




Stock market anomalies

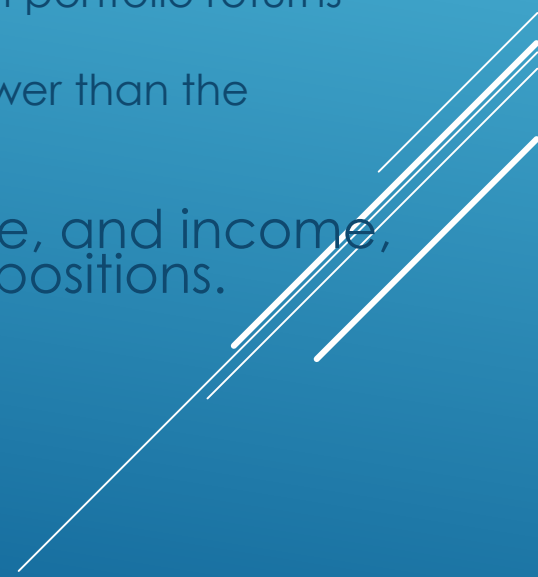
Course: Impact of COVID-19 to
financial markets


PROFESSOR NABIJON HOLOV

- ▶ A serious error in judgment you can make as an investor is to be overconfident.
 - ▶ We are all overconfident about our abilities in many areas.
 - ▶ Be honest: Do you think of yourself as a better than average driver?
 - ▶ **If you do, you are not alone.**
 - ▶ **About 80 percent of the people who are asked this question will say “yes.”**
 - ▶ How does overconfidence affect investment decisions?
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- ▶ Investors tend to invest too heavily in shares of the company for which they work.
 - ▶ This loyalty can be very bad financially.
 - ▶ Your earning power (income) depends on this company.
 - ▶ Your retirement nest-egg also depends on this company.
 - ▶ Another examples of the lack of diversification is investing too heavily in the stocks of local companies.
 - ▶ Perhaps you know someone personally who works there.
 - ▶ Perhaps you read about them in your local paper.
 - ▶ Basically, you are unduly confident that you have a high degree of knowledge about local companies.
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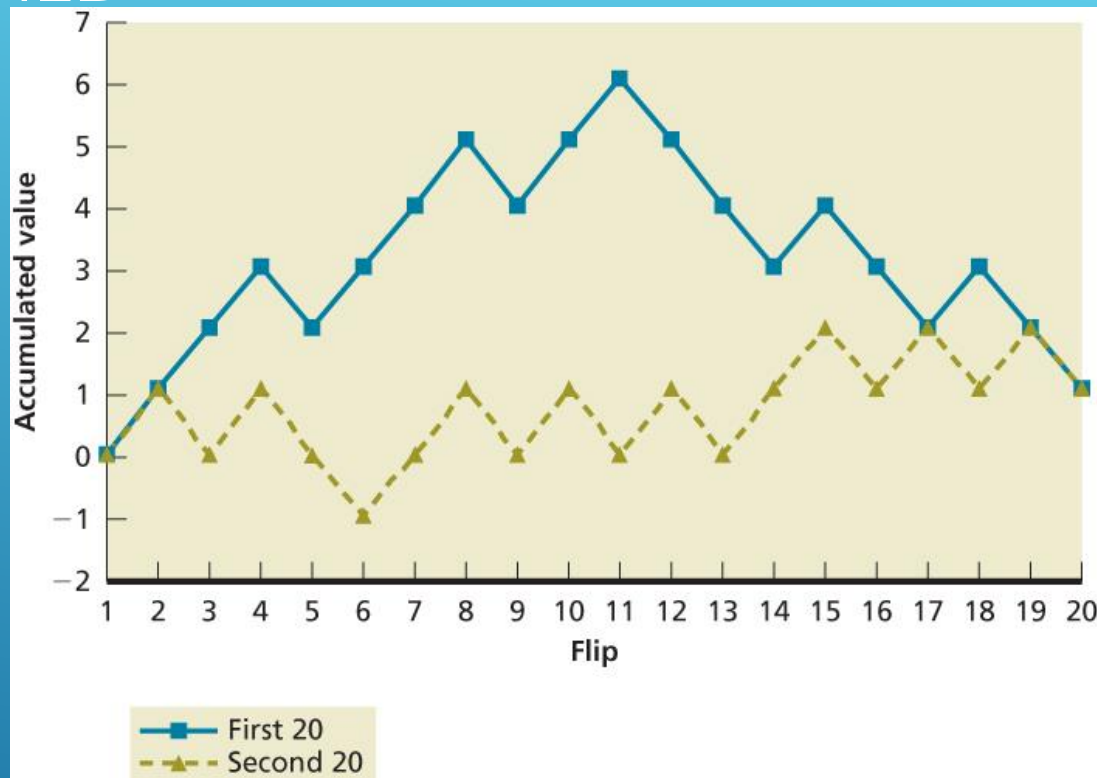
- ▶ If you are overconfident about your investment skill, it is likely that you will trade too much.
 - ▶ Researchers have found that investors who make relatively more trades have lower returns than investors who trade less frequently.
 - ▶ Researchers have found that the average household earned an annual return of 16.4 percent.
 - ▶ Researchers have found that households that traded the most earned an annual return of only 11.4 percent.
 - ▶ The moral is clear: **Excessive trading is hazardous to your wealth.**
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- ▶ Psychologists have found that men are more overconfident than women in the area of finance. So,
 - ▶ Do men trade more than women?
 - ▶ Do portfolios of men under-perform the portfolios of women?
 - ▶ Researchers show that the answer to both questions is yes.
 - ▶ Men trade about 50 percent more than women.
 - ▶ Researchers show that both men and women reduce their portfolio returns when they trade excessively.
 - ▶ The portfolio return for men is 94 basis points lower than portfolio returns for women.
 - ▶ The portfolio return for **single** men is 144 basis points lower than the portfolio return for **single** women.
 - ▶ Accounting for the effects of marital status, age, and income, researchers also show that men invest in riskier positions.
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- ▶ Cognitive psychologists have discovered that the human mind is a pattern-seeking device.
 - ▶ Humans conclude that there are causal factors or patterns at work behind sequences of events even when the events are truly random.
 - ▶ The **representativeness heuristic**: Concluding that there are causal factors at work behind random sequences. Or, if something is random, it should look random.
 - ▶ But, what does random look like?
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- ▶ Suppose we flip a coin twenty times and write down whether we get a “head” or a “tail.”
- ▶ Then, we do it all over again. The results of our two sets of twenty flips are:
 - ▶ 1st Twenty: **T T T H T T T H T T H H H T H H T H H H**
 - ▶ 2nd Twenty: **T H T H H T T H T H T H T T H T H T H H**
- ▶ Do these sequences of heads and tails both look random to you?
- ▶ Most people would say that the 1st Twenty and the 2nd Twenty somehow look “different.”
 - ▶ Both are random sequences.
 - ▶ Both have ten heads and ten tails.

A COIN FLIPPING EXPERIMENT, GRAPHED



- ▶ Do you think the line labeled “1st Twenty” has a pattern to it, but the line labeled “2nd Twenty” appears to be random?
- ▶ If so, your mind saw a pattern in a random sequence of coin flips.

- ▶ Suppose we look at the recent shooting by two basketball players named LeBron and Shaquille.
- ▶ Assume both of these players make half of their shots.
 - ▶ LeBron: **has just made** two shots in a row.
 - ▶ Shaquille: **has just missed** two shots in a row.
- ▶ Researchers have found that if they ask **basketball fans** which player has the better chance of making their next shot:
 - ▶ 91 out of 100 will say LeBron.
 - ▶ They say this because they think LeBron has a “hot-hand.”
- ▶ But, researchers have found that the “hot hand” is an illusion.
 - ▶ Players do not deviate much from their long-run shooting averages.
 - ▶ However, fans, players, announcers, and coaches think that they do.

THE HOT-HAND FALLACY, I.

THE HOT-HAND FALLACY, II.

- ▶ Cognitive psychologists have studied the shooting percentage of one NBA team for a season and found:

Shooting Percentage on Next Shot	History of Previous Attempts
46%	Made 3 in a row
50	Made 2 in a row
51	Made 1
52	First shot of the game
54	Missed 1
53	Missed 2 in a row
56	Missed 3 in a row

- ▶ A detailed analysis of the shooting data reveals that, statistically speaking, all shooting percentages in this table are the “same.”
- ▶ It is true that basketball players shoot in streaks. But, these streaks are within bounds for long-run shooting percentages.

THE HOT-HAND FALLACY, III.

- ▶ It is an illusion that basketball players are either “hot” or “cold.”
 - ▶ If you believe in the “hot hand,” you will likely reject this fact because you “know better” from watching shooters.
 - ▶ You are being fooled by randomness—randomness often appears in clusters.
- ▶ **Clustering Illusion:** Our human belief that random events that occur in clusters are not really random.
 - ▶ Example: If a fair coin is flipped 20 times, there is about a 50 percent chance of flipping four heads in a row.
 - ▶ If you flip four heads in a row, do you have a “hot hand” at coin flipping?
- ▶ Mutual fund investing and the clustering illusion.
 - ▶ Every year, funds that have had exceptionally good performance receive large inflows of money.
 - ▶ There is a universal disclaimer: “Past performance is no guarantee of future results.” Nonetheless, investors chase past returns.

THE GAMBLER'S FALLACY

- ▶ **Gambler's Fallacy:** Assuming that a departure from what occurs on average will be corrected in the short run.
- ▶ Another way to think about the gambler's fallacy: because an event has not happened recently, it has become "overdue" and is more likely to occur.
- ▶ Example: The odds on a US Roulette table never change.
 - ▶ For each spin:
 - ▶ There is an 18 in 38 chance for a red number to "hit"
 - ▶ There is an 18 in 38 chance for a black number to "hit"
 - ▶ There is a 2 in 38 chance for a green number to "hit"
 - ▶ You suffer from the Gambler's Fallacy if you think that it is more likely for a black number to "hit" after a series of red numbers have hit.

- ▶ The efficient markets hypothesis (EMH) does not require every investor to be rational.
- ▶ All that EMH requires is that there are at least some smart and well-financed investors.
 - ▶ These investors are prepared to buy and sell to take advantage of any mispricing in the marketplace.
 - ▶ This activity is what keeps markets efficient.
- ▶ Sometimes, however, a problem arises in this context.
- ▶ **Limits to Arbitrage:** The notion that, under certain circumstances, it may not be possible for rational, well-capitalized traders to correct a mispricing, at least not quickly.

SENTIMENT-BASED RISK AND LIMITS TO ARBITRAGE, I.

SENTIMENT-BASED RISK AND LIMITS TO ARBITRAGE, II.

- ▶ Strategies designed to eliminate mispricings are often risky, costly, or restricted. Three important problems are:
 - ▶ *Firm-Specific Risk (the most obvious risk).*
 - ▶ Suppose you believe that GM's stock price is too low, so you buy.
 - ▶ Then, some unanticipated bad news drives GM's stock price lower.
 - ▶ *Noise Trader Risk (also known as sentiment-based risk)*
 - ▶ **Noise Trader:** Someone whose trades are not based on information or financially meaningful analysis.
 - ▶ Noise traders could act "together" to worsen a mis-pricing.
 - ▶ Noise trader risk is important because the worsening of a mis-pricing could force the arbitrageur to liquidate early (and sustain steep losses).
 - ▶ If noise trader risk exists, then this risk is another source of risk beyond systematic risk and unsystematic risk.

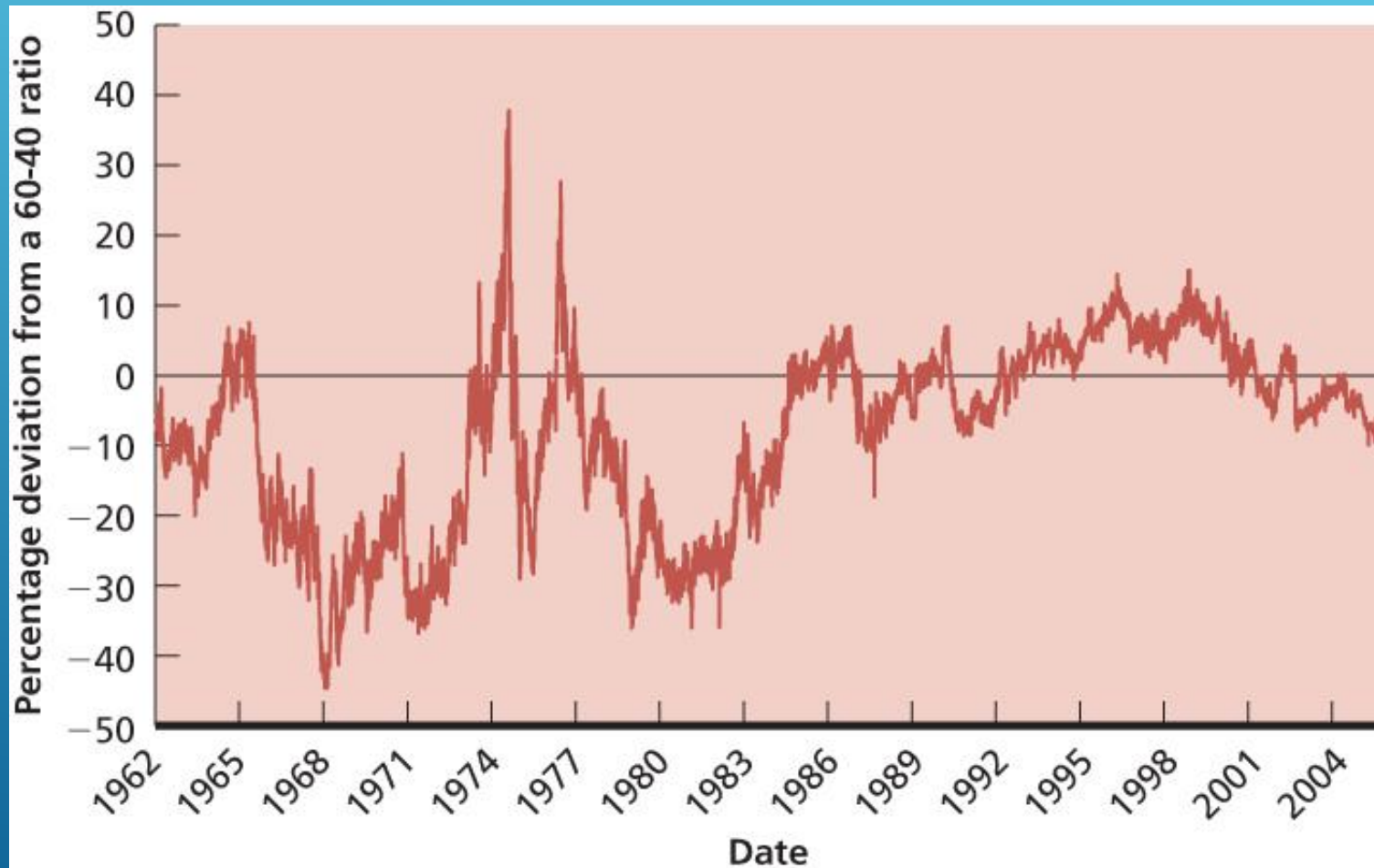
- ▶ **Implementation Costs:** These costs include transaction costs such as bid-ask spreads, brokerage commissions, and margin interest.
 - ▶ In addition, there might be some short-sale constraints.
 - ▶ One short-sale constraint arises when there are not enough shares to borrow.
 - ▶ This means the arbitrageur cannot take a large short position.
 - ▶ Another short-sale constraint stems from the legal restriction that many money managers are not allowed to sell short.
 - ▶ pension fund managers
 - ▶ mutual fund managers
- ▶ When firm specific risk, noise trader risk, or implementation costs are present, a mispricing may persist because arbitrage is too risky or too costly.
- ▶ Collectively, these risks and costs create barriers, or limits, to arbitrage.
- ▶ How important these limits are is difficult to say, but we do know that mispricings occur, at least on occasion.

SENTIMENT-BASED RISK AND LIMITS TO ARBITRAGE, III.

- ▶ In 1907, Royal Dutch of the Netherlands and Shell of the UK agreed to merge and split profits on a 60-40 basis.
- ▶ So, if the stock prices of Royal Dutch and Shell are not in a 60-40 ratio, there is a potential arbitrage opportunity.
- ▶ The next slide contains a plot of the daily deviations from the 60-40 ratio of the Royal Dutch price to the Shell price.
 - ▶ If the prices are in a 60-40 ratio, there is no deviation.
 - ▶ If there is a positive deviation, the price of Royal Dutch is too high.
 - ▶ If there is a negative deviation, the price of Royal Dutch is too low.
- ▶ As you can see, there have been large (and persistent) deviations from the 60-40 ratio.

SENTIMENT-BASED RISK AND LIMITS TO ARBITRAGE, IV.

SENTIMENT-BASED RISK AND LIMITS TO ARBITRAGE, V.



OTHER METHODS OF TESTING THE EMH

Random Walk with Reflecting Barriers

A large element of Cootner's work is based on **skewness**, γ_1 , and **kurtosis**, γ_2 .

If the mean and variance of the distribution are denoted by μ and σ^2 , respectively, its skewness γ_1 is defined as

$$\gamma_1 = \frac{E[(x-\mu)^3]}{\sigma^3}$$

And its kurtosis γ_2 as

$$\gamma_2 = \frac{E[(x-\mu)^4]}{\sigma^4} - 3$$

For a symmetrical distribution, γ_1 is zero. Positive values for γ_1 indicate that the distribution is skewed to the right, so that the right tail is in a certain sense heavier than the left compared to a symmetric distribution. A deformation in which the tails are heavier and the central part is more sharply peaked would have $\gamma_2 > 0$. If tails are lighter and the central part is flatter, γ_2 would be less than 0

OTHER METHODS OF TESTING THE EMH

Random Walk with Reflecting Barriers

- If the random walk hypothesis is correct, $\lim_{n \rightarrow \infty} \gamma_2 = 3$
- If the reflecting barrier or trend hypothesis is correct, $\gamma_2 > 3$
 - ▶ Average kurtosis of the 45-price series was used to be 4.90
 - ▶ If successive changes were independent, price changes over longer intervals would be expected to more closely approach the average kurtosis of a normal distribution.
 - ▶ Cootner's results show kurtosis decreases so rapidly that it very soon falls below that of a normal distribution.
 - ▶ This tends to refute the efficient-market theory that stock prices are independent.

OTHER METHODS OF TESTING THE EMH

Random Walk with Reflecting Barriers

- Monthly data from the Dow Jones 30 during January 1, 1980–December 31, 1984, have been tested for any indication of skewness or kurtosis. Table 12-3 indicates evidence of both skewness and kurtosis in the price series. The average skewness and kurtosis are 0.5137 and 0.6137, respectively. As can be seen, the question of skewness and kurtosis for security analysis and portfolio management is a nontrivial issue — one that will be taken up in later chapter.

OTHER METHODS OF TESTING THE EMH

Random Walk with Reflecting Barriers

Table 12-3 Statistical Estimates of Monthly Returns for the Dow Jones Average (January 2006–December 2010)

	TICKER	Company	Mean	Standard	Skewness	Kurtosis	Coefficient of Variation
1	MMM	3M	0.0019	0.0665	-0.4896	0.5488	35.7616
2	AA	Alcoa	-0.0211	0.1765	-3.0010	13.5221	-8.3725
3	AXP	American Express	-0.0094	0.1230	0.1616	4.2107	-13.0321
4	T	AT&T	0.0055	0.0616	-1.0458	0.8336	11.1907
5	BAC	Bank of America	-0.0370	0.2225	-2.5486	10.6076	-6.0210
6	BA	Boeing	-0.0036	0.0965	-1.0373	1.5956	-26.5438
7	CAT	Caterpillar	0.0029	0.1279	-1.9207	6.7557	43.4958
8	CVX	Chevron	0.0087	0.0624	-0.7818	0.6193	7.1677
9	CSCO	Cisco Systems	-0.0010	0.0892	-0.6297	0.6117	-86.4948
10	KO	Coca-Cola	0.0093	0.0510	-0.9161	3.8694	5.4828
11	DD	E.I. DuPont de Nemours	0.0024	0.0872	-0.7714	1.9378	36.0049
12	XOM	Exxon Mobil Corp.	0.0048	0.0520	-0.4104	-0.0670	10.8100
13	GE	General Electric	-0.0135	0.1126	-1.0687	2.1340	-8.3216
14	HPQ	Hewlett-Packard	0.0044	0.0752	-1.0903	1.2700	17.1494
15	HD	Home Depot	-0.0028	0.0768	-0.3816	0.0906	-27.7587
16	INTC	Intel	-0.0041	0.0855	-0.9769	0.8779	-20.8216
17	IBM	International Business Machines	0.0093	0.0603	-1.6744	5.7418	6.4939
18	JNJ	Johnson & Johnson	0.0019	0.0443	-0.9569	1.8476	22.7633
19	JPM	JPMorgan Chase	-0.0016	0.0991	-0.6226	0.9468	-61.5612
20	KFT	Kraft Foods	0.0030	0.0623	-1.2024	2.4125	20.4741
21	MCD	McDonald's	0.0150	0.0454	-0.5133	0.0846	3.0338
22	MRK	Merck	0.0025	0.0801	-0.8158	1.3874	32.0949
23	MSFT	Microsoft	-0.0006	0.0811	-0.4540	0.1834	-135.0236
24	PFE	Pfizer	-0.0028	0.0653	-0.5603	0.7952	-23.0459
25	PG	Procter & Gamble	0.0027	0.0496	-0.6313	0.6330	18.6080
26	TRV	Travelers	0.0043	0.0542	-0.6674	2.0474	12.5164
27	UTX	United Technologies	0.0055	0.0629	-0.7546	0.3983	11.3590
28	VZ	Verizon Communications	0.0063	0.0569	-0.3339	-0.4991	9.0426
29	WMT	Wal-Mart Stores	0.0028	0.0482	-0.8825	3.1772	17.1172
30	DIS	Walt Disney	0.0059	0.0718	-0.9015	1.7228	12.1450
	Mean		0.0001	0.0816	-0.9293	2.3432	-2.8095

12.4 OTHER METHODS OF TESTING THE EMH

12.4.2 Variance-Bound Approach Test

Shiller (1981a, 1981b), LeRoy and Porter (1981)

Variance-Bound Approach

$$P_t = \sum_k^{\infty} \gamma^{k+1} E_t d_{t+k} = E_t P_t^* \quad (12.17)$$

where P_t = a price or yield;

$P_t^* = \sum_{k=0}^{\infty} \gamma^{k+1} d_{t+k}$ is an estimate based on perfect foresight of the ex post rational price or yield not known at time t;

E_t = a mathematical expectation conditional on information at time t;

$\gamma = \frac{1}{1+r}$ = a discount factor; and

r = a discount rate.

By using S&P 500 index data and yield-to-maturity data on long-term bonds, Shiller (1981a) showed that the *movements in P_t appear to be too large to be justified by subsequent changes in dividends*. Overall, Shiller concluded that the use of a *random walk model for dividends to test the EMH does not appear to be promising*

OTHER METHODS OF TESTING THE EMH

Hillmer and Yu's Relative EMH Test

Hillmer and Yu (1979):

- There are various degrees of efficiency based on the particular market variable and particular type of information
- Studied how various types of information affect different types of stocks
 - ▶ **Relative EMH Test**
 - ▶ Patell and Wolfson (1984):
 - ▶ Studied the intraday speed of adjustment of stock price to earnings and dividend announcements
 - ▶ Found that the speed of adjustment is generally less than an hour

RANDOM WALK HYPOTHESIS VS. EMH TEST

Brown (2010):

- ▶ Defined the difference between the model of random walk hypothesis and the model of EMH

Let Φ_t represent the common information all investors have after observing the current price p_t . Then according to the EMH, no investors can use this specific information z_{it} to have any kind of price advantage in the markets. If the trader's specific information z_{it} is already incorporated into the market price, then we can obtain Equation (12.18).

$$E_{\Phi_t} \{ [r_{t+\tau} - E(r_{t+\tau} | z_{it})] z_{it} \} = 0 \quad (12.18)$$

However, most tests of the random walk hypothesis amount to a statement about serial covariance, modifying the previous into the following equation:

$$\gamma_{\tau} = E \{ [r_{t+\tau} - E(r)] [r_t - E(r)] \} = E \{ [r_{t+\tau} - E(r)] r_t \} = 0 \quad (12.19)$$

This expression corresponds to Eq. (12.A1) on the strong presumption that the market information Φ_t is time invariant.

MARKET ANOMALIES

- ▶ If information is fully reflected in security prices, the market is efficient and it is not worthwhile to pay for information that is already impounded in security prices.
- ▶ However, at times, there are irregularities in markets called **market anomalies** that cause disruption. Three of the most heavily researched anomalies are:
 1. P/E effect,
 2. size effect, and
 3. January effect

MARKET ANOMALIES

The P/E Effect

Price-Earnings (P/E) Effect

- Basu (1977):
 - ▶ Compared the yearly risk-adjusted returns for portfolios composed of 150 stocks with the highest P/E, 150 stocks with the next highest P/E, down to the final portfolio of 150 stocks with the lowest P/E.
 - ▶ Results showed that low P/E portfolios earned higher absolute and risk-adjusted rates of return than the high P/E securities
 - ▶ P/E ratio information was not "fully reflected" in security prices in as rapid a manner as postulated by the semi-strong form of the efficient market hypothesis

MARKET ANOMALIES

The Size Effect

Market may not be semi-strong form efficient due to not only lack of P/E information, but also size.

- Banz (1981) and Reinganum (1981a)
 - ▶ Rank all stocks on both the NYSE and the American Stock Exchange (ASE) by the total market value of the firm
 - ▶ Divide their samples into five equal portfolios based on the market-value ranking
 - ▶ Results indicate that the portfolios of the firm with the smallest market value experienced returns that were, both economically and statistically, significantly greater than the portfolios of the firms with large market value.
- Arbel *et al.* (1983)
 - ▶ Size effect may be related to the disproportionate amount of institutional interest in the larger firms

MARKET ANOMALIES

January Effect/Year-End Effect

Branch (1977):

- ▶ Investors tend to sell stocks in which they have experienced capital losses at the end of the year in order to take advantage of the US tax laws, which decreases stock prices during December
- ▶ During January, the selling is reversed as investors return to the market and buying pressure is evident
- ▶ The returns calculated for the month of January are above average because the ending prices in December are lower than they should be and the ending prices in January are higher than they should be.

SUMMARY

- ▶ This chapter has examined the basic tenets and empirical support for the EMH and has outlined some of its implications for security valuation and portfolio management.
- ▶ The relationship between market value and book value and its development into the concept of a q ratio was found to be very useful to security analysts in their estimates of the future value of a firm's financial securities. The EMH was categorized into three forms: weak, semi-strong, and strong. The main distinguishing feature among these forms was pointed out to be the information set assumed to be impounded into the market price of a firm's securities. For the weak form, the information set was shown to include historical prices, price changes, and related volume data; for the semi-strong form it was shown to include all publicly available information; and for the strong form it was shown to include all information, whether or not publicly available.

SUMMARY

- ▶ While empirical testing has provided good support for the weak and semi-strong forms of the EMH, the strong form has been upheld only in cases where, for example, mutual-fund managers have been unable to consistently outperform market averages. Tests involving corporate insiders and stock-exchange specialists have in general indicated that these groups do possess monopoly information and are able to use it to generate above-average returns.
- ▶ Besides Fama's (1970) EMH, the discussion briefly included the random walk with reflecting barriers, the variance-bound test of EMH, and the market anomalies that refute EMH. This implies that the security-analysis and portfolio-management theory and methods discussed are worthwhile tools for security analysts and portfolio managers. The next chapter discusses timing and selectivity of stocks and mutual funds.

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