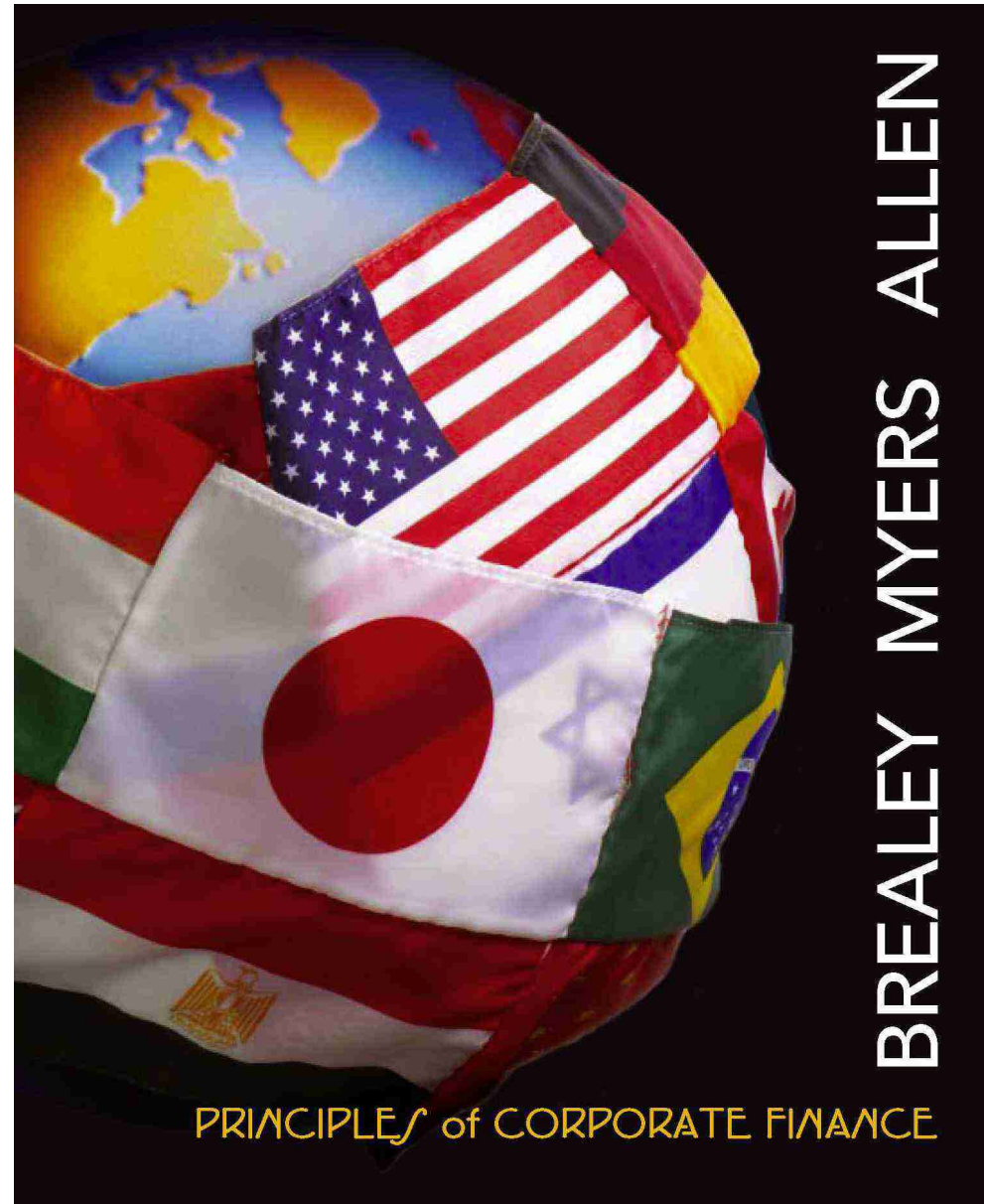Canadian Edition

Financial Markets and Institutions

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Chapter Ten

The Efficient Market Hypothesis

A Hipótese de Eficiência de Mercado

PRINCIPLES of CORPORATE FINANCE

BREALEY MYERS ALLEN

Topics Covered

- We Always Come Back to NPV

  Sempre voltamos ao valor presente líquido

- What is an Efficient Market?

  O que é um mercado eficiente?

  – Random Walk

  - Passeio aleatório

  – Efficient Market Theory

  - Teoria da Eficiência de Mercado

  – The Evidence on Market Efficiency

  - A evidência da eficiência de mercado

- Puzzles and Anomalies

  Enigmas e anomalias

- Six Lessons of Market Efficiency

  Seis lições sobre eficiência de mercado

Return to NPV

Retorno ao valor presente líquido

- The NPV (Net Present Value) of any project is the addition to shareholder wealth that occurs due to undertaking the project

O NPV de qualquer projeto é a soma à riqueza do acionista que ocorre quando se empreende o projeto.

- In order to increase shareholder wealth, only undertake projects that have a higher return than the return required by the shareholders (assume the firm is all equity financed).

Para aumentar a riqueza do acionista, somente empreenda projetos que ofereçam retorno maior que o exigido pelos mesmos.

- Positive NPV investment decisions often rely on some sustainable competitive advantage, such as patents, expertise or reputation

Decisões de investimento com NPV positivo em geral dependem de vantagens competitivas sustentáveis como ....

- Positive NPV financing decisions are much harder to find, since a positive NPV to the issuer of a security implies a negative NPV to the buyer of the security

Ddecisões de financiamento que gerem NPV positivo são muito difíceis de encontrar,
Dado que VPL positivo para o emitente de um título implica um VPL negativo para o comprador do mesmo.
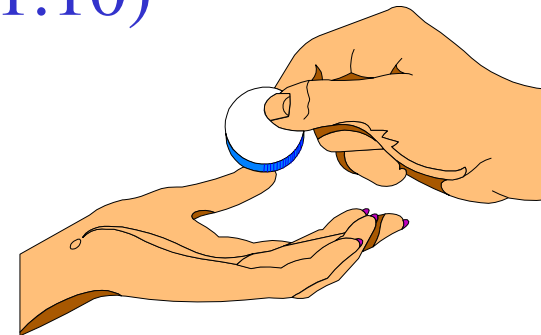
Return to NPV

Example

The government is lending you $100,000 for 10 years at 3%. They require interest payments only prior to maturity. Since 3% is obviously below market, what is the value of the below market rate loan?

Assume the market return on equivalent risk projects is 10%.

$$NPV = 100,000 - \left[\sum_{t=1}^{10} \frac{3,000}{(1.10)^t} \right] - \frac{100,000}{(1.10)^{10}}$$
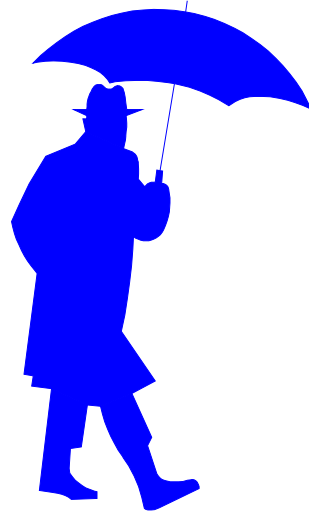
$$= 100,000 - 56,988$$

$$= \$43,012$$

What is an Efficient Market?

- 1953 – Maurice Kendall, a British statistician, presents a paper to the Royal Statistical Society on the behavior of stock & commodity prices

- He had expected to find regular & predictable price cycles, but none appeared to exist

- Kendall's results had been proposed by a French doctoral student, Louis Bachelier, 53 years earlier.

- Bachelier's accompanying development of the mathematics of random processes preceded by five years Einstein's work on the random Brownian motion of colliding gas molecules.
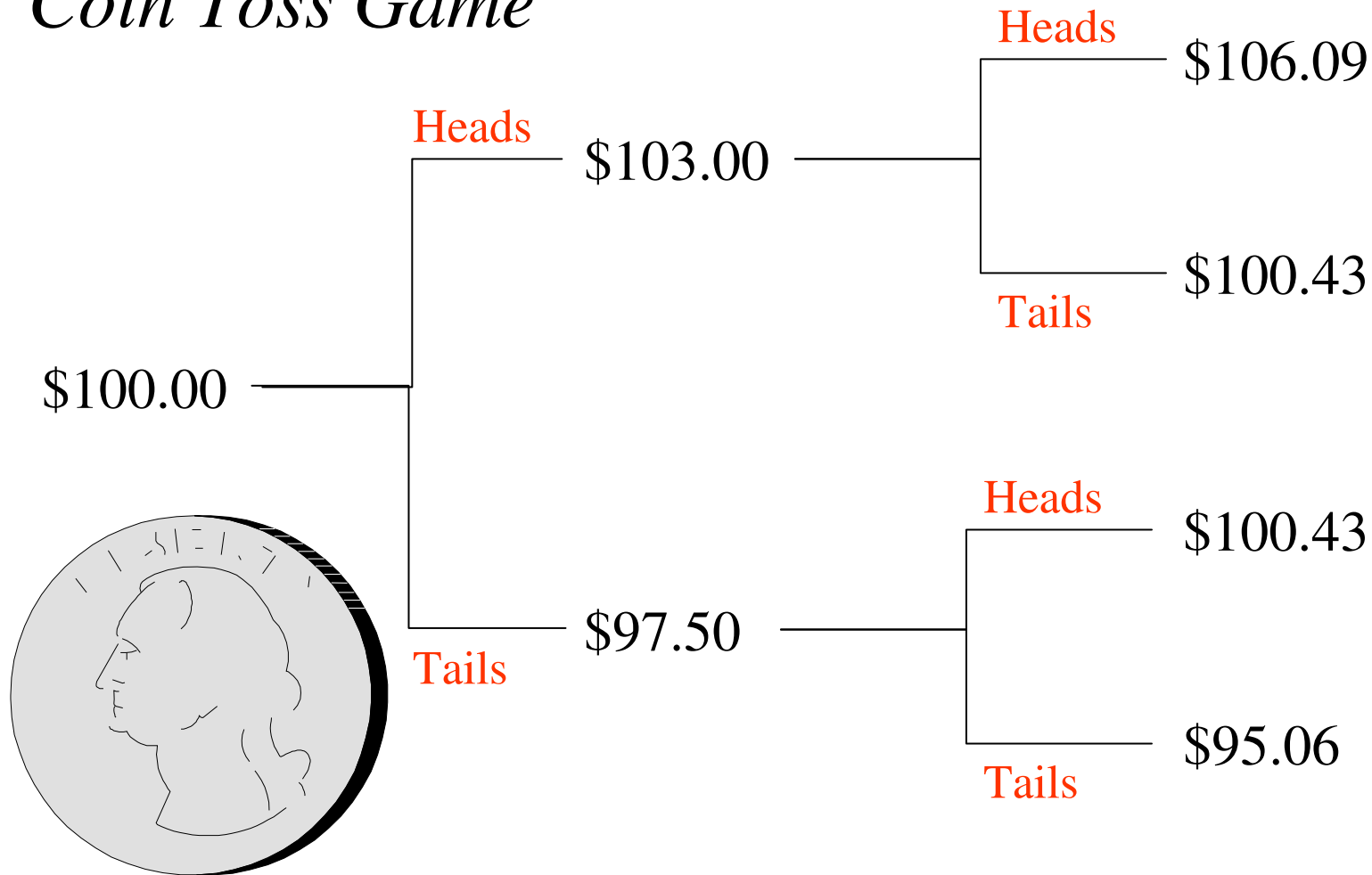
What is a Random Walk?

- Stocks follow a random walk if the movement of stock prices from day to day DOES NOT reflect any pattern.

- Statistically speaking, the movement of stock prices is random, albeit with a positive skewness (technically known as a submartingale)
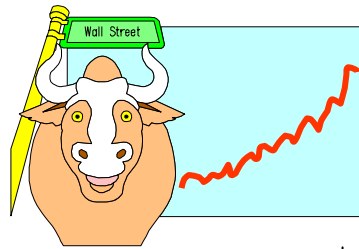
Random Walk Theory

Coin Toss Game

$100.00

Heads — $103.00

Tails — $97.50

Heads — $106.09

Tails — $100.43

Heads — $100.43

Tails — $95.06

The Coin Toss Game

- You start with $100

- At the end of each week, a coin is tossed

- If the coin comes up heads, you win 3% of your investment

- If the coin comes up tails, you lose 2.5%

- The process is a random walk with a positive drift of 0.25% per week (the drift is equal to the expected outcome – (0.5)(3%) + (0.5)(-2.5%) = 0.25%

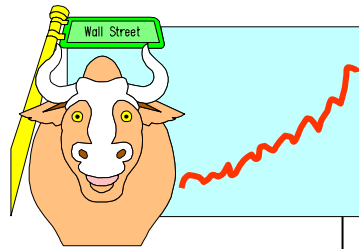- It is a random walk because the change in price next week is independent of the change in price this week

Random Walk Theory

S&P 500 Five Year Trend?
or
5 yrs of the Coin Toss Game?
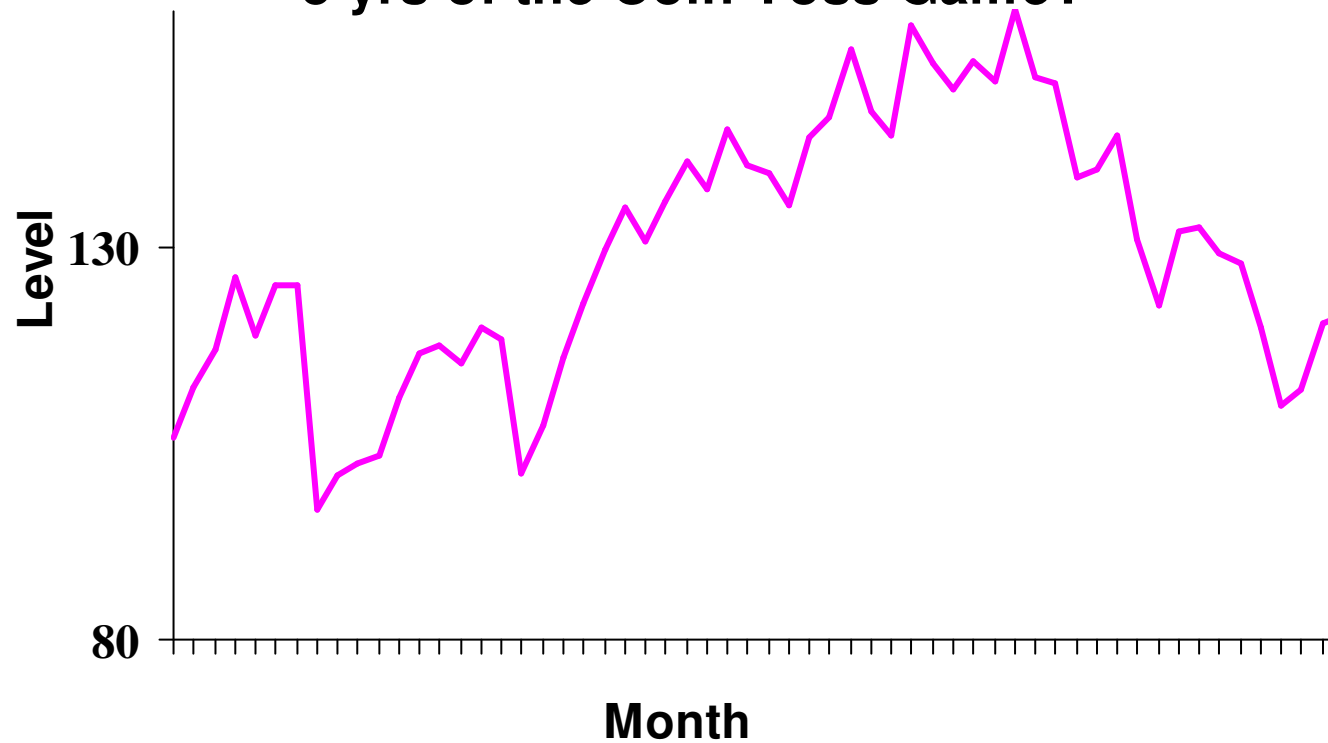
Random Walk Theory

S&P 500 Five Year Trend?
**or**
5 yrs of the Coin Toss Game?

Why Does a Random Walk Theory Make Sense for Stock Prices

- If we assume that stock prices are based on information . . .

- Then stock prices should change on the receipt of new information

- Since by definition new information arrives in a random & unpredictable fashion, stock prices should change in a random & unpredictable fashion
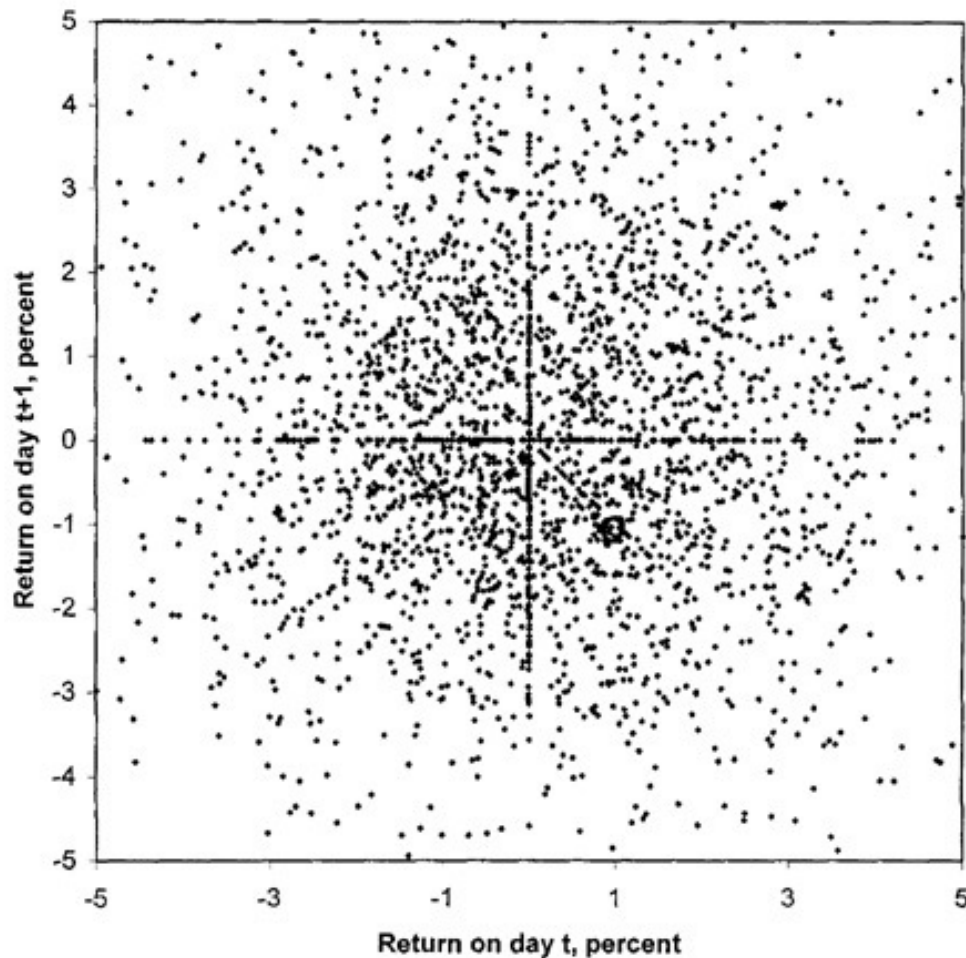
Efficient Market Theory

Microsoft Stock Price

Actual price as soon as upswing is recognized

$90

70

50
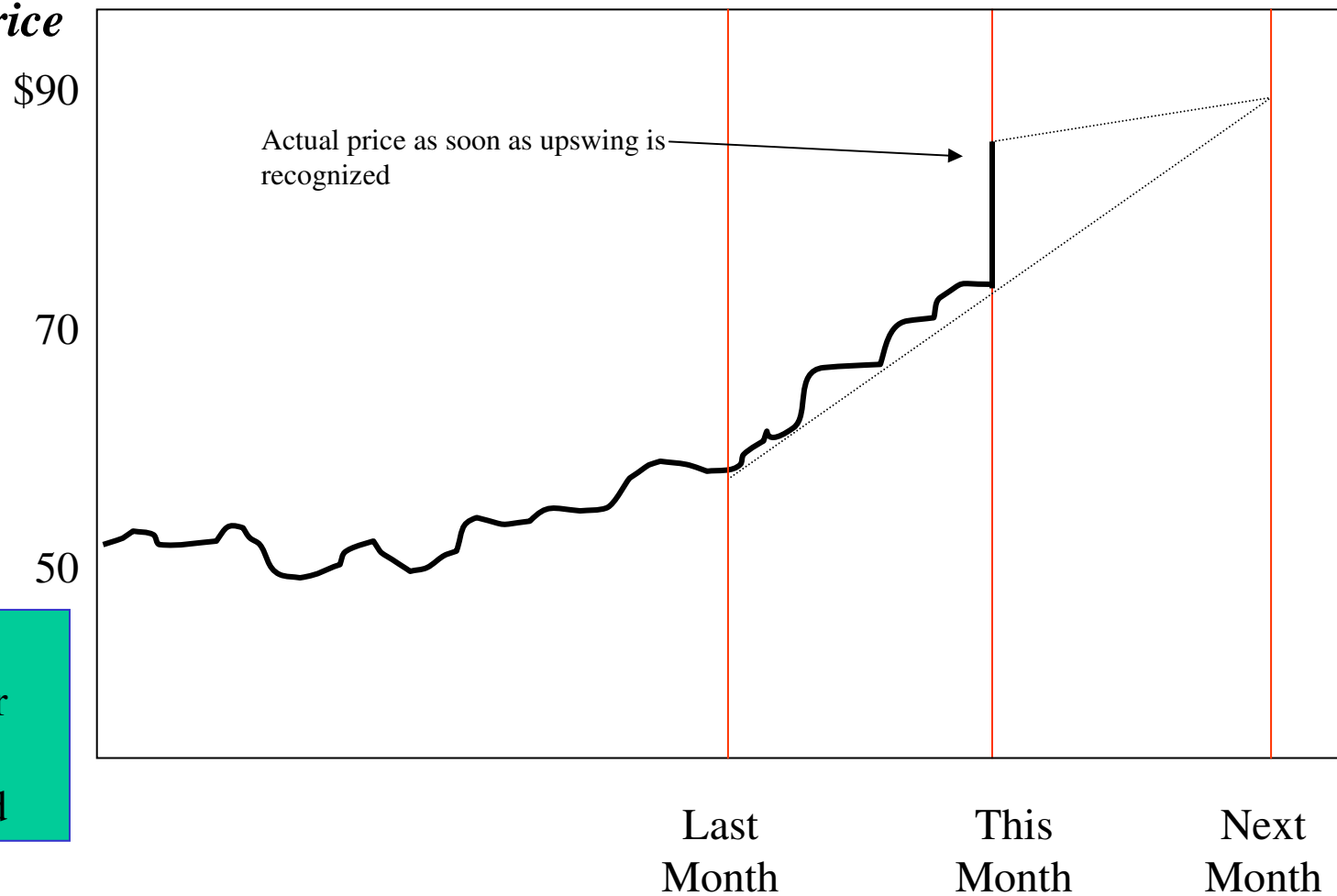
Cycles disappear once identified

Last Month

This Month

Next Month

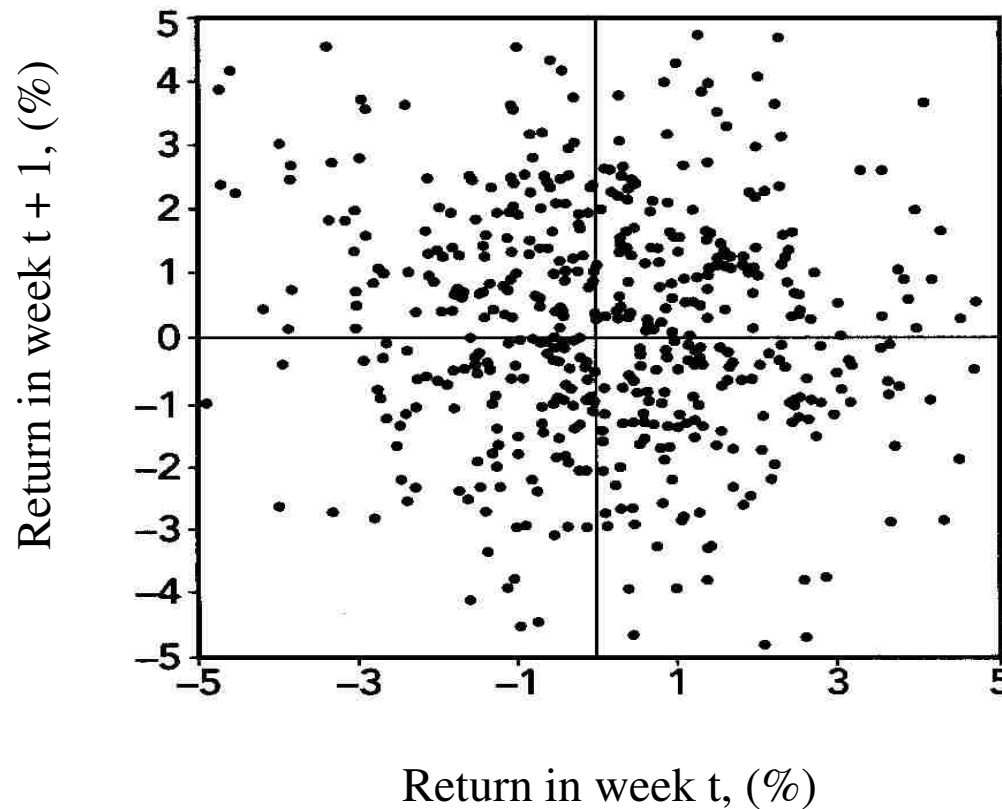# Random Walk Theory: Microsoft Stock Price Changes from March 1990 to May 2004

For Microsoft stock over the period March 1990 to May 2004, the correlation between a price change on day t and a price change on day t+1 was +0.025.

Random Walk Theory: Weekly Returns, May 1984 – May, 2004

FTSE 100

(correlation = -.08)

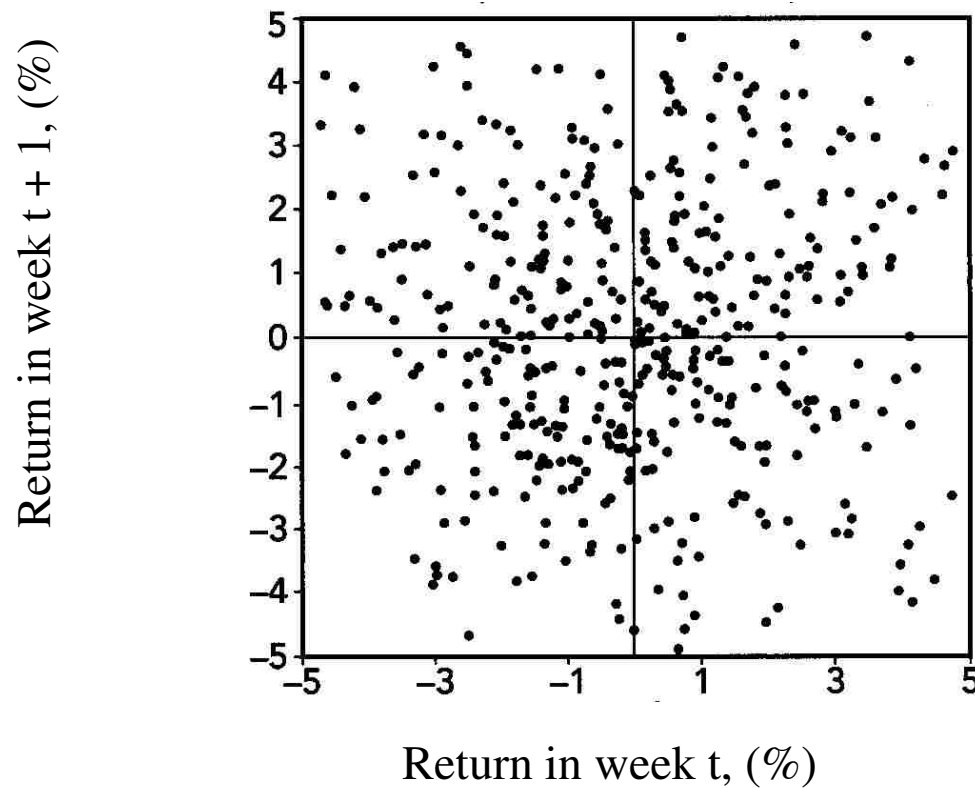Return in week t + 1, (%)

Return in week t, (%)

FTSE is an independent company owned by The Financial Times and the London Stock Exchange. Their sole business is the creation and management of indices and associated data services, on an international scale.

Random Walk Theory: Weekly Returns, May 1984 – May, 2004
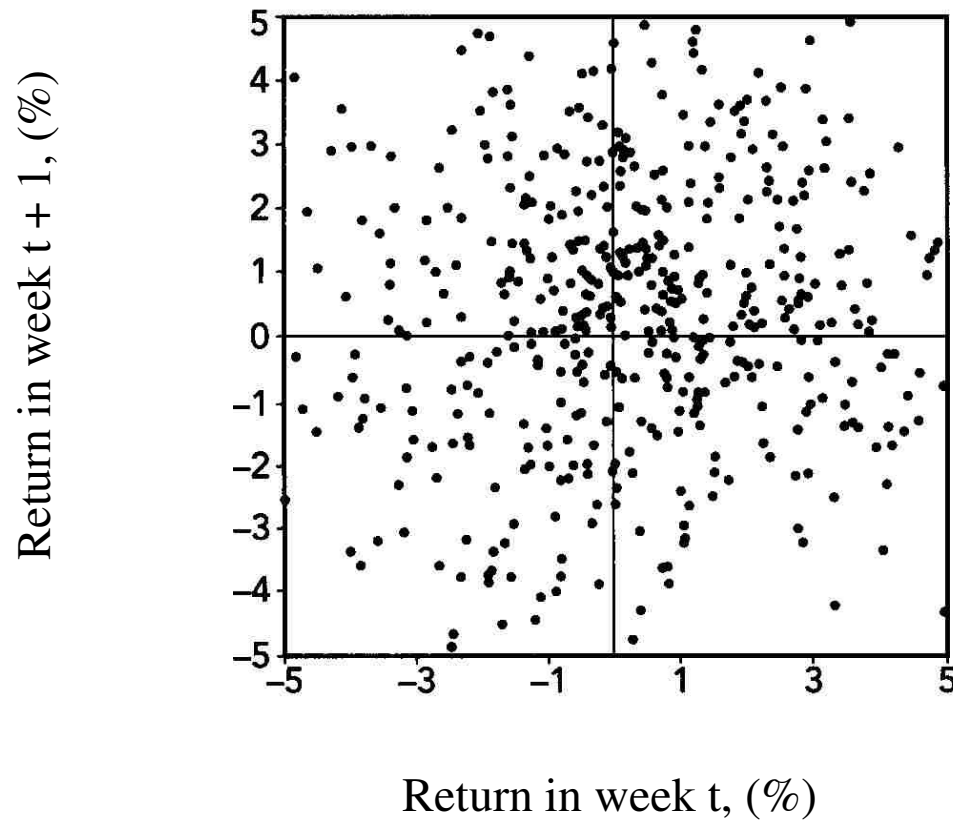
Nikkei 500

(correlation = -.06)

Return in week t + 1, (%)

Return in week t, (%)

Random Walk Theory: Weekly Returns, May 1984 – May, 2004

DAX 30

(correlation = -.03)

Return in week t + 1, (%)

Return in week t, (%)

Random Walk Theory: Weekly Returns, May 1984 – May, 2004

S&P Composite

(correlation = -.07)

Return in week t + 1, (%)

Return in week t, (%)
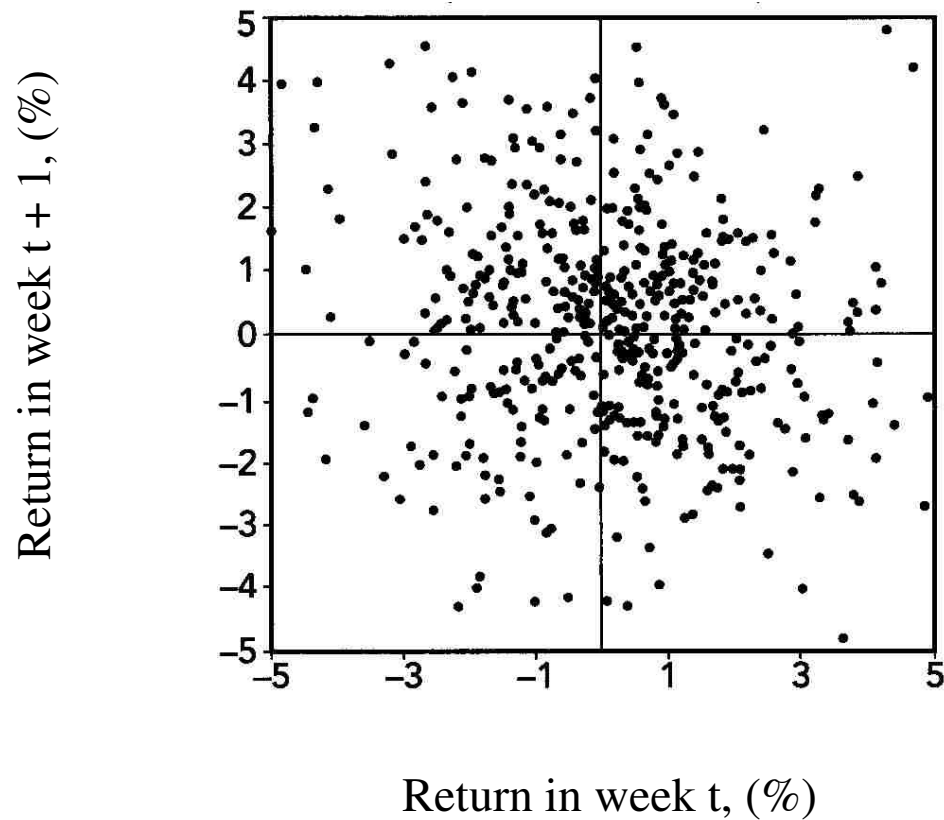
Efficient Market Theory

- First use of the term, "efficient markets" appears in a 1965 paper by Eugene Fama

- Three forms of market efficiency:
  - Weak Form Efficiency
    - Current market price captures all information contained in past stock price & volume data
  - Semi-Strong Form Efficiency
    - Current market price captures all publicly available information
  - Strong Form Efficiency
    - Current market price captures all information, both public and private
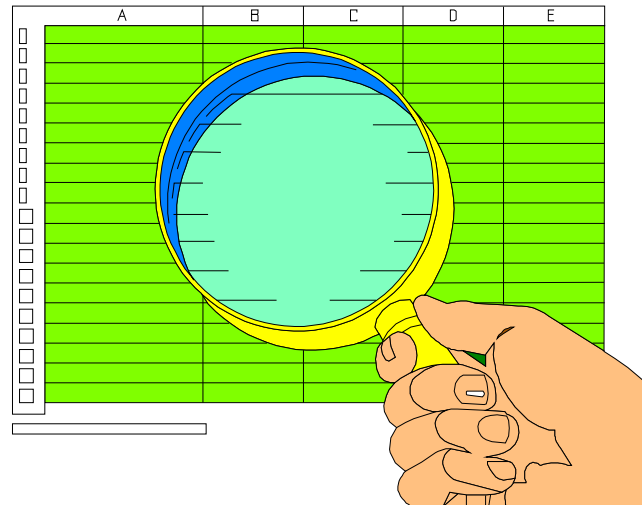
Efficient Market Theory

- **Technical Analysts**
  - Forecast stock prices based on the watching the fluctuations in historical prices & volumes (thus "*wiggle watchers*")
  - Should have no marginal value if the market is weak form efficient!
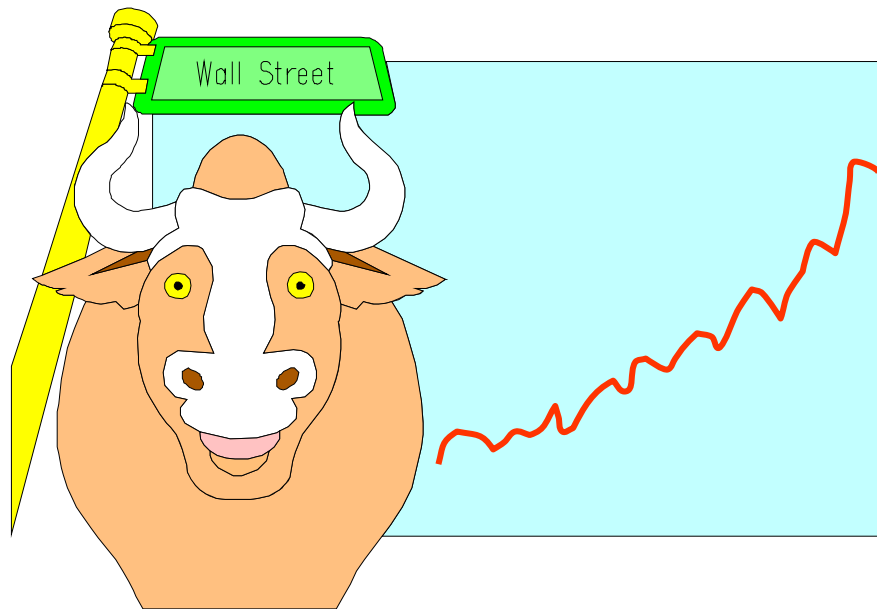
Efficient Market Theory

- **Fundamental Analysts**
  - Research the value of stocks using NPV and other measurements of cash flow
  - Should have no marginal value if the market is semi-strong form efficient!

Testing the Efficient Market Hypothesis

- To test the Efficient Market Hypothesis, you measure the abnormal return around an announcement date

  $Abnormal\ return = Actual\ return - expected\ return$

  $$= r_{Actual} - (\alpha + Br_{Market})$$

- Graph on the next page shows the average impact on the price of 194 firms that were takeover targets

- Patell & Wolfson found that when new information is released, the major part of the adjustment in price occurs within 10 minutes of the announcement

Efficient Market Theory
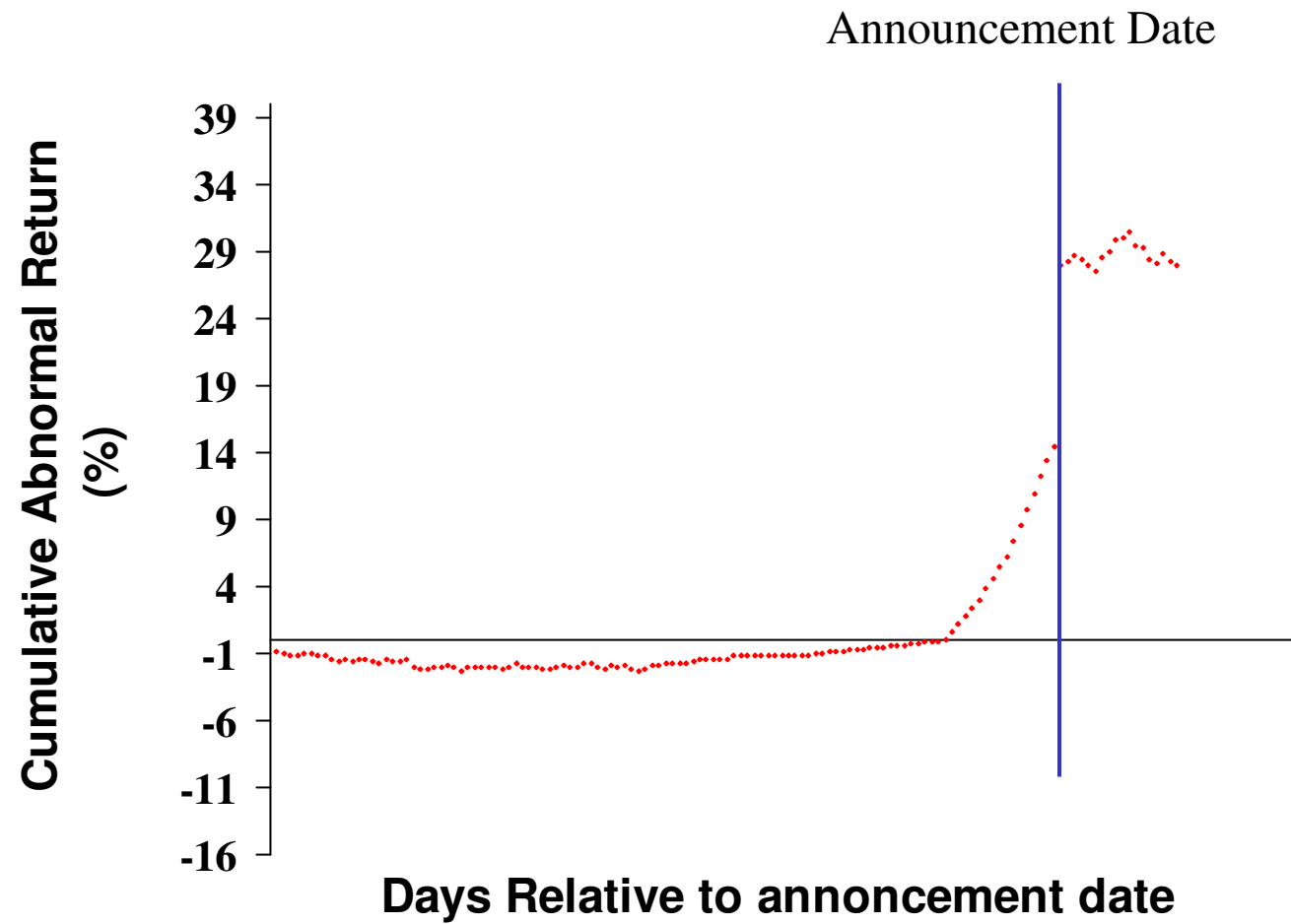
Mutual Fund Performance: Evidence that Markets are Efficient

- Mark Carhart analyzed 1,493 mutual funds to see if professional money managers could out-perform the market
- He found that, on average, mutual funds earn a lower return than the benchmark after expenses and roughly match the benchmark before expenses
- In Canada, the average equity mutual fund MER is between 2 – 2.5%
- Over long periods of time, the loss of return due to expenses will reduce terminal wealth significantly
- Result: US corporate pension funds now invest over 25% of their equity holdings in index funds

Efficient Market Theory

Average Annual Return on 1493 Mutual Funds and the Market Index
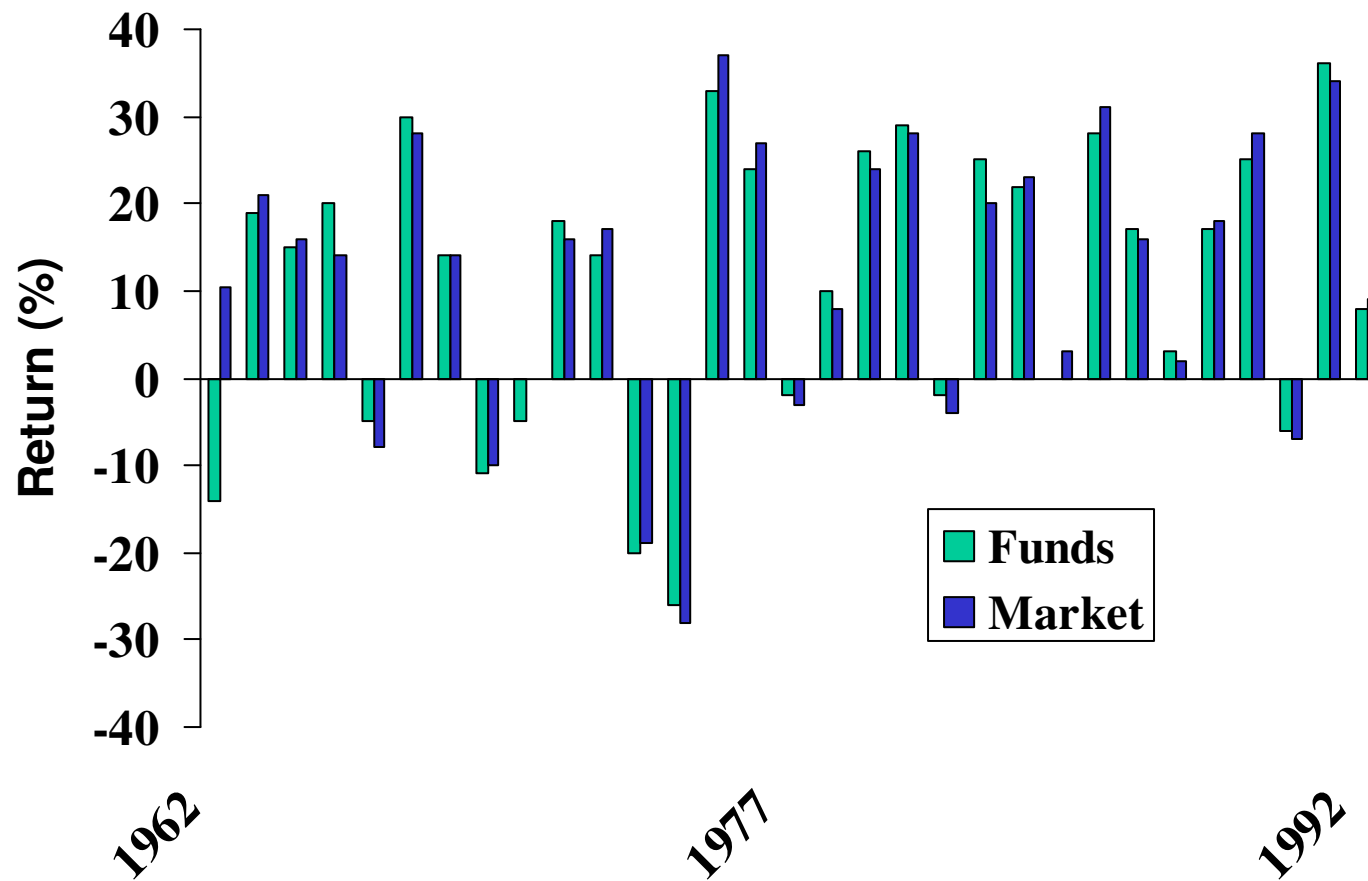
Puzzles & Anomalies

- The new issue puzzle – when firms issue an IPO, investors typically rush to buy.

- Those lucky enough to receive stock often obtain an immediate capital gain. However, later these often turn into losses

- Suppose you had bought stock immediately following each IPO & then held that stock for five years.

- Over the period 1970 – 2002, your average annual return would have been 4.2% less than the return on a portfolio of similar-sized stock

Efficient Market Theory

IPO Non-Excess Returns
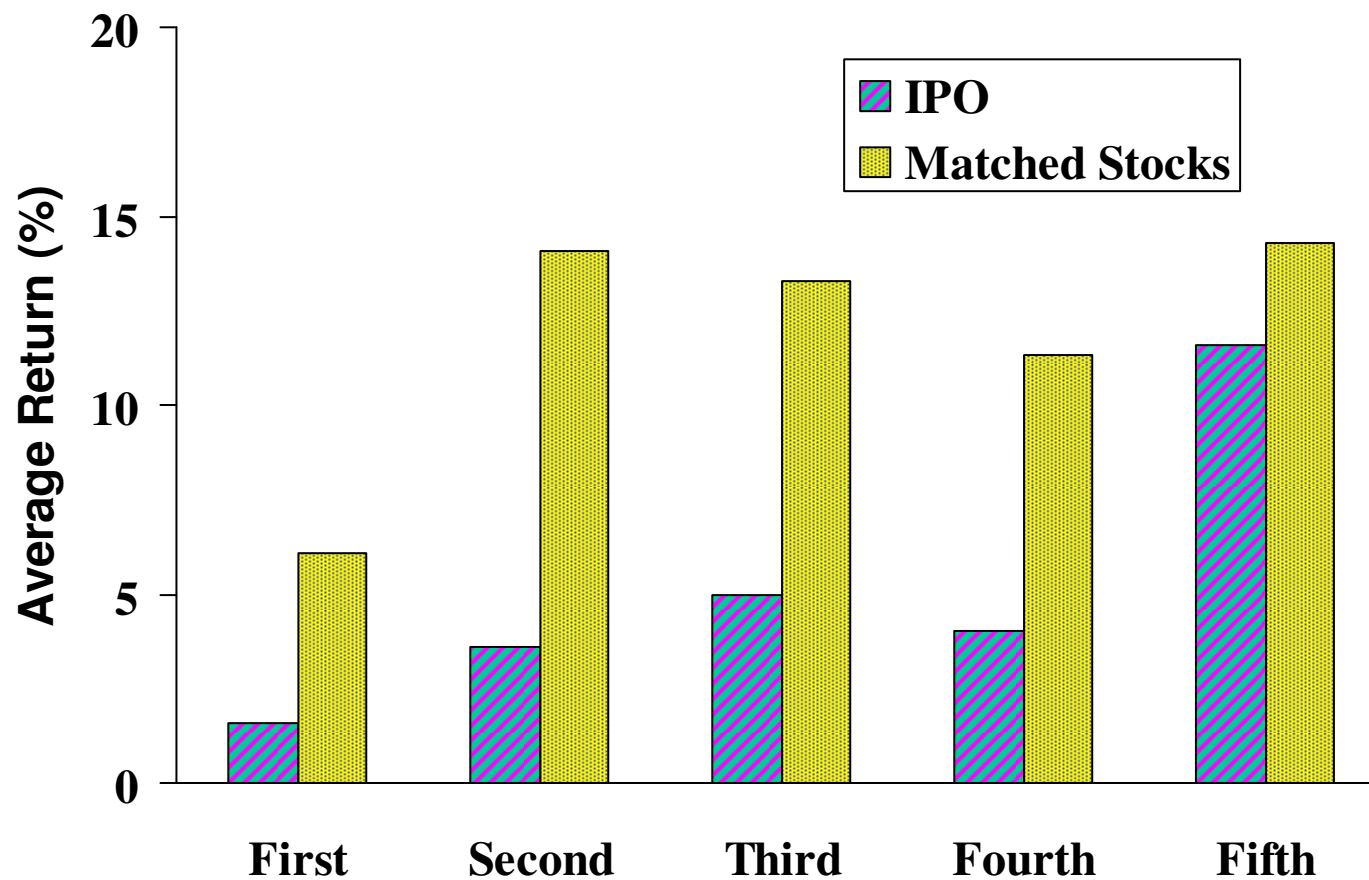
Evidence Against Efficient Market Hypothesis

- Anomalies
  1. Small-firm effect: small firms have abnormally high returns
  2. January effect: high returns in January
  3. Monday effect – one day returns highest on Friday; lowest on Monday (Monday returns often negative)
  4. Market overreaction
  5. Excessive volatility
  6. Mean reversion
  7. New information is not always immediately incorporated into stock prices
  8. Chaos and fractals

Mark Twain Effect

- The name comes from the following quote of Mark Twain
  - *October. This is one of the peculiarly dangerous months to speculate in stocks. The others are July, January, September, April, November, May, March, June, December, August, and February.*

- Evidence in support of this effect was provided by Cadsby (1989) based on data on the Canadian Stock Market.

Irrational Exuberance & the Dot.Com Bubble

- The NASDAQ Composite Index rose 580% from January 1, 1995 to its peak in March, 2000

- By October, 2002 the NASDAQ index had fallen 78%

- Yahoo! shares appreciated more than 1,400% in four years, making the company worth more than GM, Heinz & Boeing combined

- In *Irrational Exuberance*, Robert Shiller argues that as the bull market developed, it generated optimism about the future, which stimulated further demand for shares

- As individuals made large profits, they became more confident of their opinions

- Why didn't professional money managers bring rationality to the market?

Irrational Exuberance & the Dot.Com Bubble

In 2000, the total dividends paid by companies in the S&P500 totaled $154.6 million. If investors required a 9.2% return and they believed that the dividends would grow at 8%, the total value of the index would be $12.8 Billion, which was approximately equal to the value of the index at that time. By October, 2002, the value of the index had fallen to approximately $8.6 Billion.

$$PV(S \& P \; index)_{\text{March 2000}} = \frac{Div}{r-g} = \frac{154.6}{.092-.08} = 12,883$$

$$PV(S \& P \; index)_{\text{October 2002}} = \frac{Div}{r-g} = \frac{154.6}{.092-.074} = 8,589$$

Six Lessons of Market Efficiency

➲ Markets have no memory – price changes tomorrow are independent of price changes today

➲ Trust market prices – in an efficient market, the current market price will capture all (publicly available) information. Thus it is impossible for the average investor to consistently out-perform the market

➲ Read the entrails – if the market is efficient, it can tell us a great deal about a company's future prospects

Six Lessons of Market Efficiency

➲ There are no financial illusions – investors only care about cash flow. Accounting changes should be irrelevant.

➲ The *do it yourself* alternative – Investors won't pay firms to do what they can do more cheaply (such as diversification)

➲ Seen one stock, seen them all – most stocks are close substitutes for other stocks. Thus if the return on Company A's stock falls relative to its risk, investors will sell it and purchase the stock of Company B