Theory of stock market II: Rational expectation and the Efficient market Hypothesis (EMH)

EE431 Semester 2/2017

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What we will discuss in this lecture

- How price is determined in the market?
- What basically determine the movement of stock prices (and asset prices in general)?
- Theory that explains the movement of stock price (asset prices)
- Some anomalies in financial markets

How the market sets stock prices.

- Consider three investors: A, B and C.
  - Each is making an assessment to the valuation a company's stock.
- Let the expected dividend pay-out next year be $2 per share.
- Market analysts expect firm growth to be 3% but there is uncertainty about the constancy of the dividend stream.
- Required rate of return for each investor.
  - Investor A == the required rate of return is 15%.
  - Investor B == the required rate of return is 12%.
  - Investor C == the required rate of return is 10%

Stock prices valuation and Stock setting

- Following the basic Gordon growth model, perceived valuations to each investor are
  - Investor A valuation = [2/(.15-.03)] = $16.67
  - Investor B valuation = [2/(.12-.03)] = $22.22
  - Investor C valuation = [2/(.10-.03)] = $28.57

- If investor A holds stock, he/she would sell it to C.
  - Price is determined by the **highest bidding**!

What could possibly account for the differences in the required rate of return?

- A simple answer is the difference in subjective discount rate.
- Differences in the risk perspective among investors
  - **Expectation/anticipation** on the success of the company.

- What determines the expectation: **Information**.
  - Investor A == the required rate of return is 15% for investor A
  - Investor B == the required rate of return is 12%; He has researched **industry insiders** and is more confident.
  - Investor C == He has some **inside information** and hence feels that 10% is acceptable to compensate for risk.

How does the stock price change then?

- Since price is determined by expectation, change in the expectation then should explain the movement in price.
- Most existing theories explain the movement of stock prices, as well ass other asset prices, using **expectation-based** or **information-based** approach.
- When ***new* information** arrives, investors revise their expectations and act according to what they think.
  - Stock prices, as well as other financial variables, then move all the time.

A good real-world example: 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.
  - "***expected***" Downward revision of growth prospects: $\downarrow g$
  - Perceived risk higher; Increased uncertainty: $\uparrow r_j$
- **Gordon model predicts a drop in stock prices.**
  - Investors then act according to what they expect; stock prices drop.
- **Market price reflects *some information contents* that the investors have.**

Market (Actual) price v.s. Equilibrium price

- We call the market (actual) price that reflects all the information as the equilibrium price.

- Is it the case that the market (actual) price be equal to the equilibrium price? (Why is important to know the answer?)

- This question has been a hotly debate discussion in finance, at least since 1960s.

Nobel in 2013: *"for their empirical analysis of asset prices"*.

Eugene F. Fama

Lars Peter Hansen

Robert J. Shiller

Information efficient under rational expectation (Fama 1965)

Eugene F. Fama

- Market investors form the expectation all the time when they do the trading.
  - Expectation formations: adaptive v.s. rational expectation.
- Fama pointed out that
  - Investors are likely to form the rational expectation. (why?)
  - Given the rational expectation, asset prices should reflect all the relevant information available in the market.
  - Market price should therefore be equal to the equilibrium price; financial market is informationally efficient.
  - This is known as the **efficient market hypothesis**.

The rational expectation

- The expectation (or anticipation) makes use all available information.
  - This is often know as a forward-looking expectation.
- Rational expectations will be identical to *optimal forecasts.*
  - The forecast errors of optimal forecasts will, on average, be zero and cannot be predicted ahead of time.

$$X_t - E(X_t|I_t) = \varepsilon_t$$

Unbiased and minimum standard error!

Implication of rational expectation in finance

- A famous prediction for the rational expectation theory applied to financial market and asset prices is the **Efficient Market Hypothesis**.
  - If actual market price is deviating from the equilibrium price, investors will realize the arbitrage condition, i.e. profit-making opportunity.
  - Investors can implement some trading strategies that earn them the profits and enjoy an abnormal return.
  - Following those strategies, price will then move towards the equilibrium level; an abnormal return should be gone.
- Market price should reflect **all the relevant information**; financial market should be informationally efficient then.

EHM and some testable implications

- As it's a hypothesis, this must be tested for its validity.
  - Testable implications can be developed from the EHM.
  - If the data is to support the hypothesis, what we observe in the data should be consistent with implications predicted by the theory.

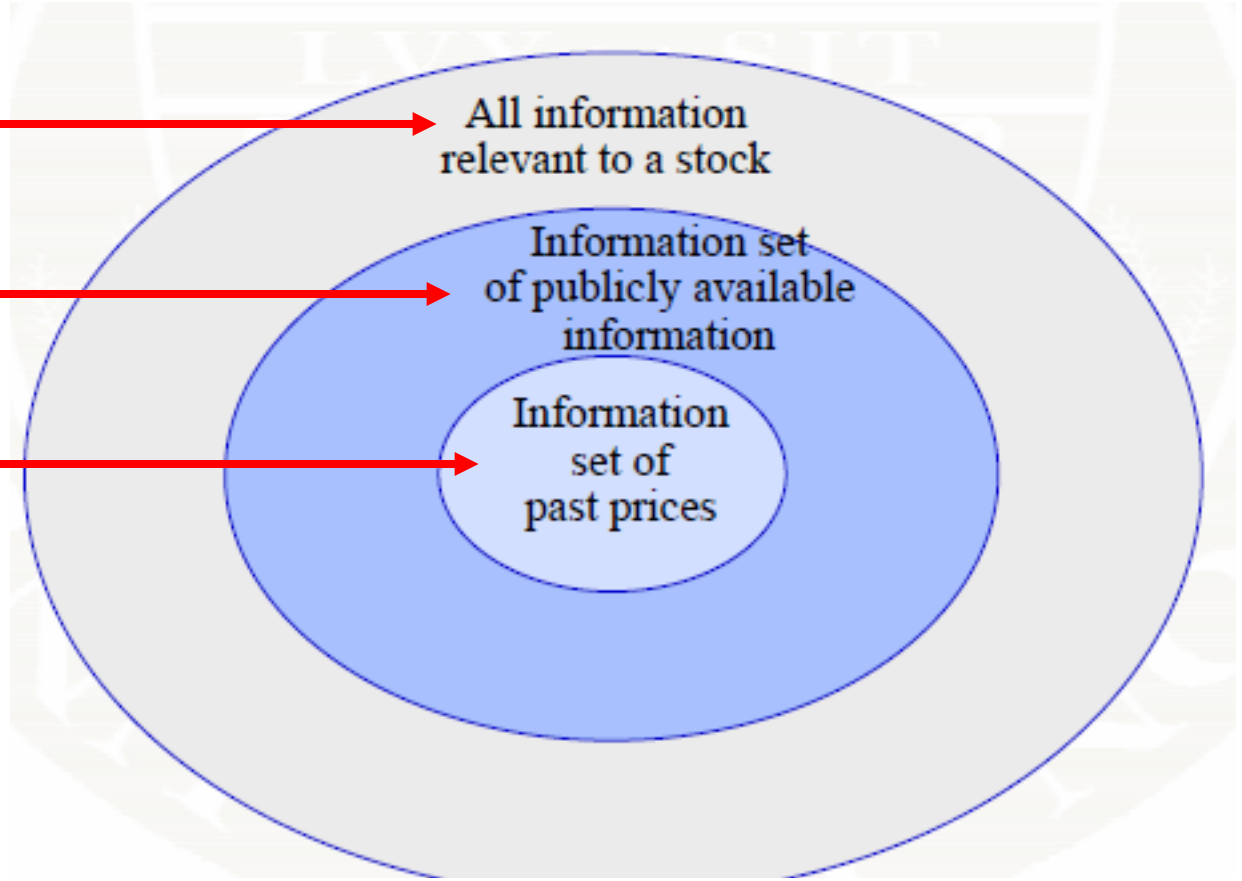
- Testable implications depend on the definition of what we mean by using "all the relevant information".
  - Past information – weak form EHM
  - Present public information – semi strong form EHM
  - Present inside information – strong form EHM

Types of relevant information

New private information

New public information

"old" / "past" information



Weak form efficiency

- ***Weak form efficiency*** – no investor can earn excess returns by developing trading rules based on historical price/returns data.
- All past information is reflected in the spot price of an asset.
- Testable implications: So, ***technical analysis*** or ***chartists*** rules cannot beat the market.
  - People already figured our that those rules work in the past, and hence incorporated those rules into trading process.
  - Such an arbitrage opportunity that used to be in place is already exploited, and no longer useful for making excess returns!

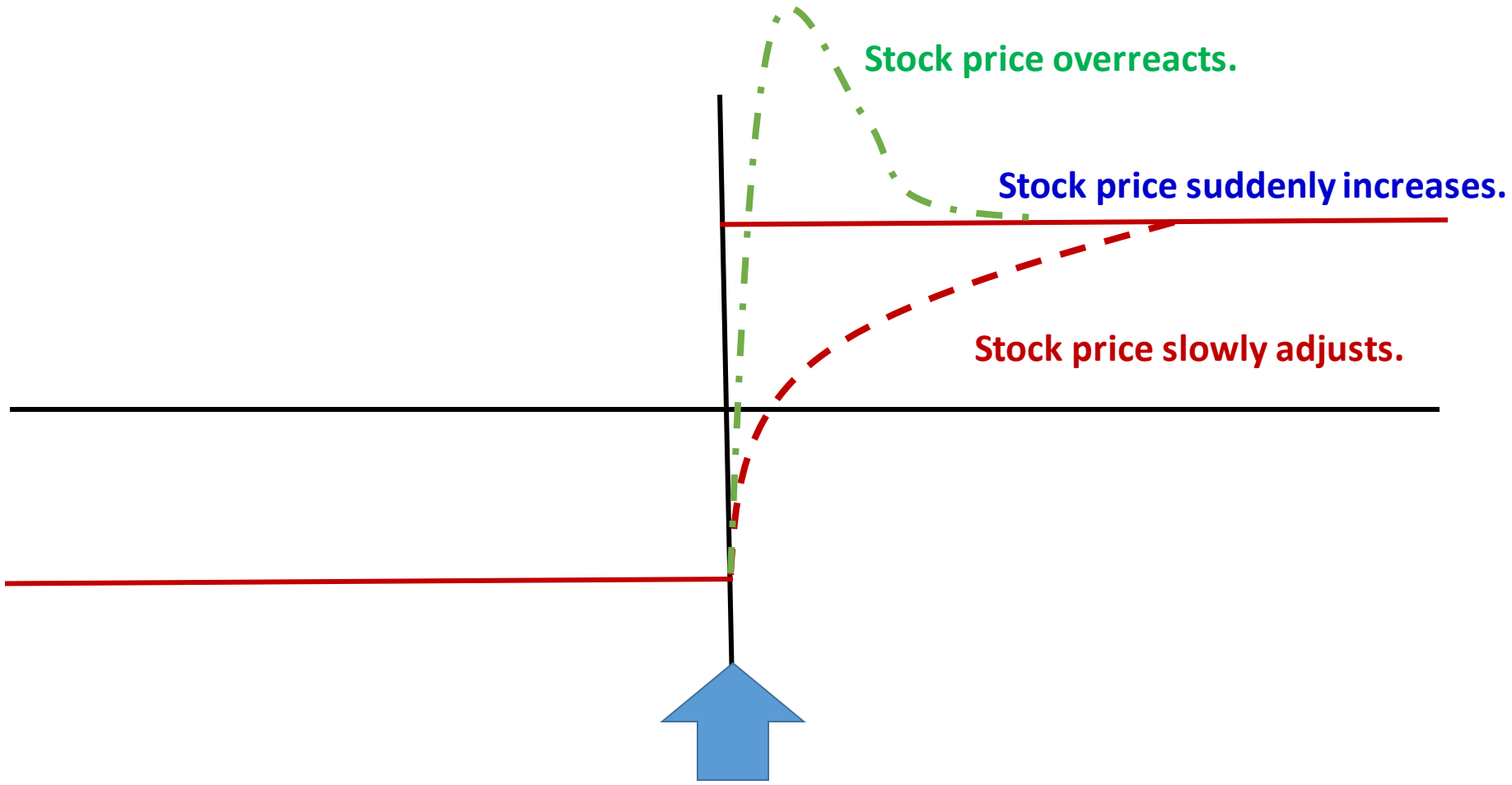
Semi-strong form efficiency

- No investor can earn excess returns from trading rules based on any publicly available information.

- Implication is that all publicly available information is fully reflected in the actual asset price.

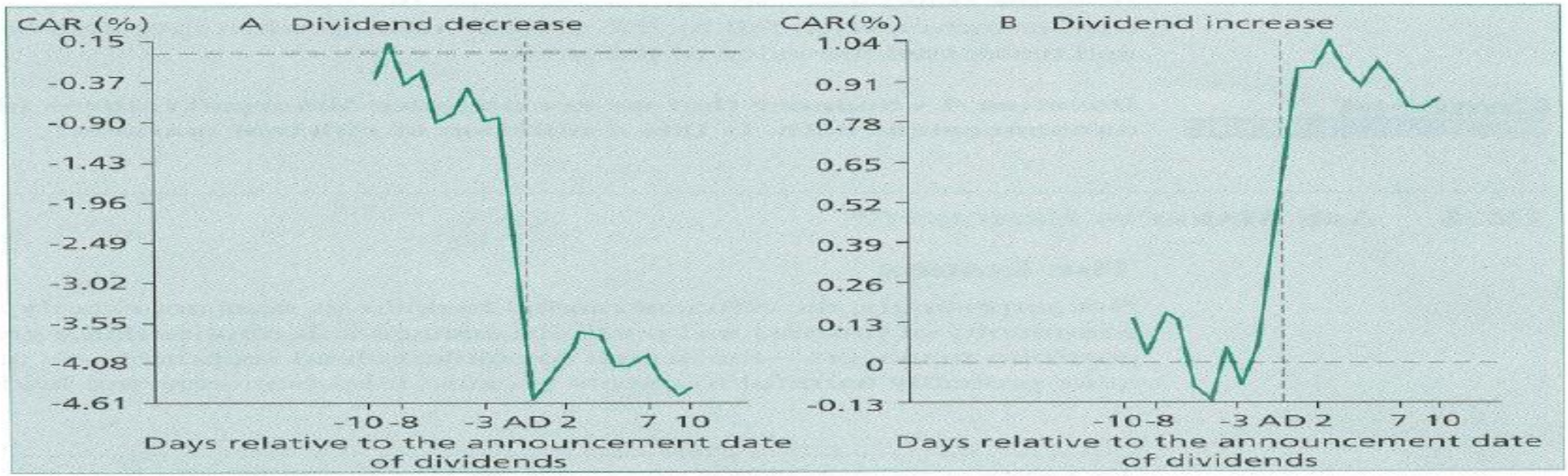
- Testable implications:
  - Market reaction to new publicly available information is instantaneous and unbiased. No over- or under-reaction.
  - ***Fundamental analysis*** based on publicly available information shouldn't result in abnormal returns.

Reaction under (new) public information.



Dividend announcements

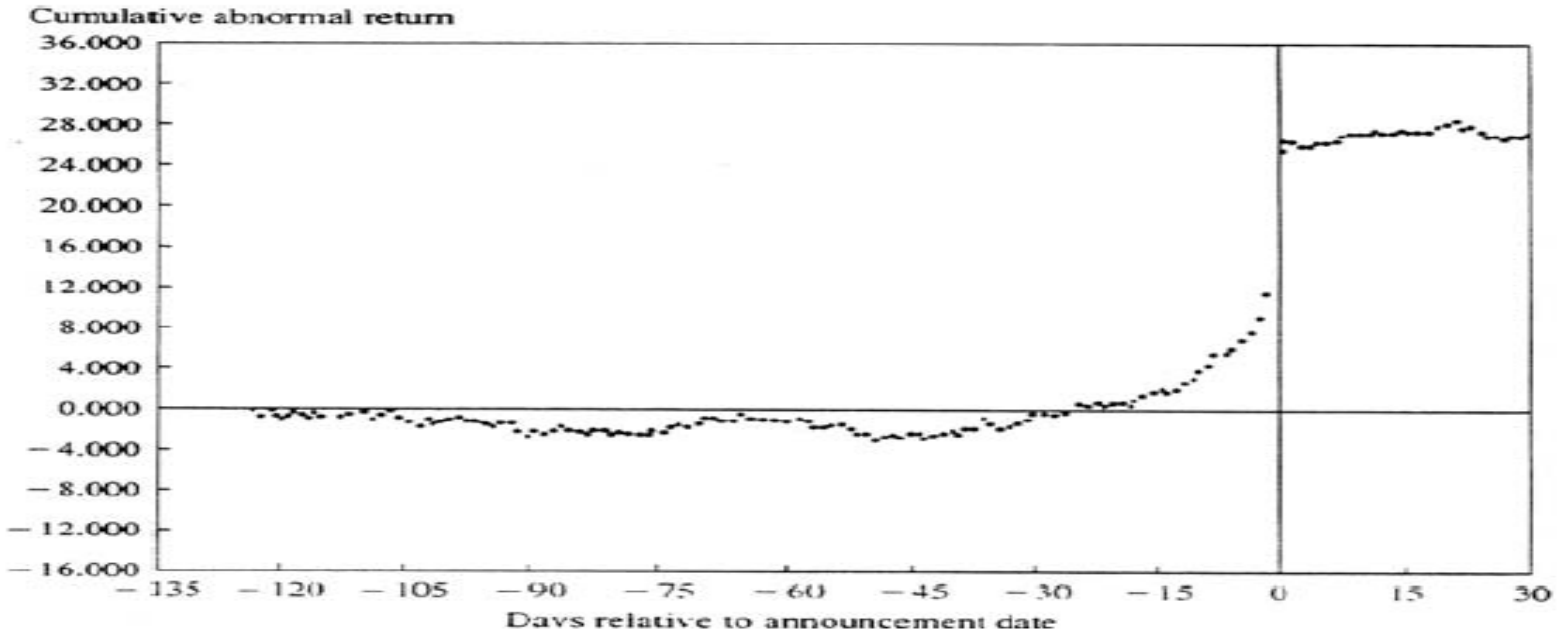
Cumulative Abnormal Returns (CAR)
before and after Dividend Announcements



Takeover / Merger announcements

Cumulative Abnormal Returns (CAR)
before and after Takeover Attempts: Target Companies

Source: A. Keown and J. Pinkerton, "Merger Announcements and Insider Trading Activity." *Journal of Finance* (1981).



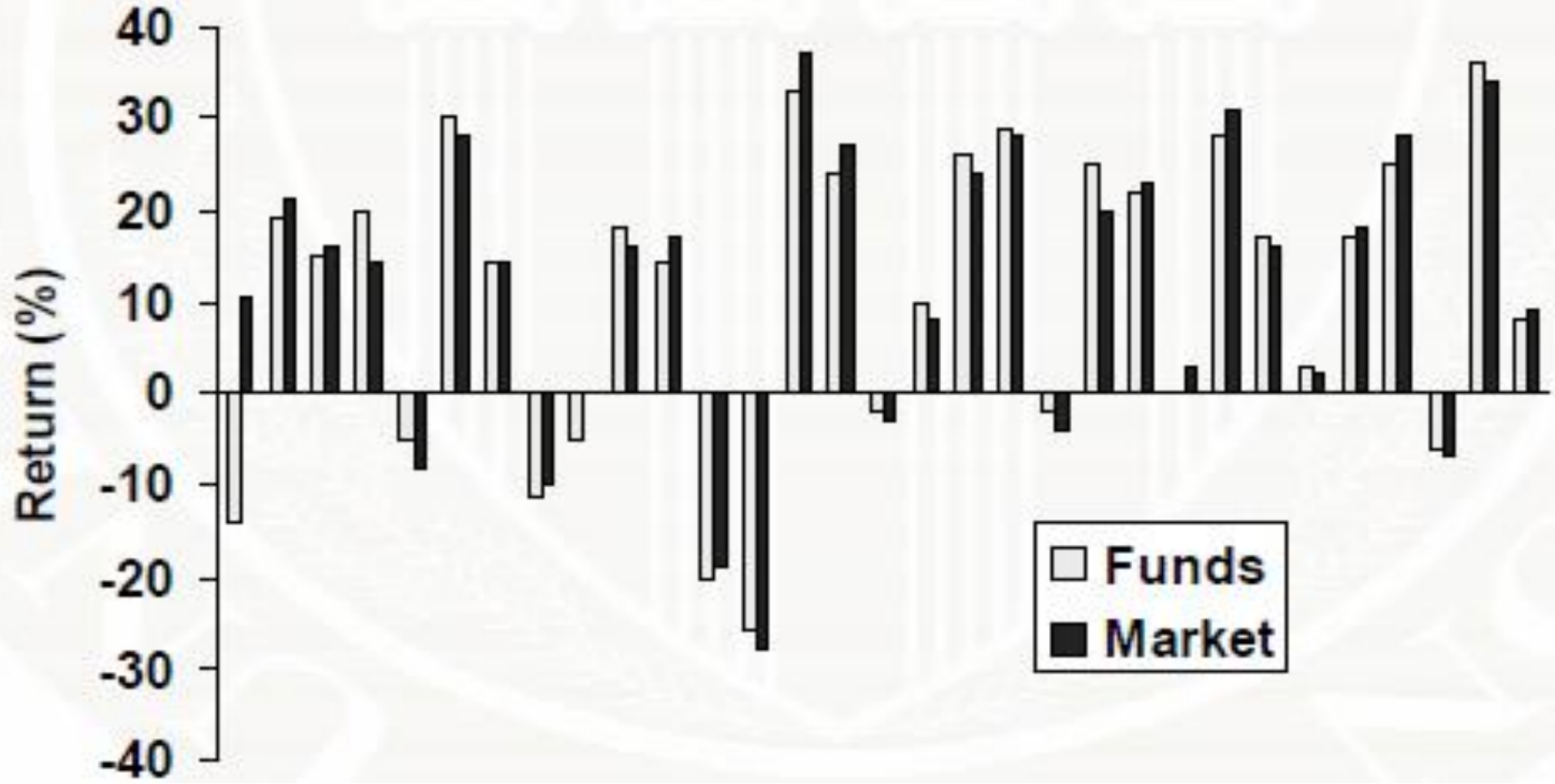
Strong form efficiency

- No investor can earn excess returns using any information – public or private.

- Strong form efficiency implies that **all** information is fully reflected in the price of the asset.

- Even private information! – Insider trading is ineffective

Average Annual Risk Adjusted Return on 1493 Mutual Funds and the Market Index



Empirical evidences *against* EMH

- Size effect – Empirical studies show that **small firms** earn abnormal returns over long periods, i.e. size premium.
- January effect – studies have confirmed an abnormal price rise from December to January, i.e. turn-of-the-year premium.
- Market overreaction – over/under shooting following 'new' news.
- Lag in effect of 'new' news – stock prices do not always react to news instantly. Some evidence of autocorrelation.
- Mean reversion – low returns stock tend to be followed by high returns and vice versa. Stocks that have done poorly in the past tend to do better in the future.

Empirical evidences *against* EMH: Stock market crash

- May be the most important evidence against the EMH is the Stock market crash.
  - We have repeatedly experienced stock market crash, as well as other asset prices bust.
- Crash in the US stock market during 1987 has marked a serious doubt over the validity of EMH.
  - Why has the stock price been overpriced for an extended period of time?
  - EHM cannot explain this because if the investors use all relevant information, none of this could have occurred at the first place.
- **Financial bubble should never occur.**

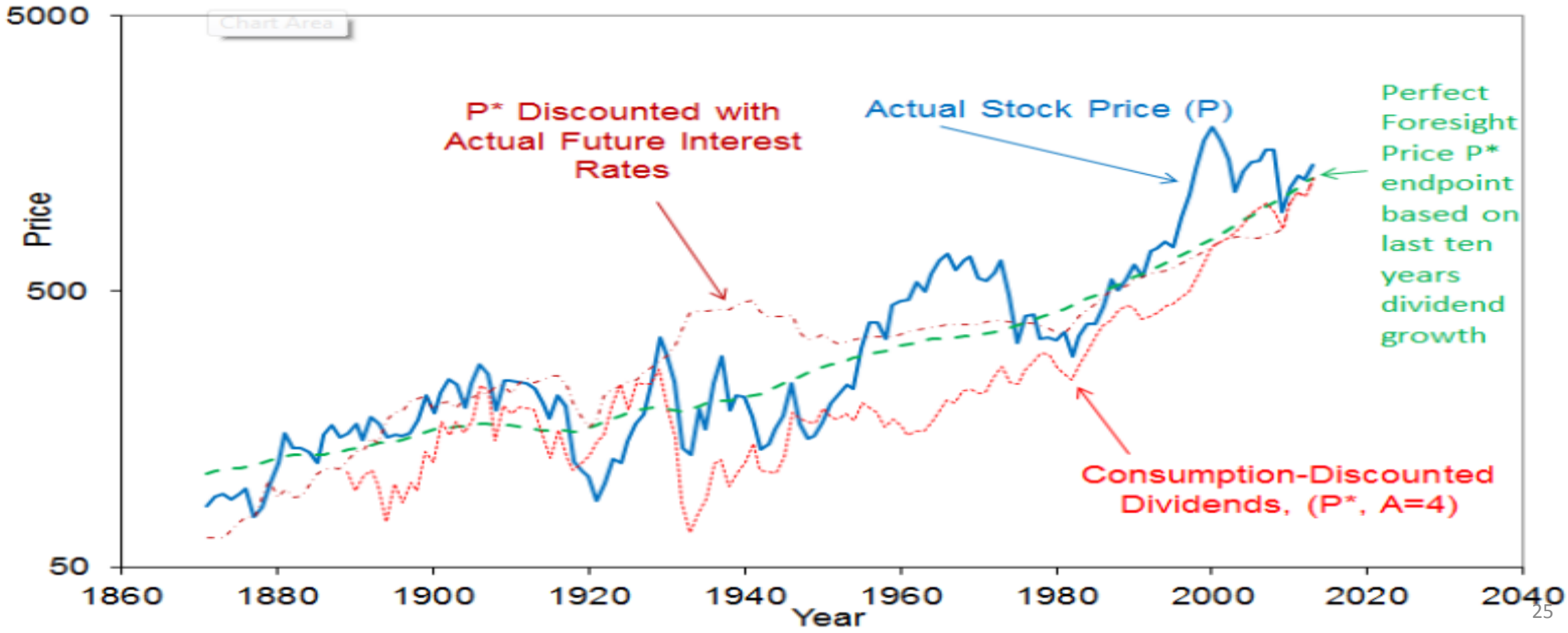
Asset prices anomalies: behavioral finance

Robert J. Shiller

- Robert Shiller found an "excess volatility" in stock price; price is more volatile than that can be explained by the fundamental equilibrium theory.
- Some irrationality embedded in investors' decision.

Excessive volatility

- Fluctuations in stock prices are greater than the fluctuations in the fundamentals.



Empirical evidence against EMH leads to a new field called "Behavioural Finance"

- Applies psychology, social anthropology and sociology to understand the behaviour of stock markets (and financial investments).

- Psychologists suggest that people are subject to *'loss aversion'.*
  - They are more unhappy from losses than happy with equivalent gains.
  - Because the potential losses can be huge from short selling in reality short selling occurs only in special circumstances.

- Psychologists also find that people tend to be *overconfident* in their own judgements. Overconfidence and social contagion explain the creation of speculative bubbles.