Chapter 8 - Market Efficiency

Random walks and efficient market hypothesis (EMH)

Implications of EMH

The role of portfolio manager in an efficient market

Evidence of market efficiency and anomalies

Interpretation of EMH

Random walks and efficient market hypothesis (EMH)

Random walk: stock price changes are random and unpredictable
Efficient market: prices of securities in the market fully and quickly reflect all available information about those securities, which means that there is no arbitrage opportunity (no free lunch)

Arbitrage: practice of taking advantage of a price difference between two or more markets to make risk-free profits

Figures 8.1 and 8.2

Forms of efficiency:
Weak-form efficiency: stock prices already reflect all information contained in the history of past trading (past stock price, past trading volume, and past stock return)

Semistrong-form efficiency: stock prices already reflect all publicly available information in the market

Strong-form efficiency: stock prices already reflect all relevant information in the market, including inside (private) information

Implications of EMH

Technical analysis vs. fundamental analysis

Technical analysis: research on recurrent and predictable patterns in the market

Relative strength: compare the recent performance of a stock with that of the market or other stocks
Resistance level: a price level above which it is supposedly unlikely for a stock or stock index to rise
Support level: a price level below which it is supposedly unlikely for a stock or stock index to fall
Moving averages: 50-day (short term) and 200-day (long term) moving averages

If the market is efficient, what will happen to technical analysis?
Fundamental analysis: research on determinants of stock value, such as earnings and dividends prospects, expectations of future interest rates, and risk of the firm

Active vs. passive portfolio management

Active: search for mispriced (overvalued or undervalued) securities, buy and sell often to timing the market

Passive: buy and hold a well-diversified portfolio (buy and hold strategy)

- The role of portfolio manager in efficient market
  Diversification to reduce firm’s specific risks

- Tax consideration for different investors (clients)

- Resource allocation
  Demand for investment varies with age, tax bracket, risk aversion, and employment, etc., so portfolio managers can tailor portfolios for different investors.

- Evidence of market efficiency and anomalies
  Three main issues
  (1) The magnitude issue: fund managers deal with portfolios worth hundreds of millions. Only one tenth of 1% will be worth a lot.
  (2) Selection bias: if a manager knows a way to make money for sure, he/she will keep it secret.
  (3) Lucky event: sometimes, a fund has a superior performance. It can just be a lucky event (bet the right stocks).

Weak-form tests: patterns in stock returns

Serial correlation test: involves measuring the correlation between stock returns for various lags and the results indicate fairly weak and positive correlation for short-horizon returns (NYSE stock weekly returns) and fairly strong and negative correlation for long-horizon returns (correction or reversal effect)

Momentum effect: the tendency of poorly-performing stocks and well-performing stocks in one period to continue that abnormal pattern in following periods (3-12 months)

Buying past winners and selling past losers will make abnormal profits
Reversal effect: the tendency of poorly performing stocks and well-performing stocks in one period to experience reversals in the following period

Implication: short- and intermediate-horizon momentum and long-run reversal

Semi-strong form tests: market anomalies
Anomalies: patterns that seem to contradict the EMH

P/E ratio effect: low P/E ratio stocks have earned higher average risk-adjusted returns than high P/E ratio stocks

Small-firm effect: small firm stocks have earned higher abnormal (risk-adjusted) returns, primary in January - Figure 8.3

Neglected-firm effect: less well-known firm stocks have earned abnormal returns

Book-to-market effect: high book-to-market value stocks have earned abnormal returns - Figure 8.4

Post-earnings-announcement price effect: stock prices don’t reflect new information rapidly - Figure 8.5

Strong-form tests: inside information
Insiders make superior profits with inside information: the market is not strong-form efficient

- Interpretation of EMH
  Risk premium or inefficiency?

  For example, Fama and French’s (FF) three factor model indicates higher returns are associated with more risks – Figure 8.6

  Anomalies or data mining?

  Are markets efficient?

- ASSIGNMENTS

  1. Concept Checks and Summary
  2. Key Terms
  3. Intermediate: 11-18 and CFA 1-6
Chapters 10&11 - Debt Securities

- Bond characteristics
- Bond pricing
- Term structure theories
- Bond price behavior to interest rate changes
- Interest rate risk
- Bond rating
- Duration and immunization
- Bond investment strategies

- Bond characteristics
  Bond: long-term debt security that the issuer makes specified payments of interest (coupon payments) over a specific time period and repays a fixed amount of principal (par or face value) at maturity; government bonds (T-bonds and T-notes, municipal bonds), corporate bonds, international bonds

  Face value or par value: usually $1,000

  Coupon rate and interest payment

  Zero-coupon bond: coupon rate is zero, no coupon payment, sells at a discount. For example: a 10 year zero-coupon bond sells at $550 and yields 6.16% per year

  Maturity date

  Call provision: the issuer can repurchase bonds during the call period

  Call premium and call price

  Convertible bonds: can be converted into common stocks

  Puttable bonds: bondholders can choose to exchange for par value at some date or to extend for a given number of years

  Floating-rate bonds: coupon rates vary with some market rates

  Indexed bonds: payments are tied to a general price index

  Junk bonds: high yields with high default risk

  Preferred stocks: hybrid security, often considered as an equity but usually included in fixed-income securities
• Bond pricing
  Accrued interest and quoted price – Figure 10.1

  Invoice price = quoted (flat) price + accrued interest

  \[ \text{Invoice price} = \frac{\text{quoted price}}{182 \text{ days}} \times \text{accrued interest} \]

  40 days  142 days remaining until next coupon

  Suppose annual coupon is $80 and the quoted price is $990,

  Invoice price = 990 + (40/182)*40 = $998.79

  Bond price = present value of coupons + present value of par value

  The required rate of return serves as the discount rate

  Premium bonds vs. discount bonds

  A premium bond sells for more than its face value ($1,000)
  A discount bond sells for less than its face value ($1,000)

  Annual interest payment valuation model

  \[ P = C \left( \text{PVIFA}_{r,n} \right) + \text{PV} \left( \text{PVIF}_{r,n} \right), \]

  \[ P: \text{intrinsic value of the bond} \]
  \[ C: \text{annual coupon payment} \]
  \[ r: \text{the required rate of return, the market interest rate for the bond} \]
  \[ n: \text{the number of years until the bond matures} \]
  \[ \text{PV}: \text{par value (face value, $1,000 usually)} \]

  Semiannual interest payment valuation model: adjust the annual coupon to
  semiannual (C to C/2), the annual required rate of return to semiannual (r to r/2),
  and the number of years to maturity to semiannual periods (n to 2n)

  Overpriced securities vs. underpriced securities

  If the intrinsic value > the market price, the bond in the market is underpriced
  If the intrinsic value < the market price, the bond in the market is overpriced
  If the intrinsic value = the market price, the bond in the market is fairly priced

  Example: A 30-year 8% coupon bond pays semiannual coupon payments. The
  market interest rate (required rate of return) on the bond is 10%. What should be
  the bond price (fair value)? If the market price of the bond is $850.00, should you
  buy the bond?
Answer: n = 60, i/y = 5%, FV = 1,000, PMT = 40, solve for PV = -810.71
No, you should not buy the bond since the intrinsic value ($810.71) < the market price ($850.00). The bond in the market is overpriced.

If the market interest rate for the bond is 8%, what should be the bond price?
Answer: PV = -1,000

If the market interest rate for the bond is 7%, what should be the bond price?
Answer: PV = -1,124.72

Bond price and market interest rates have an inverse relationship: keeping other things constant, the higher the market interest rate, the lower the bond price (Figure 10.3)

Yield to maturity (YTM): rate of return from a bond if it is held to maturity

Example (continued): what is YTM of the bond?
Answer: PV = -850, FV = 1,000, PMT = 40, n = 60, solve for i/y = 4.76%, YTM = 4.76*2 = 9.52%

Yield to call (YTC): rate of return from a bond until it is called

Example (continued): suppose the bond can be called after 5 years at a call price of $1,050, what is YTC?
Answer: PV = -850, FV = 1,050, PMT = 40, n = 10, solve for i/y = 6.45%, YTC = 6.45*2 = 12.91%

Current yield (CY): annual coupon payment divided by the current bond price
Example (continued): what is the current yield of the bond?
CY = 80/850 = 9.41%

If market interest rates rise what would happen to the current yield of a bond?
Answer: the current yield would increase since the bond price would decrease

Realized compound return: compound rate of return on a bond with all coupons reinvested until maturity

Example: 10.7 (Figure 10.5)
Consider a two-year bond selling at par and paying 10% coupon once a year. The YTM is 10%. If the coupon payment is reinvested at an interest rate of 8% per year, the realized compound return will be less than 10% (actually it will be 9.91%)
• Term structure theories
  Term structure of interest rates: relationship between time to maturity and yields for a particular fixed-income security

Yield curve: a graphical presentation of the term structure

Expectation theory: the yield curve is determined solely by expectations of future short-term interest rates

Forward rates: implied short-term interest rates in the future

Example: suppose that two-year maturity bonds offer yields to maturity of 6% and three-year bonds have yields of 7%. What is the forward rate for the third year?

Using the formula: \((1 + y_2)^2 = (1 + y_3)^3 - 1 \times (1 + f_3)\) and solving for \(f_3 = 9.02\%\)

Approximation: \(f_3 = 7\% \times 3 - 2 \times 6\% = 9.00\%\)

Liquidity preference theory: investors demand a risk premium on long-term bonds

Liquidity premium: the extra expected return to compensate for higher risk of holding longer term bonds

Market segmentation theory: investors have their preferences to specific maturity sectors and unwilling to shift from one sector to another

• Bond price behavior to interest rate changes
  (1) The value of a bond is inversely related to its yield: As yields increase, bond prices fall; as yields fall, bond prices rise – Figure 11.1

  (2) An increase in a bond’s yield to maturity results in a smaller price change than a decrease in yield of equal magnitude – Figure 11.1

  (3) As the maturity date approaches, the value of a bond approaches to its par value – Figure 10.6

  (4) Prices of long-term bonds tend to be more sensitive to interest rate changes than prices of short-term bonds – Figure 11.1

  (5) The sensitivity of bond prices to changes in yields increases at a deceasing rate as maturity increases – Figure 11.1

  (6) Interest rate risk is inversely related to the bond’s coupon rate. Prices of low-coupon bonds are more sensitive to changes in interest rates than prices of high-coupon bonds – Figure 11.1
(7) The sensitivity of a bond’s price to a change in its yield is inversely related to the yield to maturity at which the bond is currently selling – Figure 11.1

- Interest rate risk
  Interest rate price risk vs. interest rate reinvestment risk (reinvestment risk)
  
  Interest rate price risk: risk that a bond value (price) falls when market interest rates rise
  
  Reinvestment risk: risk that the interests received from a bond will be reinvested at a lower rate if market interest rates fall

- Bond rating
  Letter grades that designate quality (safety) of bonds
  AAA
  AA
  A \{ Investment grade bonds with low default risk
  BBB
  BB
  B \{ Speculative grade (junk) bonds with high default risk

  Moody’s and S&P rate each corporate bond with a letter grade – Figure 10.8

Why bond rating?
Firm's credit – default risk
Borrowing capacity

Determinants:
Coverage ratios - ratios of earnings to fixed costs
Leverage ratio - debt to equity ratio
Liquidity ratios - current ratio and quick ratio
Profitability ratios - ROA and ROE
Cash-flow-to debt ratio - ratio of total cash to outstanding debt

Bond indenture: a document defining the contract between the bond issuer and the bondholder

Sinking funds
Subordination of further debt
Dividend restrictions
Collateral vs. debenture
Duration and immunization

Duration: a measure of the effective maturity of a bond, defined as the weighted average of the times until each payment is made, with weights proportional to the present value of the payment.

Measuring duration: Macaulay duration = \( D = \sum_{t=1}^{T} t^* w_t \), where \( w_t = \frac{CF_t}{P_0} (1+y)^t \)

Note: \( T \) is the number of years until the bond matures, \( y \) is the yield to maturity, and \( P_0 \) is the market price of the bond

Example: A 3-year bond with coupon rate of 8%, payable annually, sells for $950.25 (face value is $1,000). What is yield to maturity? What is \( D \)?

Answer: \( y = 10\% \), \( D = 2.78 \) years (Spreadsheet 11.2)

Relationship between duration and bond price volatility

\[
\frac{\Delta P}{P} = -D \frac{\Delta(1+y)}{1+y} = -D^* \Delta y
\]

where \( D^* = \frac{D}{1+y} \), is the modified duration

Example (continued): What is \( D^* \)?

Answer: \( D^* = D/(1+y) = 2.53 \) years

If the yield drops by 1%, what will happen to the bond price?

Answer: the price will increase by 2.53%

If the yield rises by 1%, what will happen to the bond price?

Answer: the price will decrease by 2.53%

Rules for duration

1. For a zero-coupon bond, the duration is equal to the time to maturity
2. The lower the coupon rate, the higher the \( D \)
3. The longer the time to maturity, the higher the \( D \)
4. The lower the yield, the higher the \( D \)
5. For a perpetuity, the \( D = (1+y)/y \)
Bond immunization: a strategy to shield net worth from interest rate movements; to get interest rate price risk and interest rate reinvestment risk to cancel out each other over a certain time period to meet a given promised stream of cash outflows.

See the example (Table 11.4)

Note: immunization works only for small changes in interest rates.

Cash flow matching: matching cash flows from a fixed-income portfolio with those of an obligation.

Dedication strategy: refers to multi-period cash flow matching.

Application of bond immunization: banking management, pension fund management.

- **Bond investment strategies**
  - Passive strategy: lock in specified rates given the risk (buy and hold strategy).
  - Active management strategy: more aggressive and risky; try to timing the market.

Bond swaps: an investment strategy where an investor liquidates one bond holding and simultaneously buys a different issue (more in FIN 436).

Interest rate swaps: a contract between two parties to exchange a series of cash flows based on fixed-income securities (more in FIN 436).

Tax swaps: replace a bond that has a capital loss for a similar security in order to offset a gain in another part of an investment portfolio.

- **ASSIGNMENTS**

  Chapter 10
  1. Concept Checks and Summary
  2. Key Terms
  3. Intermediate: 12-17 and CFA 1-5

  Chapter 11
  1. Concept Checks and Summary
  2. Key Terms
  3. Intermediate: 10-13, CFA 1, 2 and 10
Chapter 12 - Macroeconomic and Industry Analysis

- Global economy
- Domestic macroeconomic conditions
- Industry analysis
- Company analysis

- Global economy
  Top-down analysis starts with the global economy: overview of the economic conditions around the world – Table 12.1

  Exchange rate and exchange rate risk – Figure 12.1

  Political risk (country risk)

- Domestic macroeconomic conditions
  To develop an economic outlook for domestic economy

  Gross domestic product (GDP): total value of goods and services produced
  High grow rate of GDP indicates rapid expansion – check for inflation
  Negative grow rate of GDP indicates contraction – check for recession

  Demand and/or supply shocks

  Unemployment rate

  Inflation: general level of prices for goods and services

  Interest rates
  Nominal interest rates vs. real interest rates

  Determinants of interest rates
  Supply side: from savers, mainly households
  Demand side: from borrowers, mainly business
  Government side: borrower or saver, through Fed
  The expected inflation rate

  Budget deficit: spending exceeds revenue

  Sentiment: optimism or pessimism of the economy

  Federal government policy: fiscal and monetary policies

  Fiscal policy - the government uses spending and taxing to stabilize the economy
Monetary policy - the Fed uses money supply and interest rate to stabilize the economy (price level)

Consumer spending

Exchange rates

Business cycle: repetitive cycles of recession and recovery - Figure 12.4

Peak vs. trough

Cyclical industries: with above average sensitivity to the state of the economy

Defensive industries: with below average sensitivity of the state of the economy

Economic indicators - Table 12.2
Leading indicators: rise or fall in advance of the rest of the economy
Coincident indicators: rise or fall with the economy
Lagging indicators: rise or fall following the economy

Other indicators – Figure 12.6

- Industrial analysis
  To develop an industrial outlook – Figures 12-7 and 12.8

  NAICS (North American Industry Classification System) code to classify industries - Table 12.5

  Sensitivity to the business cycle: sales, operating leverage, financial leverage

  Sector rotation: an investment strategy that shifts funds to the portfolio industry sectors that are expected to outperform other sectors – Figure 12.12

  Industry life cycle: stages through which firms typically pass as they mature – Figure 12.13

  Industry structure and performance
  Threat of entry
  Competitors
  Substitutes
  Bargaining power
  Technology development
  Future demand
  Labor problem
  Regulations
Company analysis
Fundamental analysis: intrinsic value, financial statements, ratio analysis, earnings and growth forecast, P/E ratio, and required rate of return (risk)

Valuation models (covered in Chapter 13)

ASSIGNMENTS
1. Concept Checks and Summary
2. Key Terms

CFA 5 - Example

a. Which one of the following statements best expresses the central idea of countercyclical fiscal policy:

Answer:
(4) Government deficits are planned during the economic recessions, and surpluses are utilized to restrain inflationary booms.

b. Which one of the following propositions would a strong proponent of supply-side economics be most likely to stress?

Answer:
(2) Higher marginal tax rates promote economic inefficiency and thereby retard aggregate output because they encourage investors to undertake low productivity projects with substantial tax-shelter benefits.
Chapter 13 - Equity Valuation

- Characteristics of common stock
- Valuation by comparables
- Dividend discount model (DDM)
- Alternative models
- Free cash flow valuation approach

- Characteristics of common stocks
  Ownership with residual claims

  Advantages and disadvantages of common stock ownership
  Higher returns
  Easy to buy and sell (liquidity)
  Higher risk
  Less current income

  Cash dividend, stock dividend, and stock split

  Treasury stocks - repurchased stocks held by a firm

  Capital gains yield and dividend yield

- Valuation by comparables
  Stocks with similar characteristics should sell for similar prices

  Book value: the net worth of common equity according to a firm’s balance sheet

  Liquidation value: net amount that can be realized by selling the assets of a firm and paying off the debt

  Replacement cost: cost to replace a firm’s assets

  Tobin’s q: the ratio of market value of the firm to replacement cost

  P/E ratio approach
  Price-to-sales ratio approach
  Market-to-book value approach
  Price-to-cash flow approach

  Example (Table 13.1)
• Dividend discount model (DDM)
  Market price vs. intrinsic value

Market price: the actual price that is determined by the demand and supply in the market

Intrinsic value: the present value of a firm’s expected future net cash flows discounted by the required rate of return

In market equilibrium, the required rate of return is the market capitalization rate

Net income, retained earnings, and cash dividends

General formula: \( V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k)^t} \)

Forecasting sales and growth rate: \( g = \text{ROE} \times b \) (\( b \) is the retention ratio)

Estimating EPS and DPS

(1) Zero growth DDM (\( g = 0 \)), which means that dividend is a constant (\( D \))

\[
V_0 = \frac{D}{k} \quad \text{or} \quad E(r) = \frac{D}{P_0}
\]

where \( k \) is the required rate of return and \( E(r) \) is the expected rate of return

Example: if \( D = 2.00 \) (constant) and \( k = 10\% \), then \( V_0 = 20.00 \)

Preferred stocks can be treated as common stocks with zero growth (\( g = 0 \))

(2) Constant growth DDM (\( g = \text{a constant} \))

\[
D_1 = D_0(1+g)
\]

\[
D_2 = D_1(1+g) = D_0(1+g)^2
\]

In general, \( D_i = D_0(1+g)^i \)

\[
V_0 = \frac{D_1}{k-g} = \frac{D_0(1+g)}{k-g} \quad \text{or} \quad E(r) = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g
\]

Example: assume \( D_0 = 3.81 \), \( g = 5\% \), \( k = 12\% \), then \( V_0 = 57.14 \)

If the market price of the stock is \$55, then the expected rate of return is \( [3.81*(1 + 0.05) / 55] + 0.05 = 12.27\% \)
Stock price and PVGO (present value of growth opportunity)

Dividend payout ratio \((1-b)\) vs. plowback ratio \((b, \text{earnings retention ratio})\)

Price = no-growth value per share + PVGO

\[
P_0 = \frac{E_1}{k} + PVGO, \text{ where } \frac{E_1}{k} \text{ is the no-growth value per share}
\]

Example: assume \(E_1 = \$5.00, k = 12.5\%, \text{ROE} = 15\%\)

If \(D_1 = \$5.00, \text{then } g = 0\% \text{ (}g = \text{ROE} \times b, b = 0\text{)}\)

\(P_0 = \frac{5}{0.125} = \$40.00\)

If \(b = 60\%, \text{then } g = 15\% \times 0.6 = 9\%, D_1 = 5 \times (1 - 0.6) = \$2.00\)

\(P_0 = \frac{2.00}{0.125 - 0.09} = \$57.14 \text{ (from constant DDM)}\)

\(PVGO = 57.14 - 40.00 = \$17.14\)

(3) Life cycle and multistage growth models: the growth rates are different at different stages, but eventually it will be a constant

Two-stage growth DDM

Example: Honda Motor Co.

Expected dividend in next four years:

<table>
<thead>
<tr>
<th>Year</th>
<th>Dividend</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$0.72</td>
</tr>
<tr>
<td>2012</td>
<td>$0.81</td>
</tr>
<tr>
<td>2013</td>
<td>$0.90</td>
</tr>
<tr>
<td>2014</td>
<td>$1.00</td>
</tr>
<tr>
<td>2015</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

Dividend growth rate will be steady beyond 2015

Assume \(\text{ROE} = 10\%, \text{ } b = 75\%, \text{then long-term growth rate } g = 7.5\%\)

Honda’s beta is 0.90, if the risk-free rate is 2.9\% and the market premium is 8\%, then \(k = 10.1\% \text{ (from CAPM)}\)

Using constant DDM, \(P_{2015} = \frac{1.00 \times (1 + 0.075)}{(0.101 - 0.075)} = \$41.35\)

<table>
<thead>
<tr>
<th>Year</th>
<th>$0.72</th>
<th>$0.81</th>
<th>$0.90</th>
<th>$1.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>2012</td>
<td>2013</td>
<td>2014</td>
<td>2015</td>
</tr>
</tbody>
</table>

\(\$41.35\)

Discount all the cash flows to the present at 10.1\%, \(V_{2011} = \$30.81\)

Multistage growth DDM: extension of two stage DDM
• Alternatives models

  P/E ratio approach
  If \( g = \text{ROE}^*b \), the constant growth DDM can be written as

  \[
  \frac{P_0}{E_1} = \frac{1-b}{k - (\text{ROE}^*b)}, \text{ where } k > \text{ROE}^*b
  \]

  Since P/E ratio indicates firm’s growth opportunity, P/E over g (call PEG ratio) should be close to 1.

  If PEG ratio is less than 1, it is a good bargain. For the S&P index over the past 20 years, the PEG ratio is between 1 and 1.5.

  Price-to-book ratio approach

  Price-to-cash flow ratio approach

  Price-to-sales ratio approach

• Free cash flow valuation approach

  Free cash flow: cash flow available to the firm or to the shareholders

  Free cash flow to the firm (FCFF)

  \[
  \text{FCFF} = \text{EBIT}*(1-t_c) + \text{depreciation} - \text{capital expenditures} - \text{increase in NWC}
  \]

  Use FCFF to estimate firm’s value by discounting all future FCFF (including a terminal value, \( P_T \)) to the present at WACC

  Free cash flow to equity holders

  \[
  \text{FCFE} = \text{FCFF} - \text{interest expense}*(1-t_c) + \text{increases in net debt}
  \]

  Use FCFE to estimate equity value by discounting all future FCFE (including a terminal value, \( P_T \)) to the present at cost of equity

  Examples

• ASSIGNMENTS

  1. Concept Checks and Summary
  2. Key Terms