Chapter 11 - The Efficient Market Hypothesis

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Kendall (1953) found no predictable pattern in stock price changes!

- Prices were as likely to go up as to go down on any particular day, regardless of past performance
- But, Eugene Fama's Ph.D. dissertation highlighted that stock prices should reflect any information that could predict stock prices
  - For example, as soon as any information indicates that a stock is underpriced, investors flock to buy the stock and immediately bid up its price to a fair level
  - From this fair level, we only expect ordinary rates of return that compensate for the risk of the stock

Stock prices should follow a *random walk*

- If stock prices are immediately bid to fair levels that reflect available information, stock prices must only respond to *new* information
- By definition, new information is unpredictable
- Therefore, stock prices that change in response to new information must also move unpredictability and follow a *random walk*[1]

[1] Strictly speaking, stock prices follow a submartingale, and the expected price change can be positive to compensate for the time value of money and systematic risk. A random walk is more restrictive—successive stock returns are independent and identically distributed.

The efficient markets hypothesis (EMH) is the notion that stock prices reflect available information

- If stock price changes were predictable, that would be evidence that stock prices do not reflect available information
- Here *efficient* has a different meaning than in Chapter 7
  - Here, in Chapter 11, an informationally efficient market is one where prices quickly reflect new information
  - In Chapter 7, an efficient portfolio is one with the highest expected return for a given level of risk
- There is ample empirical evidence that U.S. equity markets are efficient

In most takeover attempts, the acquiring firm offers a large premium to the market price of the target firm, and the target firm's price jumps on the announcement

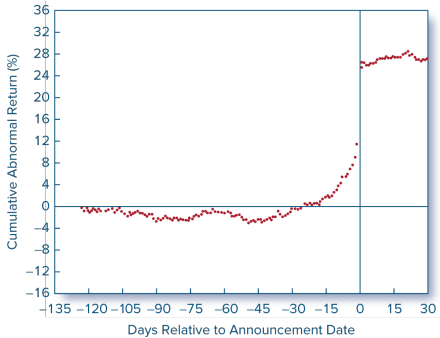

Figure 1: Cumulative abnormal returns before takeover attempts (BKM 2023, Figure 11.1)

Intraday price changes provide more evidence of market efficiency

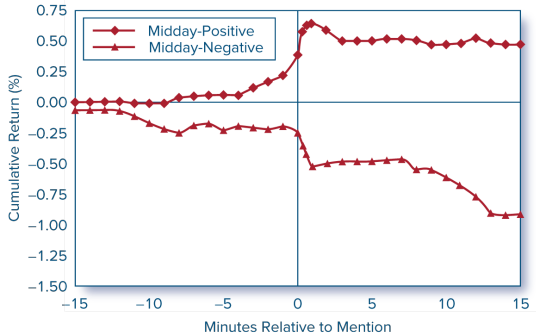

Figure 2: Stock price reaction to CNBC reports. The figure shows the reaction of stock prices to on-air stock reports during the "Midday Call" segment on CNBC. The chart plots cumulative returns beginning 15 minutes before the stock report (BKM 2023, Figure 11.2)

Competition is the source of market efficiency

- Information is the most valuable financial commodity
- Higher returns motivate information-gathering
- Competition among investors to earn higher returns assures prices reflect available information
- However, recall the Grossman and Stiglitz (1980) paradox that perfectly efficient markets are impossible
  - Diminishing marginal returns on research activity suggest only managers of the largest portfolios will find it useful
  - Eventually, the cost of new information exceeds its benefit, and this new information will not be collected and incorporated into prices

We typically distinguish three versions of the EMH

- Weak-form: Stock prices reflect all information contained in the history of past prices, implying that technical analysis is not useful
- Semistrong-form: Stock prices reflect all publicly available information, implying that fundamental analysis is not useful
- Strong-form: Stock prices reflect all relevant information, including insider information, implying that insider trading is not profitable
- Under the EMH, prices are correct on average but can be too high or too low in *hindsight*

a. In an efficient market, _____.

Check all that apply:

- [ ] patterns in past prices help predict future prices
- [ ] prices change only in response to new information
- [ ] prices adjust quickly in response to new information
- [ ] prices reflect all available information

Technical analysis is the search for predictable patterns in stock prices

- Requires stock prices to respond slowly to fundamental supply-and-demand factors
- Weak-form EMH implies technical analysis should be fruitless
- If there were profitable patterns, traders would exploit them until they no longer work, so we expect profitable patterns to be *self-destructing*

Fundamental analysis uses the prospects of the firm to determine proper stock prices

- Focuses on fundamentals, such as earnings and dividends prospects, expectations for future interest rates, and risk evaluation
- Seeks to find firms with *mispriced* stocks
- Semistrong-form EMH predicts that *most* fundamental analysis should be fruitless and only *unique* insights will be rewarded
- Fundamental analysis aims to identify and invest in firms that are *better* than everyone else's estimates because market prices reflect commonly known information

EMH proponents believe active management is largely a wasted effort and unlikely to justify its expense, so they advocate for passive investment, instead

- Active management
  - Attempts to beat the market by timing the market or through superior security selection
  - An expensive strategy
  - Suitable for very large portfolios
- Passive management
  - No attempt to beat the market
  - Index Funds and ETFs
  - Low-cost strategy
  - Suitable for everyone

Still, portfolio management has a role in an efficient market!

- Portfolio management can provide value when all securities are perfectly priced
- Portfolio management provides:
  - Diversified portfolios with the desired systematic risk
  - Portfolios that consider taxes
  - Portfolios that consider risk tolerance

Capital market prices guide the allocation of real resources

- Inefficient markets result in systematic resource misallocation
  - Corporations with overvalued securities may raise capital too cheaply
  - Corporations with undervalued securities may reject positive net present value (NPV) projects because the cost of raising capital is too high
- For example, in the U.S., the dot-com run-up of the late 1990s led to overinvestment in technology firms
- However, an efficient market does not have perfect foresight because "available information" is still incomplete information, and the future is not perfectly predictable

a. Which of the following is true about passive vs active management?

- Active managers usually allocate their capital between one or more index funds.
- Active managers usually allocate their capital to a fixed risky portfolio and change their allocations only as a result of changes in their risk tolerance.
- Active managers usually try to achieve returns higher than commensurate with risk by identifying mispriced assets.
- Passive managers usually engage in both market timing and security selection.
- Passive managers usually engage in market timing.

b. _____ refers to the attempt to identify mispriced securities or to predict broad market trends.

- Active management
- Asset allocation
- Passive management
- Security selection

An event study is a technique to measure the impact of an event on stock returns

- For example, we might want to understand the impact of dividend changes on stock returns
- First, we need a benchmark for what the stock return would have been in the absence of the event
- The *abnormal return* is the difference between the actual return and this benchmark
- There are several benchmarks
  - A broad market index, so the abnormal return is the difference between the stock and broad market index returns
  - An asset-pricing model, such as the CAPM or Fama-French three-factor model, so the abnormal return is the difference between the stock returns and the *expected return* from the model

BKM use the "market model" to estimate abnormal returns

- Under the market model, the stock return is:

$$r_t = a + br_{Mt} + e_t$$

  so the abnormal returns is:

$$e_t = r_t - (a + br_{Mt})$$

- We should estimate a and b using data not influenced by the event (i.e., before the event)
- Often, there is "leakage" where some investors are aware of the event in advance and profit from it (see Figure 11.1 above)
- To avoid these concerns, some researchers use a size-matched benchmark portfolios instead of estimating a and b
- A cumulative abnormal return (CAR) sums abnormal returns e_t over a period to capture the total firm-specific price change

Revisit Figure 11.1 with our understanding of event studies

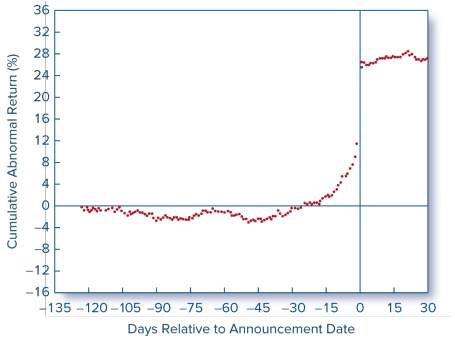

Figure 3: Cumulative abnormal returns before takeover attempts (BKM 2023, Figure 11.1)

. The daily returns for a stock and the S&P 500 are given below. The stock has an expected return equal to the index return.

Date	Stock return (%)	S&P 500 return (%)
Feb. 8	0.5	0.5
Feb. 9	-0.2	-0.4
Feb. 10	0.1	-0.1
Feb. 11	-0.3	-0.2
Feb. 12	0.6	0.3
Feb. 13	0.4	0.3
Feb. 14	0.2	0.5

a. What is the cumulative abnormal return over that period (in percentage points)?

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Feb. 13	0.4	0.3
Feb. 14	0.2	0.2
Feb. 15	0.4	0.3
Feb. 16	-0.4	-0.6

a. What is the cumulative abnormal return over that period (in percentage points)?

b. If the company released worse than expected earnings on Feb. 12, are the observed returns consistent with semistrong-form efficient markets?

- ○ No, because there were abnormal returns on most days.
- ○ No, because the cumulative abnormal return is different from zero at the end of the period.
- ○ Yes, because the cumulative abnormal return changed significantly only on that date.
- ○ Yes, because the cumulative abnormal return is different from zero at the end of the period.

Three issues that keep alive the debate over the EMH

- Magnitude issue
  - Only managers of large portfolios earn enough trading profits to make exploiting minor mispricing worth the effort
  - Still, market volatility likely swamps any increases in performance from their efforts
  - "How efficient are markets?" is a better question than "are markets efficient?"
- Selection bias issue
  - Good investment schemes may remain private
- Lucky event issue
  - With 10,000 people flipping a fair coin 50 times each, about 2 investors will flip heads at least 75% of the time
  - It takes a very long time to distinguish skill from luck

Weak-form tests of EMH I

- Returns over *short* horizons
  - Momentum is the tendency of poorly performing stocks and well-performing stocks in one period to continue that abnormal performance in the following periods
  - Observed for portfolios for 3-month to 12-month holding periods but not for single stocks
- Returns over *long* horizons
  - The *reversal effect* is the tendency of poorly performing stocks and well-performing stocks in one period to experience *reversals* in the following periods
  - Overreaction followed by correction causes prices to fluctuate around fair value, making market values more volatile than intrinsic values

Weak-form tests of EMH II

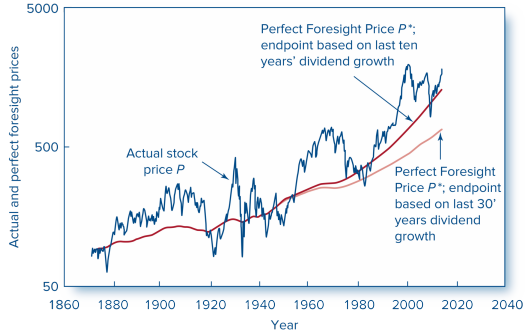

Figure 4: Real (inflation-adjusted) value of the S&P 500 and two estimates of intrinsic value obtained by discounting future dividends plus terminal value in 2013 based on a constant-growth dividend discount model. Discount rate equals 7.6%, the historical average of real market return since 1871 (BKM 2023, Figure 11.3)

Weak-form tests of EMH III

- An alternative interpretation of Figure 11.3 is that the market risk premium varies over time
- Therefore, overshooting and correction are rational responses to changes in discount rates
- *Bottom line: there is evidence of short-run momentum and long-run reversal for the market as a whole and across portfolios and sectors*

There are predictors of broad market returns

- Fama and French (1988) show that the return on the aggregate stock market tends to be higher when the dividend yield is high
- Campbell and Shiller (1988) show that earnings yield can predict market returns
- Keim and Stambaugh (1986) show that bond spreads can help predict market returns
- *Bottom line: we can interpret these findings as evidence of predictable abnormal returns or market risk premiums that vary over time*

Semistrong-form tests of EMH

- Fundamental analysis uses a wider range of information to create portfolios than technical analysis
- Several easily available pieces of information seem to predict abnormal or risk-adjusted returns
- These findings seem to contradict the EMH and are often called “anomalies”

The small-firm effect (Banz 1981)

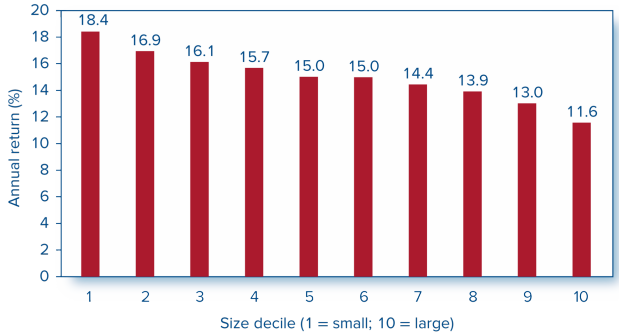

Figure 5: Average annual return for 10 size-based portfolios, 1926–2021 (BKM 2023, Figure 11.4)

The value-effect (Fama and French 1992)

Figure 6: Average return as a fucntion of book-to-market ratio, 1926–2021 (BKM 2023, Figure 11.5)

Post-earnings announcement drift (Ball and Brown 1968)

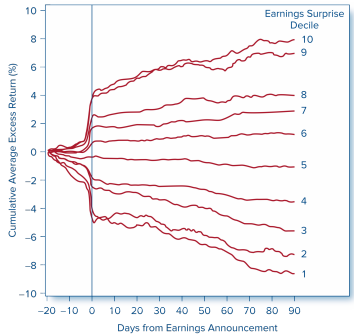

Figure 7: Cumulative abnormal returns in response to earnings announcements (BKM 2023, Figure 11.6)

Other anomalies

- P/E effect: Portfolios of low-P/E stocks have provided higher returns than high-P/E portfolios
- Neglected-firm effect: Investments in stock of less well-known firms have generated abnormal returns
- Liquidity effect: Illiquid stocks have a strong tendency to exhibit abnormally high returns
- Volatility: Negatively associated with returns
- Accruals and earnings quality: High accruals have predicted low future returns
- Growth: More rapidly growing firms (with high capital investments, sales growth, asset growth, or high share issuance) tend to have lower future returns
- Profitability: Gross profitability seems to predict higher stock returns
- q-factor: Tobin's q is a good predictor of average stock returns

Strong-form tests of EMH

- We regulate and limit trades based on inside information and do not expect markets to be strong-form efficient
- We have empirical evidence that insiders trade profitability in their stock
- The Security and Exchange Commission (SEC) requires insiders to disclose their trades, making them public information
- However, following these disclosures does not generate abnormal returns large enough to cover transaction costs

How should we interpret these anomalies? I

- Size, value, momentum, and long-term reversal are the most puzzling empirical findings in finance
- They may all be related because small, value, and loser firms have all had large negative returns recently and may be distressed firms
- These empirical findings have two interpretations
  - Fama and French argue that time-varying risk premiums explain these findings
  - Lakonishok, Shleifer, and Vishny argue that these findings are evidence of inefficient markets
- Ignoring their interpretation, are these anomalies *real* or data mining?
  - Size, value, and momentum may be real anomalies, as they exist around the world and across asset classes
  - Other anomalies have been less persistent *out-of-sample*, and some researchers have called for a higher statistical significance threshold for new anomalies
- Over time, anomalies should be self-destructing
  - McLean and Pontiff (2016) find exactly this!
  - They test 97 anomalies and find that

How should we interpret these anomalies? II

- Returns are 28% lower out-of-sample, suggesting at least some anomalies are data snooping
- Returns are 58% lower after publication, suggesting investors learn from academic research and profit from exploiting mispricings
- Anomalies are more persistent for stocks that are difficult to arbitrage (i.e., small, illiquid, and risky stocks)

Do tulip mania, the South Sea Bubble, and the dot-com boom and bust show that prices are arbitrary?

- Probably not, and obvious trading opportunities are not abundant
- Most bubbles are obvious only in retrospect, and price run-ups typically have reasonable explanations
- Security valuation is difficult, and intrinsic value estimates are imprecise
- Even if prices are "wrong", profiting from mispricings is difficult
  - Short-selling is expensive and may not be possible
  - Prices can move against you in the short term, wiping out your capital

Can skilled investors make consistent abnormal trading profits?

- This market efficiency definition we care about!
- We will consider evidence from:
  - Stock market analyst recommendations
  - Mutual fund managers

Stock market analysts give overwhelmingly positive assessments of firms

- Stock market analysts typically work for brokerage firms, so they may be conflicted
- On a scale of 1 (strong buy) to 5 (strong sell), the average recommendation in 1996 was 2.04
- So, we typically:
  - Focus on *changes* in recommendations instead of levels
  - Some researchers find that positive changes are associated with price increases and negative changes are associated with price decreases
  - However, other researchers find that trading strategies based on recommendations trade heavily and have associated trading costs that wipe out potential profits

There is little evidence that professional portfolio managers consistently beat the market I

	Number of top-half performers in year ending June 2019	Percentage of 2019 outperformers that perform in top half of sample in year ending June 2020	Percentage of 2019 outperformers that perform in top half of sample in both year ending June 2020 and year ending June 2021
All domestic equity funds	1,041	71.8	19.0
Large-cap equity funds	373	61.1	25.5
Small-cap equity funds	261	69.4	16.5

Source: Berlinda Liu and Gaurav Sinha, "U.S. Persistence Scorecard, Mid-Year 2021," *S&P Dow Jones Indices*, October 2021.

Figure 8: Consistency of Investments Results (BKM 2023, Table 11.1)

There is little evidence that professional portfolio managers consistently beat the market II

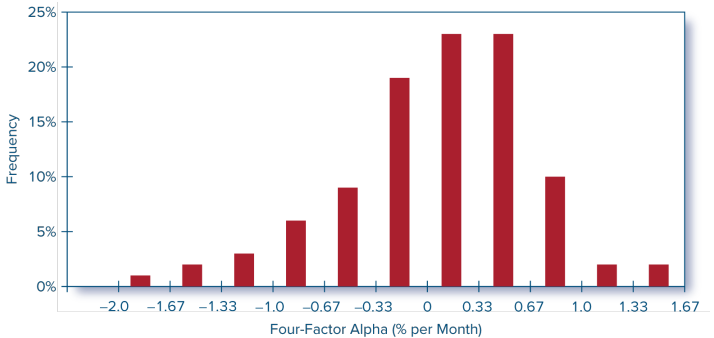

Figure 9: Mutual fund alphas computed using a four-factor model of expected return, 1993–2007. (The best and worst 2.5% of observations are excluded from this distribution.) (BKM 2023, Figure 11.8)

There is little evidence that professional portfolio managers consistently beat the market III

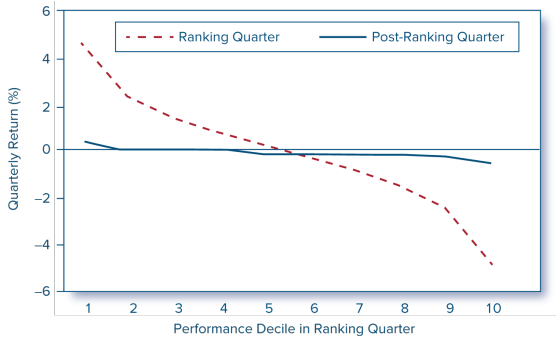

Figure 10: Risk-adjusted performance in ranking quarter and following quarter (BKM 2023, Figure 11.9)

Berk and Green (2004) provide important nuance the poor performance of portfolio managers

- They argue that skilled mutual fund managers with abnormal returns attract new investors until the costs and challenges of managing a larger mutual fund drive alpha to zero
- So, skill appears as large assets under management (AUM) instead of large abnormal returns
- Therefore, alphas are short-lived, even if managers have skill

So, are markets efficient?

- Enough anomalies exist in the empirical evidence to continue the search for underpriced securities
- However, the market is competitive enough that only superior information or insight will earn money
- The margin of superiority that any professional manager adds is so slight that the statistician will not easily be able to detect it

There are 10,000 mutual fund managers. 14 claim that they are the best, since their fund beat the relevant index every year for 6 years.

However, you think that markets are efficient and that the average fund manager is as likely to deliver a better performance than the index as to underperform the index, before fees.

a. What is the probability that the average single fund managers beats the index 6 years in a row (before fees)?

b. How many fund managers would you expect to beat the index 6 years in a row if only luck and no skill was involved?

Summary and Key Equations I

1. Statistical research has shown that to a close approximation stock prices seem to follow a random walk with no discernible predictable patterns that investors can exploit. Such findings are now taken to be evidence of market efficiency, that is, evidence that market prices reflect all currently available information. Only new information will move stock prices, and this information is equally likely to be good news or bad news.
2. Market participants distinguish among three forms of the efficient market hypothesis. The weak form asserts that all information to be derived from past trading data already is reflected in stock prices. The semistrong form claims that all publicly available information is already reflected. The strong form, which generally is acknowledged to be extreme, asserts that all information, including insider information, is reflected in prices.
3. Technical analysis focuses on stock price patterns and on proxies for buy or sell pressure in the market. Fundamental analysis focuses on the determinants of the underlying value of the firm, such as current profitability and growth prospects. Because both types of analysis are based on public information, neither should generate excess profits if markets are operating efficiently.
4. Proponents of the efficient market hypothesis often advocate passive as opposed to active investment strategies. Passive investors buy and hold a broad-based market index. They expend resources neither on market research nor on frequent purchase and sale of stocks. Passive strategies may be tailored to meet individual investor requirements.
5. Event studies are used to evaluate the economic impact of events of interest, using abnormal stock returns. Such studies usually show that there is some leakage of inside information to some market participants before the public announcement date. Therefore, insiders do seem to be able to exploit their access to information to at least a limited extent.
6. One notable exception to weak-form market efficiency is the apparent success of momentum-based strategies over intermediate-term horizons.
7. Several anomalies regarding fundamental analysis have been uncovered. These include the value-versus-growth effect, the small-firm effect, the momentum effect, and post–earnings-announcement price drift. Whether these anomalies represent market inefficiency or poorly understood risk premiums is still a matter of debate.
8. By and large, the performance record of professionally managed funds lends little credence to claims that most professionals can consistently beat the market. Superior performance in one period does not generally predict superior performance going forward.

Figure 11: Chapter 11 summary from BKM (2023)

Summary and Key Equations II

$$\begin{aligned}\text{Abnormal return} &= \text{Actual return} - \text{Expected return given the return on a market index} \\ &= r_t - (a + br_{Mt})\end{aligned}$$

Figure 12: Chapter 11 key equations from BKM (2023)

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