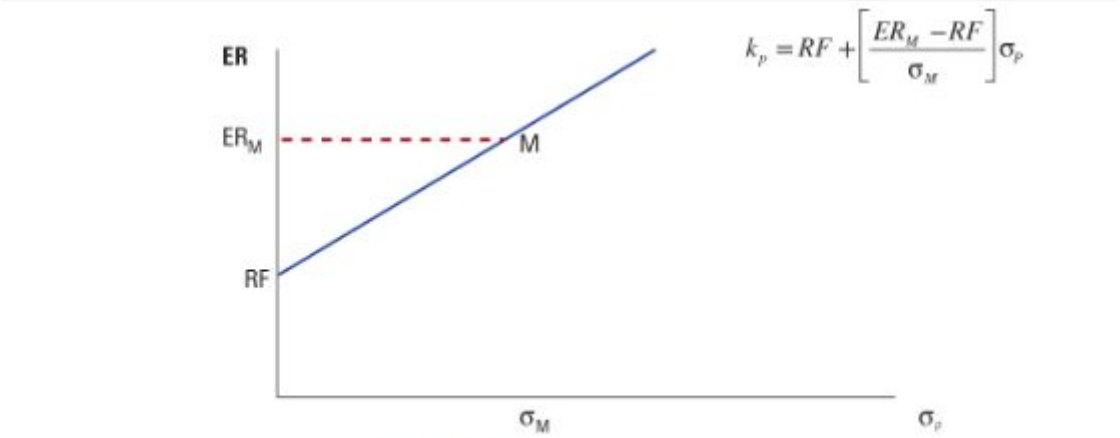


FIGURE 9-5 The Capital Market Line (CML)

Slope of CML: $\frac{ER_M - RF}{\sigma_M}$

Market price risk: additional expected return that the market demands for an increase in risk

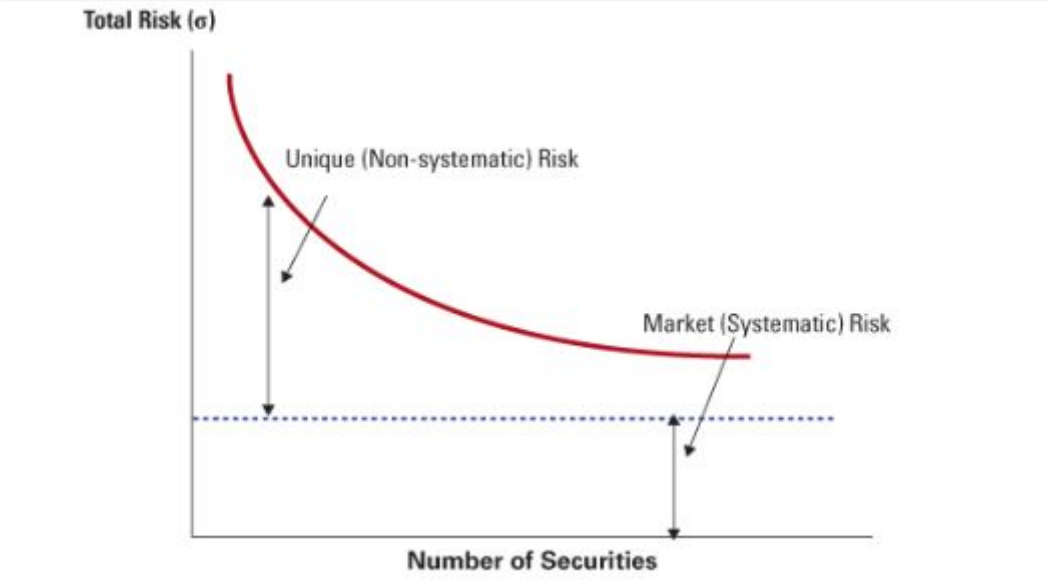
- The incremental expected return divided by the incremental risk

Sharpe ratio: Assesses portfolio performance and uses realized returns (ex post returns)

9.3: The CAPM & Market risk

Relationship between # of securities and risk: As # of securities increases in portfolio:

- unsystematic risk is eliminated
- systematic risk remains as depicted in figure 9.7:



Beta: measures **systematic risk** & performance volatility. Measures extent to which the return of a security moves with the return of the overall market

- Beta greater than 1 = more volatile/risky
- Beta less than 1= less volatile/risky
- Beta 0 = risk-free asset
- Beta negative = rare, only if security has negative correlation coefficient with market returns

Characteristic line: a line of best fit through the returns on an individual security, plotted on the vertical axis, relative to the returns for the market, plotted along the horizontal axis

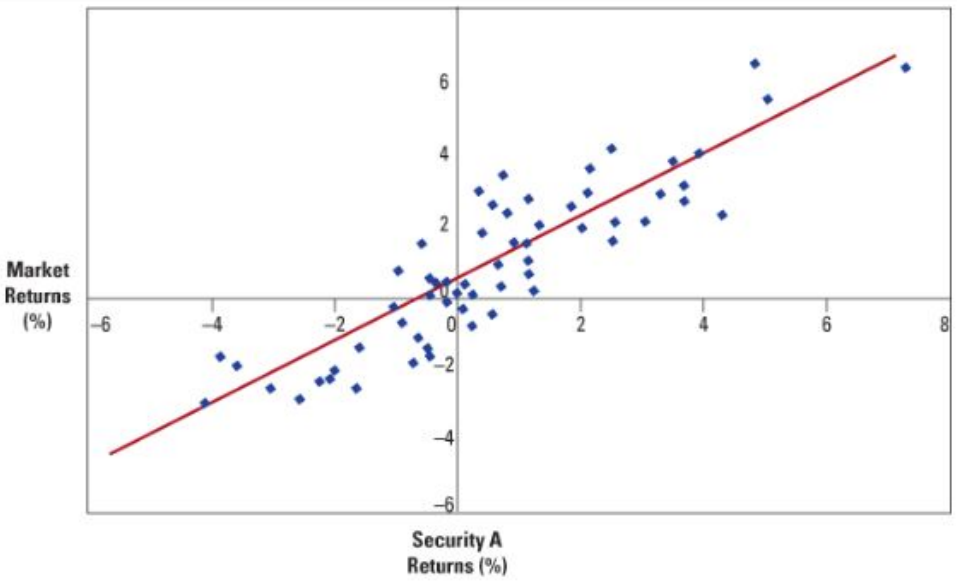


FIGURE 9-8 The Characteristic Line for Security A

The security market line (SML): the trade-off between market risk and the required rate of return for any risky investment, whether an individual security or a portfolio

- CML to derive SML: $k_i = RF + (ER_M - RF)\,\beta_i$
  - k_i = required return on security (or portfolio) i
  - $(ER_M - RF)$ = the market risk premium

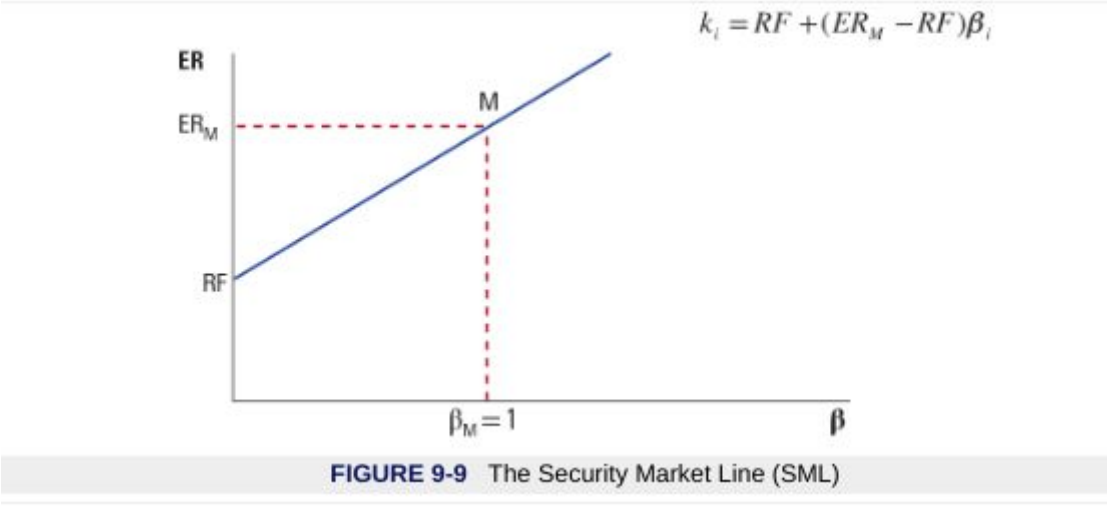


FIGURE 9-9 The Security Market Line (SML)

Market risk premium: the risk premium as a function of market conditions

The SML & Market equilibrium

- Equilibrium:
  - Expected return on **all properly priced securities** will lie *on* the SML
  - Expected return on **all portfolios** will lie *on* the CML
- If expected return on a security differs from its required rate of return according to CAPM, the security is either undervalued or overvalued.
  - **Undervalued:** expected returns (ER_M) is *greater* than required rate of return ($ER_P = k_i$) and will lie *above* the SML
  - **Overvalued:** expected returns (ER_M) are *less* than their required rate of return ($ER_P = k_i$) and will lie below the SML.

Alpha: difference between **actual excess return** on a security/portfolio during some period and the **return that should have been earned** according to its level of systematic risk (beta) and the use of the CAPM. This difference can be positive, negative, or zero.

CHAPTER 10 (10.1 to 10.5)

10.1: Defining market efficiency

Efficient market: a market that reacts quickly and accurately to new public information, which results in prices that are correct on average

- Disclosure: needed for an efficient market; revelation of all material facts so that everyone in the market is buying and selling based on the same material facts about the firm. Important part of

    - Securities law: ensures, through capital market regulations, that all investors have equal access/opportunity to react to, new/relevant information; governs the buying and selling of securities
- Assumptions for market efficiency:
    - Large number of rational, profit-maximizing investors who actively participate in the market by analyzing, valuing, and trading securities & investors are price-takers as the market is competitive
    - Information is free & widely available to everyone at the same time
    - Information arrives randomly (announcements are unrelated to one another)
    - Investors react quickly/fully to the new information & it is reflected in stock prices.

Sell-side analysts vs buy-side analysts

- Sell-side: monitor companies and regularly report on their value through earnings forecasts and buy/sell/hold recommendations
    - work for the investment banks that underwrite and sell securities to the public
- Buy-side: evaluate the research/recommendations by sell-side analysts
    - work for institutions in the capital market that invest in securities

3 Components of market efficiency (market conditions)

1. Operational efficiency: **transaction costs are low**
2. Allocational efficiency: **there are enough securities to efficiently allocate risk**
3. Informational efficiency: **important information is reflected in share prices**

Material facts: anything that can be expected to affect the share price

10.2: The efficient market hypothesis (EMH)

EMH: the theory that markets are efficient and prices always reflect all available information.
3 different levels of EMH

1. **Weak form EMH:** security prices reflect *all market data*, which refers to all past information.
    - Useless to use graphs of previous stock prices & technical trading rules based on "patterns" observed in previous prices
2. **Semi strong form EMH:** security prices reflect *all publicly known and available information*, which refers to all public information (information about earnings, dividends, corporate investments, management change, market data, etc.) If a market is semi-strong form efficient, **then it must also be weak form efficient.**
    - Useless to analyze publicly available information (financial statements), in an attempt to identify underpriced or overpriced securities
3. **Strong form EMH:** stock prices reflect *all information*, which refers to past, public and private information. Encompasses **both the weak and semi-strong versions.**

- Useless to use "inside" information that has not yet been released to the stock market.

10.3: Empirical evidence regarding market efficiency

3 types:

1. **Weak form evidence**
2. **Semi-strong form evidence**
3. **Strong form evidence**

Weak form evidence: past information is reflected in stock price

- Based on **random walk hypothesis:** prices follow a random walk, they change over time occurring independently of one another
- Ways to test weak form evidence:
  - Statistical tests
  - Technical analysis: analysis of historical trading information in order to identify patterns in trading data that can be used to invest successfully.
- Violations of weak form efficiency: exceptions
  - Momentum: tendency for stocks that have performed in previous 3- to 12-month period to outperform in the subsequent 3- to 12-month period
  - January effect: returns are higher in January than any other month in the year

Semi-strong form evidence: past + public information is reflected in stock price

- Ways to test semi-strong form evidence:
  - Stock price adjustments: study speed of stock price adjustments to announcements of significant new information.
  - Investor returns: study performance of investors to see if they are able to use publicly available information to always generate abnormal risk-adjusted returns over sustained periods
- Violations:
  - "value" stocks have consistently outperformed "growth" stocks
  - *Size effect anomaly:* small market cap stocks tend to outperform large cap stocks even after adjusting for risk

Strong form evidence: past + public + private information is reflected in stock price

- Violations:
  - Impossible that prices could reflect all information that is not public yet
  - It is common to examine the performance of groups that are thought to have access to "private" information, such as insiders

10.4: Behavioural finance

Behavioral finance: investor behaviour isn't always rational but is influenced by biases that create systematic errors in judgement

Traditional view of finance: suggests that investors

1. Consider all available information;
2. Act rationally and do not make systematic errors
3. Adhere to modern portfolio theory (MPT): they are risk averse, they diversify, and they consider risk in the context of a well-diversified portfolio.

Irrational forces motivating investors

- **Market volatility and loss aversion**
    - Loss aversion: tendency to place heavier emphasis on losses instead of gains
    - Risk aversion: tendency to dislike risk while still be willing to assume it compensation is adequate
- **Investor overconfidence and anchoring**
    - Anchoring: emotionally tied to some initial price or perception
    - Mental accounting: process of accounting for individual investments separately
- **Market efficiency and speculative bubbles**
    - Bubbles: significant/unnecessary increases in asset prices that create unsustainably high price levels

10.5: implications of market efficiency

Some of the implications for investors include the following:

- Technical analysis: studies trading data for patterns. Unlikely to result in substantial returns, because markets appear to be weak form efficient.
- Fundamental analysis: studies publicly available information. Unlikely to result in substantial returns although there is more chances if analysis is superior and consistent quality.
- "Active" trading strategies: are unlikely to outperform "passive" portfolio management strategies.
    - Active strategies: have extra costs, collecting and processing information, & trading costs.
    - Passive strategies minimize these costs and therefore provide "average" results.

- Paying attention to factors such as: expected return, acceptable risk levels, and diversification will increase likelihood of returns more than analysis of individual security prices.

CHAPTER 22 (22.10)

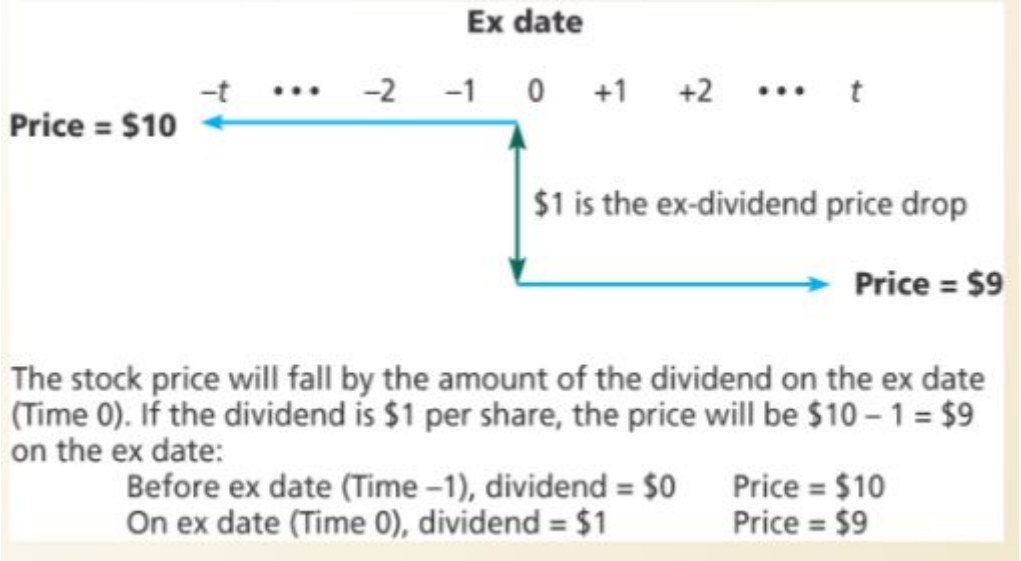
Cash dividends:

- **Regular cash dividend:** cash payments made directly to stockholders, usually each quarter
- **Extra cash dividend:** indication that the extra amount may not be repeated in the future
- **Liquidating dividend:** some or all of the business has been sold

Dividend payment in order:

1. **Declaration date:** board declares the dividend and it becomes a liability of the firm
2. **Ex-dividend date:** Occurs 2 business days before date of record. If you buy stock on or after this date, you will not receive the dividend. Stock price generally drops by about the amount of the dividend
3. **Date of record:** holders of record are determined and they will receive the dividend payment
4. **Date of payment:** cheques are mailed

Price behavior around ex-dividend date



Alternatives to paying a dividend

- Select additional capital budgeting projects
- Repurchase shares
- Acquire other companies

- Purchase financial assets

Stock repurchase:Company buys back its own shares of stock. Stock prices often increases when repurchases are announced. Sends positive signal → management believes that current price = low

- *Tender offer:* states a purchase price and a desire number of shares
    - more positive signal than open market because the company is stating a specific price
- *Open market:* buys stocks in the open market

Stock dividends:

- Pay additional shares of stock instead of cash
- Increases the number of outstanding shares
- If you own 100 shares & company declares a 10% stock dividend, you would receive an additional 10 shares

Stock splits:

- Stock splits: same as a stock dividend except expressed as a ratio. Stock price is reduced when the stock splits
    - Example: a 2 for 1 stock split is the same as a 100% stock dividend

Chapter 12: Options (12.1-12.2)

Types of options:

1. Call options
2. Put options

Call options: give holder right to buy underlying asset at the strike price (X) prior to expiry of option. Have a *bullish* outlook for the price of the underlying asset **as in you should buy a call option if you expect the price of the stock to go up**

Exercise price or strike price: at which an investor can buy underlying asset

Exercise: implement rights of options by buying (call) or selling (put)

Expiration date: last date at which options can be converted or exercised

Payoff: proceeds that would be generated from the option if today was the expiration date

European vs American options:

- European: can be exercised **only at expiry**

- American: can be exercised **at any time up to expiry**

Call writer: person who sells option (assumes a short position) & receives call premium. Have a *bearish* outlook for underlying asset. Payoff for call writer is the same as for the call holder

Call holder: person who buys option (assumes a long position). When underlying asset price (S) rises above the strike price (X), the intrinsic value of the call option is more than $0. *Bullish outlook*

Out, in and at the money for call options

- **Out-of-the-money:** underlying asset price is below strike price, IV= $0 → S<X
- **In-the-money:** underlying asset price is larger than strike price, IV = above $0 = exercise option → S>X
- **At-the-money**: exercise price = spot price of underlying asset, IV =$0 → S=X

Managers have the option to:

1. Cut back or abandon investments that go sour
2. Expand investments that do well

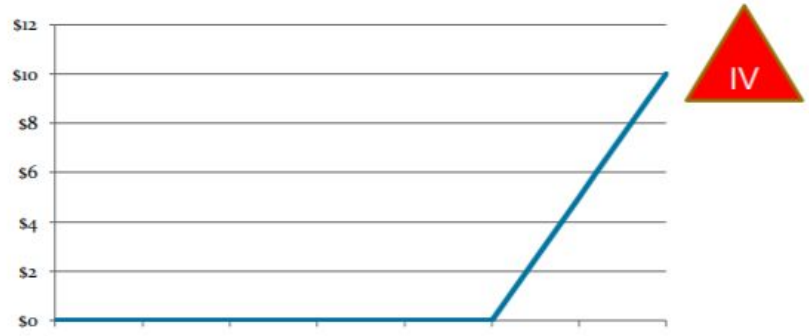
Call option payoff

Call Option Payoff:

Table:

If	Status	Exercise?	Payoff	Profit
S < X	OTM	NO	$0	– P
S = X	ATM	INDIFFERENT	$0	– P
S > X	ITM	YES	S – X	S – X – P

Graph:



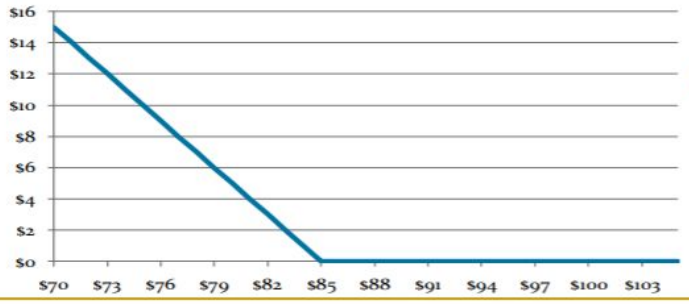
Put option payoff

Put Option Payoff:

Table:

If	Status	Exercise?	Payoff	Profit
S < X	ITM	YES	X – S	X – S – P
S = X	ATM	INDIFFERENT	$0	–P
S > X	OTM	NO	$0	–P

Graph:



Options and volatility: More volatility = more valuable option

Basic call option pricing relationships at expiry

- At expiry, an American call option is worth the same as a European option with the same characteristics
- If the call is in-the-money, it is worth $S_T - E$
- If the call is out-of-the-money, it is worthless

$C_{aT} = C_{eT} = Max[S_T - E, 0]$

- S_T = value of the stock at expiry (time T)
- E = exercise price
- C_{aT} = value of an american call at expiry
- C_{eT} = value of a european call at expiry

Options value

- Intrinsic value: difference between the exercise price of the option and the spot price of the underlying asset. The value of the option at expiration, **which is the PAYOFF**
    - Positive when option is **ITM**
    - Zero when option is **OTM**
    - **IV (call) =** max $[S - X, 0]$ = payoff
    - **IV (put) =** max $[X - S, 0]$ = payoff

- Speculative value: difference between the option premium and the intrinsic value of the option SV = OP − IV

Option Premium: market value of the option, OP= IV + TV

TV (time value): the difference between the option's premium and intrinsic value. Reflects the potential for beneficial price changes before option expiration.
TV= option premium − IV

Call option premium (values):

- Increase with the **price of the underlying asset, with risk, with time to expiration, with stock volatility, with the risk-free rate**
- Decrease with a **higher strike price** & as the **dividend payments increase**
- The value of a call option is *positively* related to the price of the underlying asset, the remaining time to expiration, and the volatility of the price of the underlying asset
- *Negatively* related to the dividend paid if the underlying asset is a company's stock.

Put options: give the holder the right to sell the underlying asset at the strike price prior to the expiry of the option. Have a "bearish" outlook for the price of the underlying asset **as in you should sell put options if you expect the price of the stock to decrease**

Basic put option pricing relationships at expiry

- At expiry, an american put option is worth the same as a european option with the same characteristics
- If the put is in-the-money, it is worth $E - S_t$
- If the put is out-of-the-money, it is worthless

$$P_{aT} = P_{eT} = Max\,[E - S_T,\ 0]$$

- P_{aT} = value of an american call at expiry
- P_{eT} = value of a european call at expiry

Put option values: factors affecting time premium: the same factors that drive put prices are the same factors that affect call prices but usually in the opposite direction

1. The put's maximum time value occurs at the strike price when its IV = 0
2. Put option prices are *positively* related to the strike price, time to expiration, the volatility of the underlying asset price, and dividend payments (as dividend payments increase, put prices increase).
3. Put option prices are *negatively* related to the underlying asset price and interest rates.

Factors Affecting Option Prices

	Call Prices	Put Prices
Higher asset price (S)	↑	↓
Higher strike price (X)	↓	↑
Longer time to expiration	↑	↑
Increased volatility	↑	↑
Increase in interest rates	↑	↓
Increased dividends	↓	↑

Put-call parity: the relationship between the price of a call options and a put option that have the same strike price and expiry dates (assuming they are not exercised before their expiration)

- Because the payoffs at expiration (T) will always be the same, the cost of constructing each portfolio must be the same
- With put as P, and cost of the call C, and S as the price of the underlying asset, we can therefore obtain equation: $P + S = C + PV(X)$

Option trading strategies

1. Covered call
2. Protective put

	Call option	**Put option**
Long (buy)	Max profit: ∞ Max loss: option premium	Max profit: strike price - option premium Max loss: option premium
Short (sell)	Max profit: option premium Max loss: ∞ ***Riskiest**	Max profit: option premium Max loss: strike price- option premium

Chapter 13: Capital budgeting, risk considerations, & other special issues (13.1-13.3)

Evaluating investment: alternatives in capital budgeting

- Methods
    - Payback, discounted payback
    - NPV
    - IRR
    - Profitability index
    - Average accounting return

Discounted cash flow (DCF) methodologies: ways for making capex decisions that are consistent with the overriding objective of maximizing shareholder wealth; they involve estimating future cash flows and comparing their discounted values with investment outlays required today

Payback period and discounted payback period:

1. **Payback period:** the number of years required to fully recover the initial cash outlay associated with a capital expenditure. Shorter payback periods are better. Intuitive measure of how long it takes to recover an investment and sometimes used as an informal measure or project risk b/c quicker firm recovers its investment outlay the less risky the project is = $CF_1 + CF_2 + CF_3 + ...CF_T$ *or* $\sum_{t=1}^{T} CF_t = CF_0$
    - Minimum acceptance criteria = set by management
    - Ranking criteria = set by management
    - Pros & cons
        i. Pros:
            1. Easy to understand
            2. Biased toward liquidity
        ii. Cons:
            1. Ignores time value of money
            2. Ignores cash flows after payback period
            3. Biased against long-term projects
            4. Requires an arbitrary acceptance criteria
    - Payback period = T = length of time required to recover the initial investment (CF_0)
    - Estimated future after-tax incremental cash flow at time t = CF_t
    - Estimated future after-tax incremental initial cash outlay = CF_0
2. **Discounted payback period:** accounts for the time value of money; it is defined as the number of years required to fully recover the initial cash outlay in terms of discounted cash flows. Shorter periods are better and projects with discounted payback periods before the cutoff date will be accepted. Ignores cash flows beyond the cutoff date

$$\frac{CF_1}{(1+k)^1} + \frac{CF_1}{(1+k)^1} + \frac{CF_1}{(1+k)^1} + \ldots \frac{CF_1}{(1+k)^1} = CF_0 \; or \; \sum_{t=1}^{T} = \frac{CF_t}{(1+k)^t}$$

- Cons:
  - i. Ignores cash flows after the payback period
  - ii. Biased against long-term projects
  - iii. Requires an arbitrary acceptance criteria
- k = appropriate risk-adjusted after-tax discount rate (which is usually the after-tax marginal cost of capital)

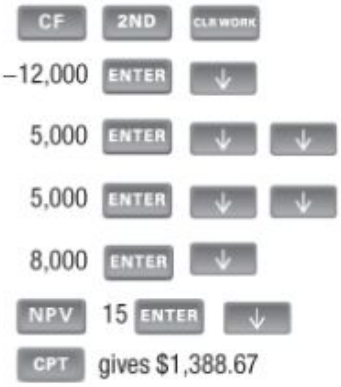
Net present value (NPV) analysis: is defined as the sum of the present value of all future after-tax incremental cash flows generated by an initial cash outlay, minus the present value of the investment outlays. In other words, it is the present value of the expected cash flows net of the costs needed to generate them

- Cash flows are **incremental,** which means they change as a result of the decision
- *Risk-adjusted discount rate (RADR):* is set based on the overall riskiness of the project and is a discount rate
  - Positive NPV projects: add value to the firm and should be accepted because it implies that the PV of the expected future cash flows will exceed the cash outlay today and increases value of the firm
  - Negative NPV projects: destroys firm's value and should be rejected because the destruction of shareholder value is not in the best interests of the shareholders

$$\frac{CF_1}{(1+k)^1} + \frac{CF_1}{(1+k)^1} + \frac{CF_1}{(1+k)^1} + \ldots \frac{CF_1}{(1+k)^1} - CF_0 \; or \; \sum_{t=1}^{T} = \frac{CF_t}{(1+k)^t} - CF_0$$

EXAMPLE 13-3

Solution Using a Financial Calculator



Calculating NPV when future CFs represent an annuity

A project that requires an initial investment of $30,000 is expected to generate after-tax cash flows of $5,000 per year for the next nine years, and then $6,000 in year 10. Estimate the NPV using a 12-percent discount rate.

WORKED SOLUTION

Solution

The "long version" of the solution, which involves discounting each of the nine future cash flows separately, is time-consuming and unnecessary. This is because the future CFs are all equal, at $5,000 (i.e., they form an annuity), except for the ending cash flow of $6,000, which we can view as another $5,000 payment, plus an additional one-time cash flow of $1,000. Therefore, we can solve the PV of the future cash flows by finding the sum of the PV of a 10-year annuity of $5,000 and the PV of a $1,000 cash flow, arriving at t equals 10, as follows:

$$\begin{aligned} PV_0 &= 5{,}000\left[\frac{1-\frac{1}{(1.12)^{10}}}{0.12}\right] + \frac{1{,}000}{(1.12)^{10}} = 5{,}000\,(5.650223) + (1{,}000)\,(0.32197) \\ &= 28{,}251.12 + 321.97 = \$28{,}573.09 \end{aligned}$$

So, $NPV = 28{,}573.09 - 30{,}000 = -\$1{,}426.91$

The project should be rejected, because it has a negative NPV and would destroy firm value.

EXAMPLE 13-4

Solution Using a Financial Calculator

Input the following variables:

1,000 → FV ; 5,000 → PMT ; 10 → N ; 12 → I/Y

Press CPT and then PV = −28,573.09 or, 28,573.09 (which is the PV of future CFs).

So $NPV = 28{,}573.09 - 30{,}000 = -\$1{,}426.91$

EXAMPLE 13-4

Solution Using a Financial Calculator

CF 2ND CLR WORK

−30,000 ENTER ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

6,000 ENTER ↓

NPV 12 ENTER ↓

CPT gives −$1,426.91

EXAMPLE 13-4

Solution Using a Financial Calculator

CF 2ND CLR WORK

−30,000 ENTER ↓

5,000 ENTER ↓

Because 5,000 occurs nine times, when F01 shows up on the screen, enter 9 then ENTER ↓

Then C02 will appear, so just enter 6,000, and finish as below.

6,000 ENTER ↓

NPV 12 ENTER ↓

CPT gives −$1,426.91

Internal rate of return (IRR): is the same as the yield to maturity (economic rate of return) for a bond, it is the discount rate that makes the NPV equal to 0 for a given set of cash flows. It is the discount rate that sets the PV of future CFs equal to the initial cash outlay. Also known as *economic rate of return* of a given project

- Accept project when IRR > *k* (appropriate risk-adjusted discount rate = cost of capital)

- Problems:
  - Timing problem
  - Multiple IRRs
  - The scale problem

$$\frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots \frac{CF_T}{(1+IRR)^T} = CF_0 \; or \; \sum_{t=1}^{T} = \frac{CF_t}{(1+IRR)^t}$$

Modified IRR: combine cash flows until only one change in sign remains (conventional project)

EXAMPLE 13-5

Solution Using a Financial Calculator

CF 2ND CLR WORK

−12,000 ENTER ↓

5,000 ENTER ↓ ↓

5,000 ENTER ↓ ↓

8,000 ENTER ↓

IRR CPT gives 21.31%. (Notice that our previous estimate was off by only 7 basis points.)

EXAMPLE 13-6

Calculating the IRR When Future CFs Represent an Annuity

Estimate the IRR for the project in Example 13-4.

WORKED SOLUTION ⊖

Solution

We will skip the long trial-and-error version of the solution, because it is unnecessary here: the future CFs are equal at $5,000 (i.e., they form an annuity), except for the ending cash flow of $6,000, which we can view as another $5,000 payment plus an extra $1,000 that can be discounted separately. Therefore, we can solve the IRR using a financial calculator.

EXAMPLE 13-6

Solution Using a Financial Calculator

Input the following variables:

1,000 → FV ; 5,000 → PMT ; -30,000 → PV ; 10 → N

CPT ; I/Y =10.84%

EXAMPLE 13-6

Solution Using a Financial Calculator

CF 2ND CLR WORK

−30,000 ENTER ↓

5,000 ENTER ↓

Because 5,000 occurs nine times, when F01 shows up on the screen, enter 9 then ENTER ↓

Then C02 will appear, so just enter 6,000, and finish as below.

6,000 ENTER ↓

IRR CPT gives 10.84%

NPV vs. IRR

- *Mutually exclusive projects:* means that a firm has to decide between them and can accept only one
- *Crossover rate:* a special discount rate at which the net present value of two projects cross (they are equal)

TABLE 13-1 NPV versus IRR

Issue	NPV	IRR
1. Future cash flows change sign	NPV works the same way for both accept/reject and ranking decisions.	Multiple IRRs may result—in this case, the IRR cannot be used for either accept/reject or ranking decisions.
2. Ranking projects	Higher NPV implies greater contribution to firm wealth—it is an absolute measure of wealth.	The higher IRR project may have a lower NPV, and vice versa, depending on the appropriate discount rate and the size of the project. For example, would analysts prefer an IRR of 100 percent on $1,000 or 20 percent on $1 million?
3. Reinvestment rate assumed for future cash flows received	Assumes all future cash flows are reinvested at the discount rate. This is appropriate because it treats the reinvestment of all future cash flows consistently, and k is the investor's opportunity cost.	Assumes cash flows from each project are reinvested at that project's IRR. This is inappropriate, particularly when the IRR is high.

- NPV and IRR yield the *same* ranking when evaluating *independent* projects. They may have *different* rankings when evaluating *mutually exclusive* projects.

Profitability Index (PI): is another DCF approach used to evaluated capital expenditure decisions, like the IRR, the PI is a relative measure of project attractiveness. Defined at the ratio of a project's discounted net incremental after-tax cash inflows divided by the discounted cash outflows, which are usually the initial after-tax cash outlays

- PI > 1 = accept project = + NPV
- PI < 1 = reject project = - NPV

$$PI = PV\ (cash\ inflows) \div PV\ (cash\ outflows)$$

EXAMPLE 13-8 Calculating the PI When Future CFs Represent an Annuity

Revisit Example 13-4 and estimate the PI of the project under consideration.

WORKED SOLUTION

Solution

$$\text{PI} = \frac{\$5{,}000\left[\frac{1-\frac{1}{(1.12)^{10}}}{0.12}\right] + \frac{1{,}000}{(1.12)^{10}}}{30.000} = \frac{28{,}573.09}{30{,}000} = 0.952$$

Therefore, this project should be rejected because its PI is less than 1.

Capital expenditures (capex): Capital expenditures are a firm's investments in long-lived assets.

- Long-lived assets can be:
    - Tangible (property, plant, equipment) = easier for firm to borrow against tangible assets
    - Intangible (R&D, patents,copyrights, trademarks, brand names, and franchise agreements)
- Capital expenditures determine the future direction of the company, they are among the most important that the firm can make because:
    - Involve lots of money and time
    - Often take many years to demonstrate their returns
    - Irrevocable
    - Because of their size and long-term nature, they can significantly alter the risk of the entire firm

Capital expenditure decisions: capital budgeting is the process through which a firm makes capital expenditure decisions by:

1. Identifying investment alternatives
2. Evaluating these alternatives
3. Implementing the chosen investment decisions
4. Monitoring and evaluating the implemented decisions

Porter's 5 forces that determine that attractiveness of an industry:

1. Entry barriers
2. Threat of substitutes
3. Bargaining power of buyers
4. Bargaining power of suppliers
5. Rivalry among existing competitors

Porter strategies to create competitive advantage

1. Cost leadership: be the lowest cost producer
2. Differentiation: offer differentiated products

Bottom-up analysis vs top-down analysis

1. Bottom-up: based on the idea that a firm is simply a set of capex decisions
    - Analysis is one of risks
2. Top-down: focuses on strategic decisions about which industries or products the girm should be involved in
    - Involve a situation of uncertainty

Relationships amongst projects: projects are

1. Independent: have no relationship with one another
2. Interdependent: do have relationships with one another

3. Contingent: projects for which the acceptance of one requires the acceptance of the other either beforehand or simultaneously
4. Mutually exclusive: only one project can be selected (i.e.: highest NPV)

Chain replication approach: involves finding a time horizon into which all the project lives under consideration divide equally and then assuming each project is repeated until they all reach this horizon

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EXAMPLE 13-9
The Chain Replication Approach

A company is considering three separate, mutually exclusive projects, A, B, and C. Project A requires a $10,000 cash outlay today and is expected to generate after-tax cash flows of $7,000 in year 1 and $6,000 in year 2. Project B requires an $8,500 cash outlay today and is expected to generate after-tax cash flows of $4,000 in year 1 and $7,000 in year 2. Project C requires a $10,600 cash outlay today and is expected to generate after-tax cash flows of $5,000 for each of the next three years. Assume that 15 percent is the appropriate discount rate, and use the chain replication approach to determine which project the firm should choose.

WORKED SOLUTION

Solution

Notice that projects A and B both have two-year time horizons, so we can calculate their respective NPVs and choose the one that generates the higher NPV, provided it is positive.

$$\text{NPV}_A = \left[\frac{7{,}000}{(1.15)^1} + \frac{6{,}000}{(1.15)^2}\right] - 10{,}000 = 10{,}623.82 - 10{,}000 = +623.82$$

$$\text{NPV}_B = \left[\frac{4{,}000}{(1.15)^1} + \frac{7{,}000}{(1.15)^2}\right] - 8{,}500 = 8{,}771.27 - 8{,}500 = +271.27$$

Therefore, the firm would choose project A over project B.
Now the firm would compare project A with project C, which has a three-year life.
First, it would calculate the NPV for project C.

$$\text{NPV}_C = \left[\frac{5{,}000}{(1.15)^1} + \frac{5{,}000}{(1.15)^2} + \frac{5{,}000}{(1.15)^3}\right] - 10{,}600 = 11{,}416.13 - 10{,}600 = +816.13$$

Project C is also attractive. Notice that it generates an NPV ($816.13) that is higher than the one A generates ($623.82) over a two-year period. If C produced an NPV that was lower than (or equal to) project A's NPV, which was generated over a shorter period, the firm would accept A over C. However, because this is not the case, the firm needs to determine the project that is best over a six-year period (because the projects have two- and three-year horizons).
The firm would now estimate the total NPV generated by projects A and C over a six-year time horizon, assuming A is replicated twice and C is replicated once.
Assuming A generates an NPV at time 0 of $623.82 (over years 1 and 2), the same NPV at time 2 (over years 3 and 4), and the same NPV at time 4 (over years 5 and 6), the total NPV at time 0 is as follows:

$$\text{NPV}_A = \left[623.82 + \frac{623.82}{(1.15)^2} + \frac{623.82}{(1.15)^4}\right] = 623.82 + 471.70 + 356.67 = \$1{,}452.19$$

Similarly, for project C, the total NPV is as follows:

$$\text{NPV}_C = \left[816.13 + \frac{816.13}{(1.15)^3}\right] = 816.13 + 536.62 = \$1{,}352.75$$

Therefore, project A should be accepted instead of project C, because it would generate a higher total NPV over a six-year period than project C would, assuming both projects can be replicated.

Equivalent annual NPV (NPV): compares projects by finding the net present value of individual projects and determining the amount of the annual annuity that is economically equivalent to the NPV generated by each project over its respective time horizon

$$EANPV = project\ NPV \div \left[\frac{1-\frac{1}{(1+k)^n}}{k}\right]$$

EXAMPLE 13-10
The EANPV Approach

Redo Example 13-9 using the EANPV approach instead of the chain replication approach.

WORKED SOLUTION

Solution

We already solved for the NPVs of all three projects in the solution to Example 13-9, so we will not replicate those calculations here. The NPVs for A, B, and C were $623.82, $271.27, and $816.13, respectively, and that would rule out project B, because it has the same lifespan as A but has a lower NPV. Therefore, all we need to do is compare the EANPV of A with the one for C.

$$EANPV_A = \frac{\text{Project NPV}_A}{\left[\frac{1-\frac{1}{(1+k)^2}}{k}\right]} = \frac{623.82}{\left[\frac{1-\frac{1}{(1.15)^2}}{0.15}\right]} = \frac{623.82}{1.625709} = \$383.72$$

$$EANPV_C = \frac{\text{Project NPV}_C}{\left[\frac{1-\frac{1}{(1+k)^3}}{k}\right]} = \frac{816.13}{\left[\frac{1-\frac{1}{(1.15)^3}}{0.15}\right]} = \frac{816.13}{2.283225} = \$357.45$$

EXAMPLE 13-10
Solution Using a Financial Calculator

Project A: 0 → FV; 623.82 → PV; 2 → N; 15 → I/Y;
CPT → PMT = −383.72 or $383.72

Project C: 0 → FV; 816.13 → PV; 3 → N; 15 → I/Y;
CPT → PMT = −357.45 or $357.45

Rejecting the project:

- NPV < 0
- IRR < required rate of return (k)
- discounted payback period > required period
- PI < 1

Qualities of a good criterion:

1. Consider all cash flows
2. Account for timing differences
3. Provide unambiguous decision rule
4. Measure wealth created for shareholders

Some criteria don't:

- Payback
- Discounted payback
- Average accounting return

The average accounting return rule

AAR = *average net income ÷ average book value of investment*

- Ranking criteria & min acceptance criteria set by mgmt
- Pros and cons
    - Pros:
        - Accounting information is usually available
        - Easy to calculate
    - Cons:
        - Ignores TVM
        - Uses arbitrary benchmark cutoff rate
        - Based on book values, not cash flows and market value

Chapter 14: Cash Flow estimation

Chapter 14: Cash-flow estimation (14.1-14.3)

General guidelines for estimating cash flows associated with capital expenditure decisions:

1. Estimate all cash flows after-tax: because taxes play an important role in any investment decision & we use after-tax cost of capital to discount these cash flows
2. Use appropriate cash flow estimates that represent marginal or incremental cash flows arising from capital budgeting decisions, including changes in existing flows that result from the firm's decisions
3. Do not include associated interest and dividend payments in estimated project cash flows; they should already be accounted for in the discount rate
4. Adjust cash flows to reflect any additional working capital requirements that are associated with the project
5. Treat sunk costs (have already been incurred, cannot be recovered) as irrelevant
6. Consider opportunity costs into cash flow estimates
7. Determine ideal time horizon for project
8. Ignore intangible considerations
9. Ignore externalities (consequences from investment that may benefit or harm unrelated third parties)
10. Consider the effect of all project interdependencies on cash flow estimates
11. Treat inflation consistently
12. Undertake all social investments required by law

The initial after-tax cash flow (CF_0): the total cash outlay that is required to initiate an investment project

Capital cost (C_0): all costs incurred to make an investment operations such as machinery installation, land clearing, etc.

$$CF_0 = C_0 + NWC_0 + OC$$

$\Delta\ NWC_0$ = change in net working capital requirements

OC = opportunity costs associated with the project

Expected annual after-tax cash flows (CF_t): estimated to occur as a result of the investment decision. Include expected incremental increase in after-tax operating income & incremental tax savings

Table 14.1 Common Asset Classes Established by Canada Revenue Agency

Asset Class	Type of Assets	CCA Rate
Class 1	Buildings	4%
Class 8	Office equipment	20%
Class 30	Automobiles, system software, etc.	30%
Class 43	Manufacturing equipment	30%
Class 45	Computers	45%

Two ways to deal with CCA:

1. Deduct CCA from operating income, then deduct the associated taxes payable and final add amount of the CCA expense back (because it is a non-cash expense)
2. Recognize that CCA creates tax savings for the firm in the amount of the CCA expense multiplied by company's effective tax rate (T) which is then added to the after-tax operating income, determined by deducting the taxes associated with the firm's before-tax operating income

TABLE 14-2 Two Ways to Determine Cash Flows after Capital Cost Allowance

(1) Before-tax operating income (before depreciation)	(2) Before-tax operating income (before depreciation)
−CCA	−Taxes payable on operating income
=Taxable income	=After-tax operating income
−Taxes payable	+CCA tax savings
=After-tax income	=Net cash flow
+CCA (non-cash expense)	
=Net cash flow	

Three things to notice from both approaches:

1. They both give the same result which leads to the following equation for annual operating cash flows:

$$CF_t = CFBT_t(1-T) + CCA_t(T)$$

$CFBT_t$ = cash flows before taxes (incremental pre-tax operating income)
CCA_t = the CCA expense for year t
T = firm's marginal or effective tax rate

2. CCA expense is lower in year 1 because of ½ year rule, it is highest in year 2 and declines in year 3 and declines every year thereafter as the UCC continually declines
3. After-tax operating income is the same for each year and we could view these cash flows as an annuity

Ending (or terminal) after-tax cash flow (ECF_n): the total cash flow that is expected to be generated in the terminal year of a project, aside from that year's expected after-tax cash flow, as determined above. Comprises the estimated selling or **salvage value** (estimated sale price of an asset at the end of its useful life) of the asset

- Selling price can have tax consequences: capital gains are taxable

$$ECF\ (with\ tax)_n = SV_n + \Delta NWC_n - \left[(SV_n - C_0)\,x\,T\right] - [(SV_n - UCC_n)\,xT]$$

Or $ECF_n = SV_n + \Delta NWC_n$

$ECF\ (with\ tax)_n$ = Ending cash flow in year n (at end of project life)

SV_n = estimated salvage value in year n for the asset purchased

ΔNWC_n = net working capital "released" upon termination of the project

C_0 = original capital cost of the asset

UCC_n = the asset (or asset class) ending UCC balance

T = firm's effective tax rate

NPV of project: $NPV = \sum_{t=1}^{n} \frac{CF_t}{(1+k)^t} - CF_0 = PV\ (future\ CFs) - CF_0$

or $NPV = PV\ (Annuals\ CFs) + PV\ (ECF_n) - CF_0$

PV of operating cash flows:

$$PV\ \ (operating\ cash\ flows) = CFBT\ \ (1-T)\ x\ [\frac{1-\frac{1}{(1+k)^n}}{k}]$$

PV (CCA tax shield):

$$\text{PV (CCA Tax Shield)} = \frac{(C_0)\,(d)\,(T)}{(d+k)} \times \frac{(1+0.5k)}{(1+k)} - \frac{(SV_n)\,(d)\,(T)}{(d+k)} \times \frac{1}{(1+k)^n}$$

d=applicable CCA rate

$$\text{PV (CCA Tax Shield)} = \frac{(C_0)\,(d)\,(T)}{(d+k)} \times \frac{(1+0.5k)}{(1+k)} - \frac{(UCC_n)\,(d)\,(T)}{(d+k)} \times \frac{1}{(1+k)^n} - \frac{(SV_r - UCC_r)\,(T)}{(1+k)^n}$$

PV (capital gains taxes paid) = $\frac{(SV_n - C_0)(T)}{(1+k)^n}$

$$\text{NPV} = \text{PV (Operating CFs)} + \text{PV (CCA Tax Shield)} + \text{PV}(ECF_n) - \text{PV (Capital Gains Taxes Paid)} - CF_0$$

Replacement decisions

Replacement projects: involve the replacement of an existing asset (or assets) with a new one

Expansion projects: projects that would add something extra to the firm in terms of extra sales or cost savings