# Economics of Financial Markets – Lecture 5

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# Preview

- Today we examining the theory of **rational expectations**.
- When this theory is applied to financial markets, the outcome is **the efficient market hypothesis**, which has some general implications for how markets in other securities besides stocks operate.

# Learning Objectives

- Calculate the price of common stock.
- Recognize the impact of **new information** on stock prices.
- Compare and contrast **adaptive and rational expectations**.
- Explain why **arbitrage opportunities** imply that the efficient market hypothesis holds.

# Learning Objectives

- Identify and explain the **implications of the efficient market hypothesis** for financial markets.
- Summarize the reasons why **behavioral finance** suggestions that the efficient market hypothesis may not hold.

# Stock Valuation: Example

- After a year, you will need to sell your investment to pay tuition.
- Suppose that you want to buy Intel Corp. stock.
- Intel is currently selling for $50 per share, and pays $0.16 per year in dividencs.
- It is estimated that the stock will be selling for $60 in one year.

# The One-Period Valuation Model

The One-Period Valuation Model:

$$P_0 = \frac{Div_1}{(1+k_e)} + \frac{P_1}{(1+k_e)}$$

$P_0$ = the current price of the stock

$Div_1$ = the dividend paid at the end of year 1

$k_e$ = the required return on investment in equity

$P_1$ = the sale price of the stock at the end of the first period

# By using the one-period valuation model,

- You would be satisfied to earn a 12% return.
- From the one-period valuation model,

$$P_0 = \frac{0.16}{1+0.12} + \frac{\$60}{1+0.12} = \$0.14 + \$53.57 = \$53.71$$

- Because it sells for $50 now, you may want to buy it.
- The value of any investment is calculated by computing the present value of all cash flows the investment will generate over its life.

# The Generalized Dividend Valuation Model

The Generalized Dividend Valuation Model:

The value of stock today is the present value of all future cash flows

$$P_0 = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

If $P_n$ is far in the future, it will not affect $P_0$

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t}$$

The price of the stock is determined only by the present value of the future dividend stream

# The Gordon Growth Model

The First Assumption: Dividends are assumed to continue growing at a constant rate forever, that is,

$$D_1 = D_0 \times (1+g)$$

$$D_2 = D_0 \times (1+g)^2$$

$$P_0 = \frac{D_0(1+g)}{(k_e - g)} = \frac{D_1}{(k_e - g)}$$

$D_0$ = the most recent dividend paid

$g$ = the expected constant growth rate in dividends

$k_e$ = the required return on an investment in equity

Dividends are assumed to continue growing at a constant rate forever

The growth rate is assumed to be less than the required return on equity

# From Generalized Dividend Valuation Model to the Gordon Growth Model

$$P_0 = \frac{D_0 \times (1+g)^1}{(1+k_e)^1} + \frac{D_0 \times (1+g)^2}{(1+k_e)^2} + \ldots + \frac{D_0 \times (1+g)^\infty}{(1+k_e)^\infty}$$

- Multiply both sides by $(1+k_e)/(1+g)$,

$$P_0 \times \frac{1+k_e}{1+g} = D_0 + \frac{D_0 \times (1+g)^1}{(1+k_e)^1} + \frac{D_0 \times (1+g)^2}{(1+k_e)^2} + \ldots + \frac{D_0 \times (1+g)^\infty}{(1+k_e)^\infty}$$

- Subtracting the original equation from the result, we obtain

$$P_0 \times \left[ \frac{1+k_e}{1+g} - 1 \right] = D_0 - \frac{D_0 \times (1+g)^\infty}{(1+k_e)^\infty}$$

# The Second Assumption

- Assuming $k_e > g$, $\frac{D_0 \times (1+g)^{\infty}}{(1+k_e)^{\infty}} \to 0$

- Thus,

$$P_0 \times \left[ \frac{1+k_e}{1+g} - 1 \right] = D_0$$

$$P_0 \times \frac{1+k_e-1-g}{1+g} = D_0$$

$$P_0 = \frac{D_0 \times (1+g)}{k_e - g} = \frac{D_1}{k_e - g}$$

# How the Market Sets Stock Prices

- The price is set by the buyer willing to pay the highest price.
- The market price will be set by the buyer who can take best advantage of the asset.
- Superior information about an asset can increase its value by reducing its perceived risk.

# How the Market Sets Stock Prices

- Information is important for individuals to value each asset.
- When new information is released about a firm, expectations and prices change.
- Market participants constantly receive information and revise their expectations, so stock prices change frequently.

# Application: The Global Financial Crisis and the Stock Market

- The financial crisis that started in August 2007 led to one of the worst bear markets in 50 years.
- Downward revision of growth prospects: $\downarrow g$
- Increased uncertainty: $\uparrow k_e$
- Gordon model predicts a drop in stock prices.

# The Theory of Rational Expectations

- Adaptive expectations:
  - Expectations are formed from past experience only.
  - Changes in expectations will occur slowly over time as data changes.
  - However, people use more than just past data to form their expectations and sometimes change their expectations quickly.

# The Theory of Rational Expectations

- Expectations will be identical to optimal forecasts using all available information.
- Even though a rational expectation equals the optimal forecast using all available information, a prediction based on it may not always be perfectly accurate.
  - People might be aware of all available information but find it takes too much effort to make their expectation the best guess possible.
  - People might be unaware of some available relevant information so that their best guess of the future will not be accurate.

# Formal Statement of the Theory

$$X^{e} = X^{of}$$

$X^{e}$ = expectation of the variable that is being forecast

$X^{of}$ = optimal forecast using all available information

**The expectation of X equals the optimal forecast using all available information.**

# Rationale Behind the Theory

- The incentives for equating expectations with optimal forecasts are especially strong in financial markets. In these markets, people with better forecasts of the future get rich.
- The application of the theory of rational expectations to financial markets (where it is called the **efficient market hypothesis** or the **theory of efficient capital markets**) is thus particularly useful.

# Implications of the Theory

- If there is a change in the way a variable moves, the way in which expectations of the variable are formed will change as well.
  - Changes in the conduct of monetary policy (e.g. target the federal funds rate)
  - If today's interest rate is high relative to the normal level, an optimal forecast is that it will decline to the normal level.
  - However, suppose that if when the interest rate is high, it says high. Then it will predict that it will stay high.
- The forecast errors of expectations will, on average, be zero and cannot be predicted ahead of time.

# The Efficient Market Hypothesis: Rational Expectations in Financial Markets

Recall

The rate of return from holding a security equals the sum of the capital gain on the security, plus any cash payments divided by the initial purchase price of the security.

$$R = \frac{P_{t+1} - P_t + C}{P_t}$$

$R$ = the rate of return on the security

$P_{t+1}$ = price of the security at time $t + 1$, the end of the holding period

$P_t$ = price of the security at time $t$, the beginning of the holding period

$C$ = cash payment (coupon or dividend) made during the holding period

# The Efficient Market Hypothesis: Rational Expectations in Financial Markets

At the beginning of the period, we know $P_t$ and $C$.

$P_{t+1}$ is unknown and we must form an expectation of it.

The expected return then is

$$R^e = \frac{P^e_{t+1} - P_t + C}{P_t}$$

Expectations of future prices are equal to optimal forecasts using all currently available information so

$$P^e_{t+1} = P^{of}_{t+1} \Rightarrow R^e = R^{of}$$

Supply and Demand analysis states $R^e$ will equal the equilibrium return $R^*$, so $R^{of} = R^*$

# The Efficient Market Hypothesis: Rational Expectations in Financial Markets

- Current prices in a financial market will be set so that the optimal forecast of a security's return using all available information equals the security's equilibrium return.
- In an efficient market, a security's price fully reflects all available information.

# Why the Efficient Market Hypothesis Makes Sense: Arbitrage

- Pure arbitrage: the elimination of unexploited profit opportunities involves no risk.
- Another type of arbitrage: The arbitrageur takes on some risk when eliminating the unexploited profit opportunities.
- Example: suppose that the normal return on ExxonMobil common stock is 10% at an annual rate, and its current price $P_t$ is lower than the optimal forecast of tomorrow's price $p_{t+1}^{of}$, so that the optimal forecast of the return at an annual rate is 50%.

# Rationale Behind the Hypothesis

$$R^{of} > R^{*} \Rightarrow P_t \uparrow \Rightarrow R^{of} \downarrow$$

$$R^{of} < R^{*} \Rightarrow P_t \downarrow \Rightarrow R^{of} \uparrow$$

until

$$R^{of} = R^{*}$$

In an efficient market, all unexploited profit opportunities will be eliminated

# How Valuable are Published Reports by Investment Advisors?

- Information in newspapers and in the published reports of investment advisers is readily available to many market participants and is already reflected in market prices.
- Acting on this information will not yield abnormally high returns, on average.
- The empirical evidence for the most part confirms that recommendations from investment advisers cannot help us outperform the general market.

# Random-Walk Behavior of Stock Prices

- The term random walk describes the movement of a variable whose future values cannot be predicted because, given today's value, the value of the variable is just as likely to fall as it is to rise.
- An important implication of the efficient market hypothesis is that stock prices should approximately follow a random walk, that is, future changes in stock prices should, for all practical purposes, be unpredictable.

# Efficient Market Prescription for the Investor

- Recommendations from investment advisors cannot help us outperform the market.
- A hot tip is probably information already contained in the price of the stock.
- Stock prices respond to announcements only when the information is new and unexpected.
- A “buy and hold” strategy is the most sensible strategy for the small investor.

# Why the Efficient Market Hypothesis Does Not Imply that Financial Markets are Efficient

- Some financial economists believe all prices are always correct and reflect **market fundamentals** (items that have a direct impact on future income streams of the securities) and so financial markets are efficient.
- However, prices in markets like the stock market are unpredictable- "bubbles and crashes."
- This casts serious doubt on the stronger view that financial markets are efficient.

# Behavioral Finance

- **Smart money** is the capital that is being controlled by institutional investors, experts and other financial professionals.
- Short sales: investors borrow stock from brokers and then sell it in the market, with the aim of earning a profit by buying the stock back again after it has fallen in price.
- The lack of short selling (causing over-priced stocks) may be explained by loss aversion. Very little short selling actually takes place.
- The large trading volume may be explained by investor overconfidence.
- Stock market bubbles may be explained by overconfidence and social contagion.