中南财经政法大学

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Financial Markets

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Chapter 7:
The Stock Market, the Theory of Rational Expectations, and the Efficient Market Hypothesis

Preview

In this chapter 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.

- Expectations are very important in our financial system.
  - Expectations of returns, risk, and liquidity impact asset demand
  - Inflationary expectations impact bond prices
  - Expectations not only affect our understanding of markets, but also how financial institutions operate.

Preview

- To better understand expectations, we examine the *efficient markets hypothesis.*
  - Framework for understanding what information is useful and what is not
  - However, we need to validate the hypothesis with real market data. The results are mixed, but generally supportive of the idea.

- In sum, we will look at the basic reasoning behind the efficient market hypothesis. We also examine empirical evidence examining this idea. Topics include:
  - The Efficient Market Hypothesis
  - Evidence on the Efficient Market Hypothesis
  - Behavioral Finance

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.
- 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.

Computing the Price of Common Stock

To value the stock today, you need to find the present discounted value of the expected cash flows.

The One-Period Valuation Model:

$$P_0 = \frac{D_1}{1 + k_e} + \frac{P_1}{1 + k_e}$$

Where

P_0 = the current price of the stock

D_1 = the dividend paid at the end of year 1

k_e = the required return on investments in equity, it is not the interest rate.

P_1 = the price at the end of the first period; the predicted sales price of the stock

Computing the Price of Common Stock

Using the present value concept, we can extend the one-period valuation model to the Generalized Dividend Valuation Model:

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

In this equation, it looks like that you need to find P_n before you can calculate P_0. However, if P_n is far in the future, $\lim_{n\to\infty} \frac{P_n}{(1+k_e)^n} = 0$, so it will not affect P_0. The model can be simplified as:

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

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

Computing the Price of Common Stock

The generalized dividend valuation model requires that we compute the present value of an infinite stream of dividends, a process that could still be difficult. If we impose an assumption on the stream of dividends, we can further simplify the model.

The Gordon Growth Model Assumptions:

1. Dividends are assumed to continue growing at a constant rate forever (g)
2. The growth rate g is assumed to be less than the required return on equity k_e

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

Where

D_0 = the most recent dividend paid

P_0 = the current price of the stock

How the Market Sets Stock Prices

- The price is set by the buyer willing to pay the highest price. The price is not necessarily the highest price the asset could fetch, but it is greater than what any other buyers are willing to pay.

- 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. If you have inferior info, to compensate yourself for the uncertainty, you will require a higher return.

- 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: ↓g

- Increased uncertainty: ↑k_e

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

- 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.

Rational expectations:

Expectations will be identical to optimal forecasts using all available information.

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

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

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

The Theory of Rational Expectations

Even though a rational expectation equals the optimal forecast using all available information, a prediction based on a rational expectation may not always be perfectly accurate.

A Prediction based on a rational expectation needs only be the best possible forecast given the available information, and be correct on average.

An expectation may fail to be rational for two reasons:

- It takes too much effort to make their expectation the best guess possible.
- The best guess will not be accurate because the predictor is unaware of some relevant 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) from counter-cyclical to pro-cyclical

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.

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

Where

$R =$ 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 that R^e should equal the equilibrium return R^*, so

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

The Efficient Market Hypothesis

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

This equation tells us that **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.**

As a result, a security's price fully reflects all available information in an efficient market.

Note: R^{*} depends on risk, liquidity, other asset returns …

Rationale Behind the Hypothesis

Why **efficient market hypothesis** makes sense?

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

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

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

In an efficient market, all unexploited profit opportunities eliminated.

Efficient market condition holds even if there are uninformed, irrational participants in market.

Only a few investors (even 1 big one) are needed to eliminate unexploited profit opportunities and push the market price to its equilibrium level.

Evidence on Efficient Market Hypothesis

Favorable Evidence

1. Investment analysts and mutual funds don't beat the market
2. Stock prices reflect publicly available info: anticipated announcements don't affect stock price
3. Stock prices and exchange rates close to random walk; if predictions of ΔP big, $R^{of} > R^* \Rightarrow$ people immediately sell or buy $\Rightarrow$ predictions of ΔP close to zero
4. Technical analysis does not outperform market

Evidence in Favor of Market Efficiency

1. **Performance of Investment Analysts and Mutual Funds should not be able to consistently beat the market**

- The “Investment Dartboard” often beats investment managers.

- Mutual funds not only **do not outperform the market** on average, but when they are separated into groups according to whether they had the highest or lowest profits in a chosen period, the mutual funds that did well in the first period **do not beat the market** in the second period.

- Investment strategies using inside information is the only “proven method” to beat the market. In the U.S., it is illegal to trade on such information, but that is not true in all countries.

Evidence in Favor of Market Efficiency

2. Stock prices reflect publicly available info

- If information is already publicly available, a positive announcement about a company will not, on average, raise the price of its stock because this information is already reflected in the stock price.

- Early empirical evidence confirms: favorable earnings announcements or announcements of stock splits (a division of a share of stock into multiple shares, which is usually followed by higher earnings) do not, on average, cause stock prices to rise.

Evidence in Favor of Market Efficiency

3. Random-Walk Behavior of Stock Prices

- The Efficient Market Hypothesis suggests that future changes in stock prices should, for all practical purposes, be unpredictable.

- If stock is predicted to rise, people will buy to equilibrium level; if stock is predicted to fall, people will sell to equilibrium level (both in concert with EMH).

- Thus, *if stock prices were predictable*, thereby causing the above behavior, price changes would be near zero, where the efficient market condition again holds.

Evidence in Favor of Market Efficiency

3. Random-Walk Behavior of Stock Prices

- Two types of tests are used to explore the hypothesis that stock prices follow a random walk:

(1) check if changes in stock prices are systematically related to past changes and hence could have been predicted on that basis.

(2) examine the data to see if publicly available information other than past stock prices could have been used to predict changes.

Early results from both types of tests generally support the efficient market view.

Evidence in Favor of Market Efficiency

4. Technical Analysis does not outperform market

- Technical analysis means to study past stock price data and search for patterns such as trends and regular cycles, suggesting rules for when to buy and sell stocks
- The EMH suggests that technical analysis is a waste of time
- The simplest way to understand why is to use the random-walk result that holds that past stock price data cannot help predict changes. Therefore, technical analysis, which relies on such data to produce its forecasts, cannot successfully predict changes in stock prices

Unfavorable Evidence on Efficient Market Hypothesis

Unfavorable Evidence

1. Small-firm effect: small firms have abnormally high returns
2. January effect: high returns in January
3. Market overreaction
4. Excessive volatility
5. Mean reversion
6. New information is not always immediately incorporated into stock prices

Evidence Against Market Efficiency

1. Small-Firm Effect

- Many empirical studies have shown that small firms have earned abnormally high returns over long periods of time, even when the greater risk for these firms has been considered.

- Various theories have been developed to explain the small-firm effect, suggesting that it may be due to **rebalancing of portfolios** by institutional investors, **tax issues**, **low liquidity** of small-firm stocks, large **information costs** in evaluating small firms, or an **inappropriate measurement of risk** for small-firm stocks

- The small-firm effect seems to have diminished in recent years but is still a challenge to the theory of efficient markets

Evidence Against Market Efficiency

2. January Effect

- The January Effect is the tendency of stock prices to experience an abnormal positive return in the month of January that is predictable and, hence, inconsistent with random-walk behavior.

- Some economists argue that the January effect is due to tax issues. However, this argument is not convincing.

- The January effect has diminished in recent years for shares of large companies, but still occurs for shares of small companies.

Evidence Against Market Efficiency

3. Market Overreaction

- Recent research suggests that stock prices may overreact to news announcements and that the pricing errors are corrected only slowly.

- When corporations announce a major change in earnings, say, a large decline, the stock price may overshoot, and after an initial large decline, it may rise back to more normal levels over a period of several weeks.

- This violates the EMH because an investor could earn abnormally high returns, on average, by buying a stock immediately after a poor earnings announcement and then selling it after a couple of weeks when it has risen back to normal levels.

Evidence Against Market Efficiency

4. Excessive Volatility

- The stock market appears to display excessive volatility; that is, fluctuations in stock prices may be much greater than is warranted by fluctuations in their fundamental value.

- Researchers have found that fluctuations in the S&P 500 stock index could not be justified by the subsequent fluctuations in the dividends of the stocks making up this index.

- Other research finds that there are smaller fluctuations in stock prices when stock markets are closed, which has produced a consensus that stock market prices appear to be driven by factors other than fundamentals.

Evidence Against Market Efficiency

5. Mean Reversion

- Some researchers have found that stocks with low returns today tend to have high returns in the future, and vice versa.

- Hence stocks that have done poorly in the past are more likely to do well in the future because mean reversion indicates that there will be a predictable positive change in the future price, suggesting that stock prices are not a random walk.

- Newer data is less conclusive; nevertheless, mean reversion remains controversial.

Evidence Against Market Efficiency

6. New Information Is Not Always Immediately Incorporated into Stock Prices

- Recent evidence suggests that, inconsistent with the efficient market hypothesis, stock prices do not instantaneously adjust to profit announcements.

- Instead, on average stock prices continue to rise for some time after the announcement of unexpectedly high profits, and they continue to fall after surprisingly low profit announcements.

The Practicing Manager: Implications for Investing

1. How valuable are published reports by investment advisors?
2. Should you be skeptical of hot tips?
3. Do stock prices always rise when there is good news?
4. Efficient Markets prescription for investor.

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.

Should you be skeptical of hot tips?

YES. The EMH indicates that you should be skeptical of hot tips since, if the stock market is efficient, it has already priced the hot tip stock so that its expected return will equal the equilibrium return.

Thus, the hot tip is not particularly valuable and will not enable you to earn an abnormally high return.

As soon as the information hits the street, the unexploited profit opportunity it creates will be quickly eliminated.

The stock’s price will already reflect the information, and you should expect to realize only the equilibrium return.

Do stock prices always rise when there is good news?

NO. In an efficient market, stock prices will respond to announcements only when the information being announced is new and unexpected.

So, if good news was expected (or as good as expected), there will be no stock price response.

And, if good news was unexpected (or not as good as expected), there will be a stock price response.

Efficient Market Prescription for the Investor

Investors should not try to outguess the market by constantly buying and selling securities. This process does nothing but incur commissions costs on each trade.

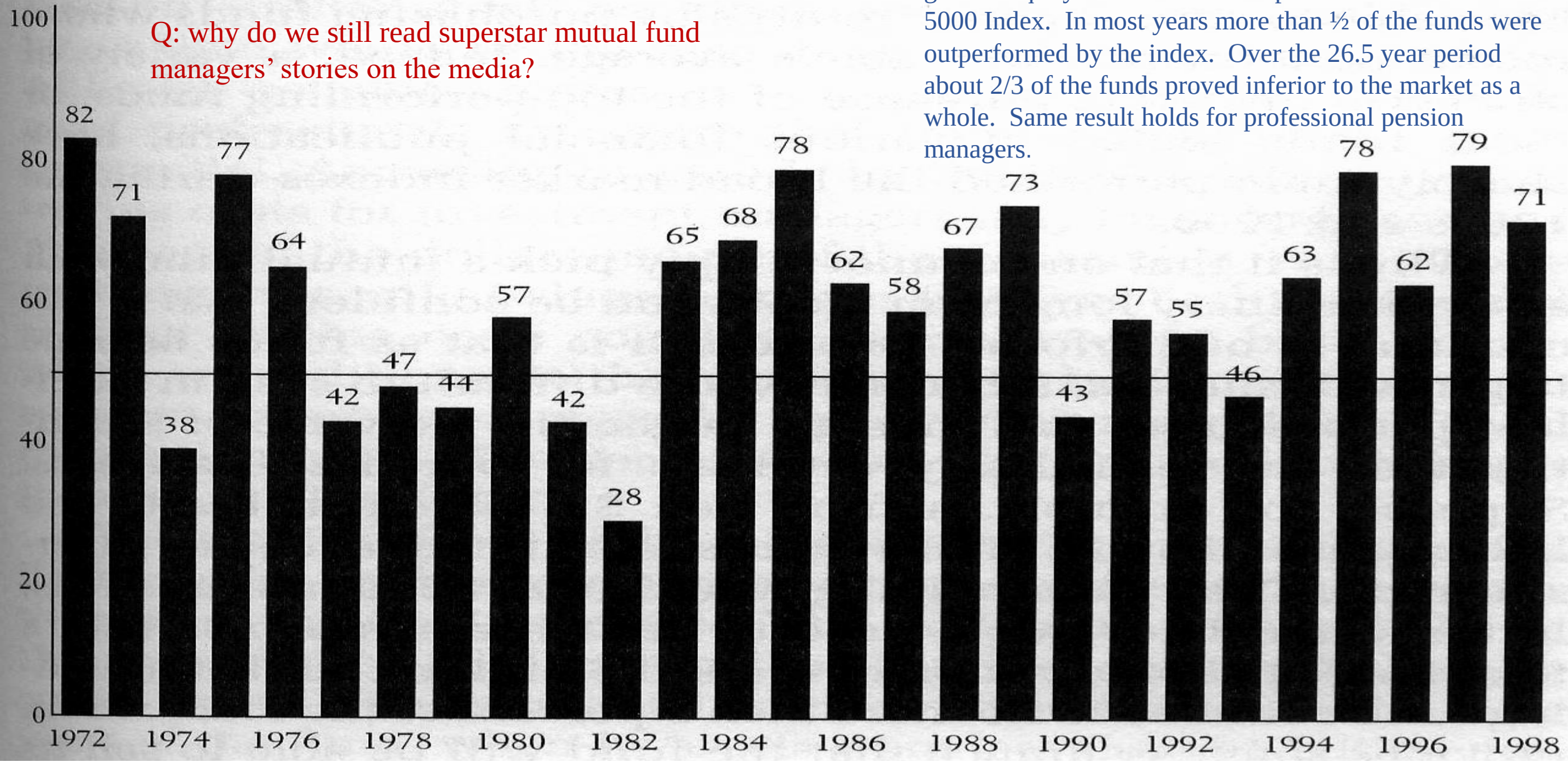
A “buy and hold” strategy is the most sensible strategy for the small investor.

Purchase stocks and hold them for long periods of time. This will lead to the same returns, on average, but the investor’s net profits will be higher because fewer brokerage commissions will have to be paid.

General Equity Funds Outperformed by the Wilshire 5,000

All mutual funds sold to the public – performance of all general equity mutual funds compared to the Wilshire 5000 Index. In most years more than ½ of the funds were outperformed by the index. Over the 26.5 year period about 2/3 of the funds proved inferior to the market as a whole. Same result holds for professional pension managers.

Q: why do we still read superstar mutual fund managers' stories on the media?



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. The existence of market crashes and **bubbles**, in which the price of assets rise well above their fundamental values, casts serious doubt on the stronger view that financial markets are efficient.

Behavioral Finance

Doubts about the efficiency of financial markets, particularly after the stock market crash of 1987, led economists such as Robert Shiller to develop a new field of study, **behavioral finance**, which applies psychology and neural science to understand the behavior of securities prices.

- The lack of short selling (causing over-priced stocks) may be explained by loss aversion.
- The large trading volume may be explained by investor overconfidence.
- Stock market bubbles may be explained by overconfidence and social contagion.

Behavioral Finance

BF argues that a few psychological phenomena pervade financial markets:

1. Practitioners rely on rules of thumb called heuristics to process information.

Heuristic—a process by which people find things out for themselves, usually by trial and error. Leads to the development of rules of thumb which are imperfect and result in errors which lead to **heuristic-driven bias.**

2. In addition to objective considerations, practitioners perception of risk & return are highly influenced by how decision problems are framed → **frame dependence**.

3. Heuristic-driven bias and framing effects cause market prices to deviate from fundamental values, i.e. **markets are inefficient**.

Heuristic Driven Bias

1. Representativeness—reliance on stereotypes
    - Example of High School GPA as predictor of College GPA

2. Overconfidence
    - People set overly narrow confidence bands, high guess is too low and low guess is too high.
    - Results in being surprised too often.

3. Anchoring to old information
    - Security analysts do not revise their earnings estimates enough to reflect new info.

Frame Dependence

EMH assumes framing is transparent—If you move a $ from your right pocket to your left pocket, you are no wealthier!

… In other words, practitioners can see through all the different ways that cash flow might be described.

But if frame is opaque, a difference in form (which pocket) is also a difference in substance and affects behavior.

Frame Dependence

- Loss Aversion
  - Choose between
    - Sure loss of $7,500 or
    - 75% chance of loosing $10K or 25% chance of loosing $0.

- Hedonic Editing
  - Organizing Gains and Losses in separate mental accounts.
  - Mental accounting refers to the different values a person places on the same amount of money, based on subjective criteria.

Frame Dependence

An mysterious disease will kill 800 people. We now have two treatments:

Treatment A: 200 people will be saved

Treatment B: a 75% chance of saving 0 person, 25% chance of saving 800 people

Which treatment will you choose?

Frame Dependence

Now suppose we have another two treatments

Treatment C: 400 people will die after accepting this treatment

Treatment D: a 25% chance that 0 person will die, 75% chance that all people will die.

Which treatment will you choose?

Frame Dependence

Now imagine that you have just won $1500 in one lottery, and you can choose to participate in another. The outcome of this second lottery is determined by the toss of a fair coin.

Heads—> you win $450
Tails—> you loss $500

Would you choose to participate in the second lottery?

Frame Dependence

Hedonic editing has both cognitive and emotional causes

- Main cognitive issue in the above question—Do you ignore the preliminary $1500 winnings or not?

- Those that begin by seeing themselves $1500 ahead then experience the emotion of loosing $500 as the equivalent of winning $1000 (i.e. a smaller gain, not a loss).

- Those that ignore the $1500 are less prone to accept the gamble because they will *feel* a $500 loss as a loss.

Chapter Summary

- The Efficient Market Hypothesis: We examined the theory of how both old and new information are expected to be incorporated into current stock prices.

- Evidence on the Efficient Market Hypothesis: We looked at evidence for/against the hypothesis and how well the hypothesis holds.

- Behavioral Finance: We also examined another important area of research to explain how stock prices are formed based on psychological factors affecting investors.

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