



Market Efficiency and Behavioral Finance



Objectives

- Understand the concept of market efficiency and how to make rational investment decisions based upon the existence of market efficiency
- Have a thorough understanding of the many tests of market efficiency, the forms of market efficiency, and observed market anomalies



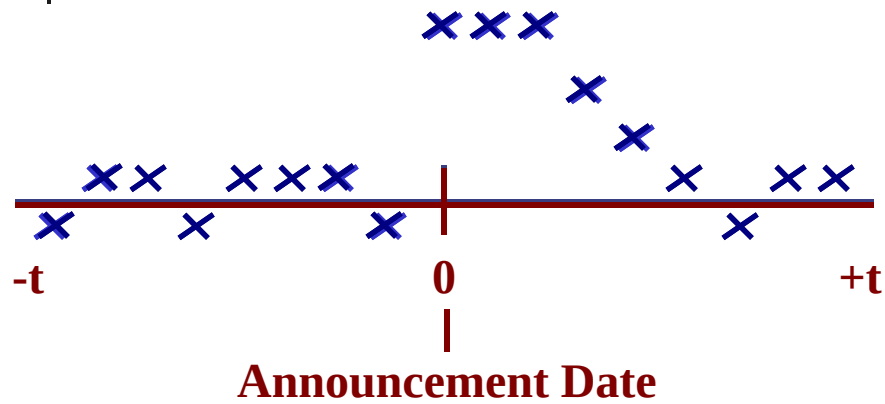
Outline

- What do we mean by efficient?
- Conditions for efficiency
- Why does it matter?
- Is the market efficient?
- How do we test market efficiency?
- What is the verdict?
- Behavioral interpretations



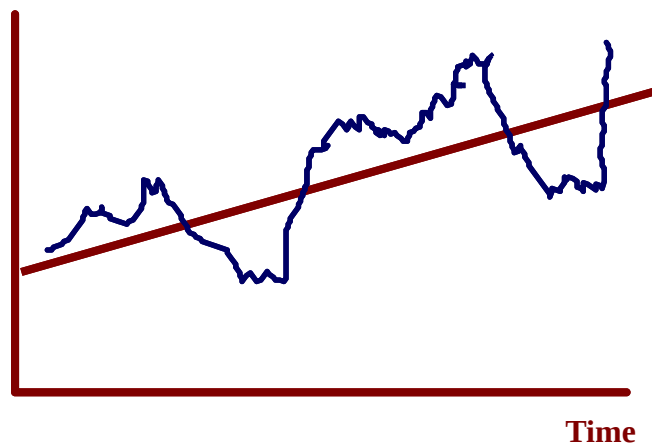
WHAT IS MARKET EFFICIENCY?

Return response to positive news



Random walk and the EMH

Security
Prices





EMH & Random price changes

- Why are price changes random?
- Beliefs: If an investors believes that a stock is under priced, he she will buy the stock, price will go up to the point where it is fairly priced
- Information
 - Prices react to information
 - Flow of information is random
 - Therefore, price changes are random



Random walk and the EMH

- Random Walk - stock prices are random
 - Stock returns actually follow a submartingale process
 - Expected return is positive over time
 - Returns exhibit positive trend and random about the trend



Forms of EMH

- Weak: stock prices reflect all information available from historical market prices
 - Charting and technical analysis won't work
- Semi-strong: stock prices reflect all public information available to investors
 - Using past prices and public information, the investor cannot consistently find undervalued stocks.
- Strong: stock prices reflect all public and private information
 - No-one (insider or outsider) can consistently find undervalued stocks.



Technical analysis

- Using prices and volume information to predict future prices
- Examples
 - Dow theory
 - Primary trend lasting for several years
 - Secondary trend reflects short-term deviation from main trend
 - Tertiary or minor trends



Technical analysis

- Charting
 - Moving averages: 1. average price is an indication of true value; 2. average price is an indication of long-run trends
 - Price relative to industry prices
- Resistance level
- Weak form EMH implies technical analysis should not work



Fundamental analysis

- Uses earnings and dividend prospects of the firm, expectation of future interest rates, and risk evaluation of the firm to determine proper stock prices
 - Starts with study of past earnings and examination of company balance sheet
 - Supplement this analysis with detail economic analysis



Fundamental analysis

- The objective is to attain insight into future performance of the firm that is not yet recognized by the rest of the market
- It is not enough to identify GOOD firms, the trick is to find firms that are BETTER than EVERYONE ELSE'S ESTIMATE
- Semi-strong form EMH implies fundamental analysis should not work



What is an efficient market?

- Efficient market is one where the market price is an **unbiased estimate** of the true value of the investment.
- Implicit in this derivation are several key concepts -
- (a) Market efficiency **does not require that the market price be equal to true value** at every point in time. All it requires is that errors in the market price be unbiased, i.e., that prices can be greater than or less than true value, as long as these deviations are random.
- (b) The fact that the deviations from true value are random implies, in a rough sense, **that there is an equal chance that stocks are under or over valued** at any point in time, and that these deviations are uncorrelated with any observable variable. For instance, in an efficient market, stocks with lower PE ratios should be no more or less likely to under valued than stocks with high PE ratios.
- (c) If the deviations of market price from true value are random, it follows **that no group of investors should be able to consistently find under or over valued stocks** using any investment strategy.



CONDITIONS FOR MARKET EFFICIENCY



Market Conditions under EMH and Market Conditions Observed

EMH Market

- Information is readily available, accurate and comes at no cost.
- No transaction costs
- No limits to arbitrage

Observed market conditions

- Information is costly and can be inaccurate.
- Transaction costs not zero.
- There are limits to arbitrage



The representative investor characteristics

EMH assumptions

- Homogeneous
- Choice over uncertainty based on expected utility theorem
- Learning from the past (Bayesian learning)
- Independence

BF assumptions

- Heterogeneous
- Choice over uncertainty exhibits loss aversion or fear of regret
- Behavioural Heuristics & Decision Making Biases
 - Anchoring
 - Overconfidence
- Social pressure to conform
 - Herding

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WHY DOES IT MATTER?



Implications of market efficiency

- **No group of investors should be able to consistently beat the market** using a common investment strategy.
- Equity research and valuation would be a costly task that provided no benefits. **The odds of finding an undervalued stock should be random (50/50).**
- A **strategy of randomly diversifying across stocks or indexing** to the market, carrying little or no information cost and minimal execution costs, would **be superior to any other strategy.**



Implications for business and corporate finance

Efficient

- The cost of capital accurately measures the firm's risk and quality of management.

Not so efficient

- The market does not know firm type so firms need to signal that they're good.

Implications for investment

Efficient market

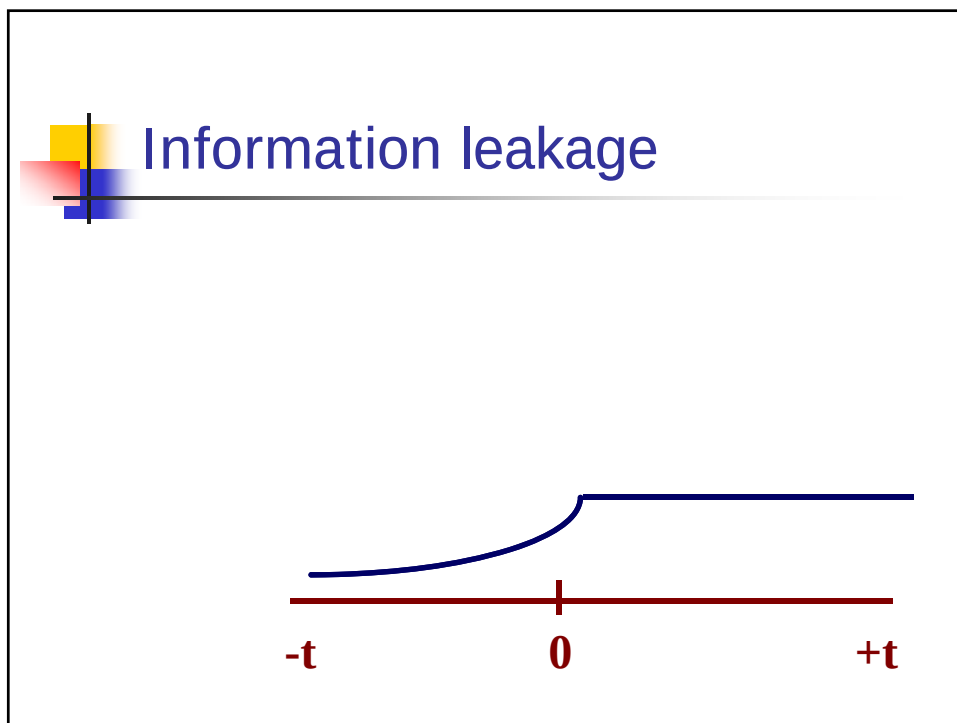
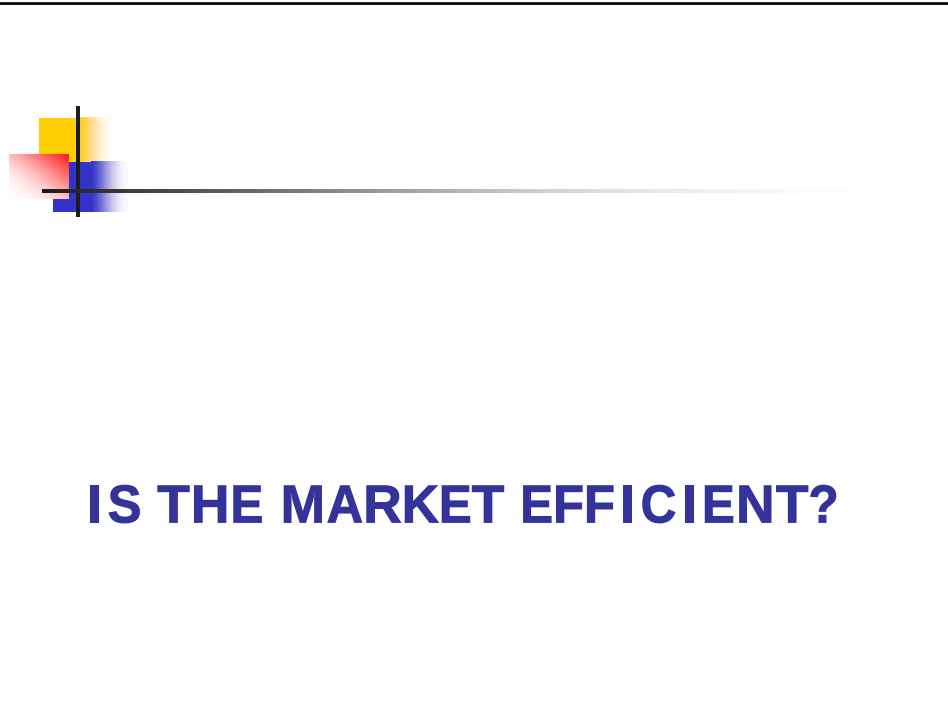
- Assets are priced according to their true fundamental value.
- Mutual funds perform equally well.
- Investors use full and complete information set to arrive to investment decisions.

Not so efficient

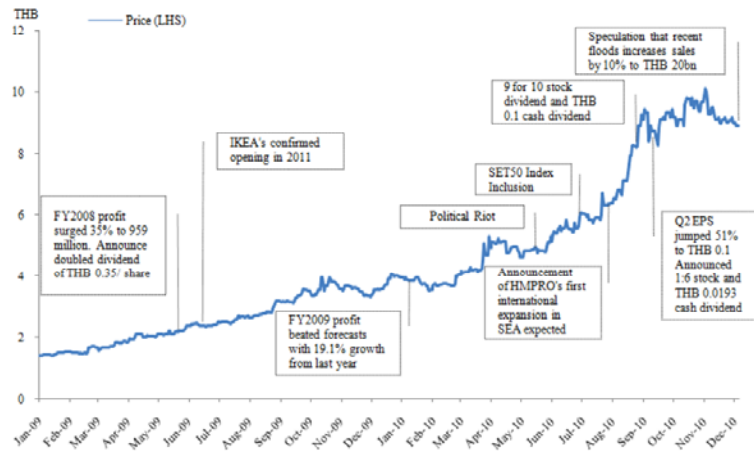
- Investor sentiment creates disturbances to efficient prices.
- Limitations to arbitrage does not counter irrational disturbances.

What market efficiency does not imply

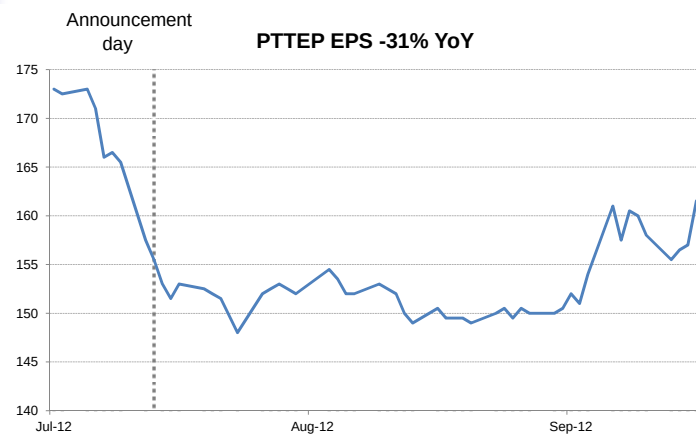
- **Stock prices cannot deviate from true value**; in fact, there can be large deviations from true value. The only requirement is that the deviations be random.
- **No investor will 'beat' the market in any time period.** To the contrary, approximately half of all investors, prior to transactions costs, should beat the market in any period.
- **No group of investors will beat the market in the long term.** Given the number of investors in financial markets, the laws of probability would suggest that a fairly large number are going to beat the market consistently over long periods, not because of their investment strategies but because they are lucky.



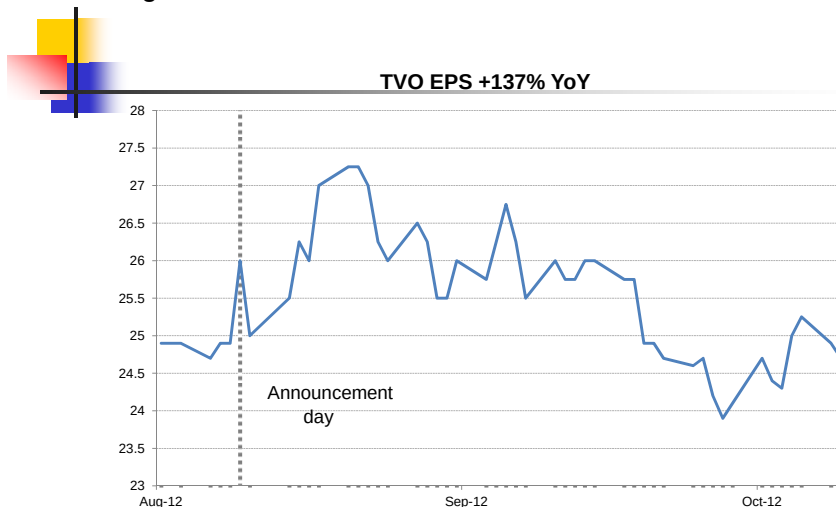
HMPRO price response to news



Earnings Announcement & Stock Price

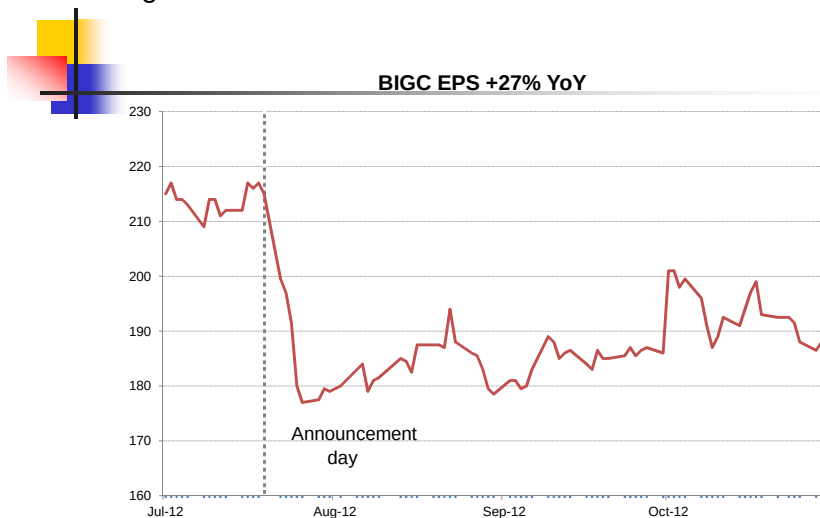


Earnings Announcement & Stock Price

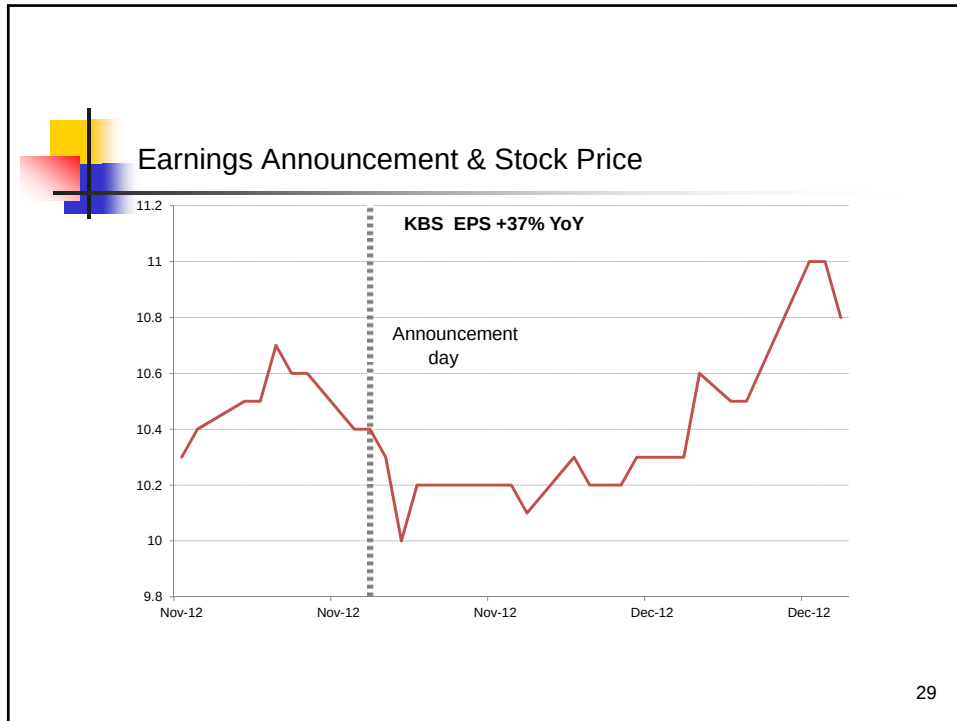


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Earnings Announcement & Stock Price



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TESTING MARKET EFFICIENCY



Empirical tests of market efficiency

- Event studies
- Tests patterns in the stock market
- Testing some trading rules
- Assessing performance of professional managers



Event studies

- Measure unexpected return that results from an informational event such as
 - Surprise earnings announcements
 - Mergers and acquisitions
- A firm's return consists of a component related to fundamental risks and firm specific component

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



Event studies

1. Examine prices and returns over time
2. Returns are adjusted to determine if they are abnormal.

Use Market model or other return models such as the Fama French three-factor model

- a. $r_t = a_t + b_{trmt} + e_t$
(Expected Return)
- b. Excess Return =
(Actual - Expected)
 $e_t = \text{Actual} - (a_t + b_{trmt})$
- c. Cumulate the excess returns over time:



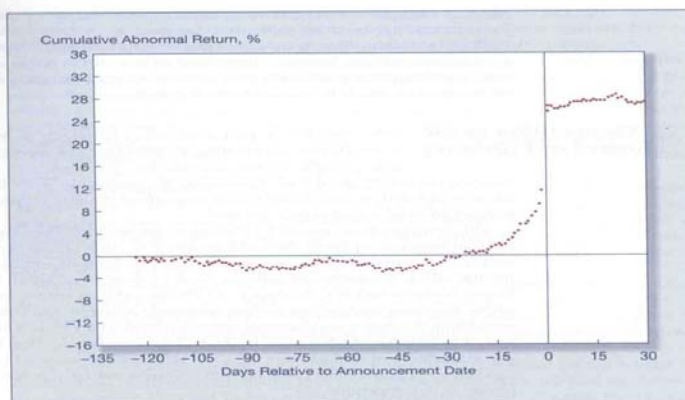
Event studies

- We use cumulative abnormal returns (CAR) over an event window to identify how information is incorporated in stock prices

$$CAR = \sum_{t=1}^k e_t$$

- If there is no new information CAR moves around 0

Mergers and acquisition



Source: Arthur Keown and John Pinkerton, "Merger Announcements and Insider Trading Activity," *Journal of Finance* 36 (September 1981).

Empirical tests of market efficiency

- Assessing performance of professional managers
 - If markets are efficient, fund managers cannot make abnormal returns
- Tests patterns in the stock market
 - If there are patterns in the stock market, then weak form EMH does not hold
- Testing some trading rule
 - If trading rules based on past stock market price information generate positive abnormal returns, then weak form EMH does not hold
 - If trading rules based on information other than past stock market price generate positive abnormal returns, then semi-strong form EMH does not hold



Are markets efficient?

- 80% of actively managed funds do not generate abnormal returns after adjustments for fees
- This is NOT necessary evidence that markets are efficient
 - Problems in measuring magnitudes of gains
 - In a competitive market, manager should be able to extract rents equal to the abnormal returns he/she is making
 - The luck component



Are markets efficient?

Evidence supporting EMH

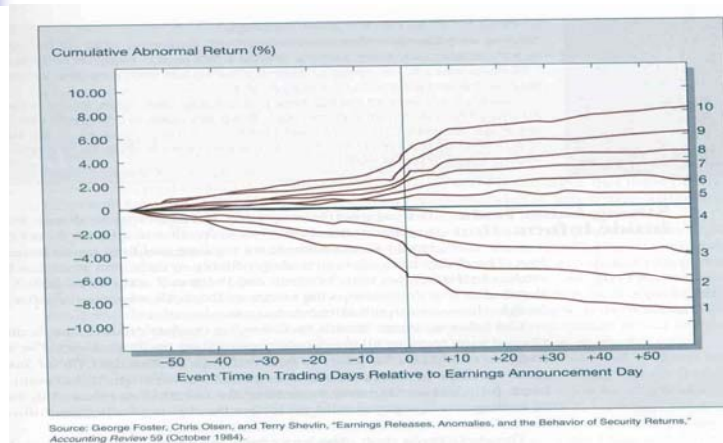
- No short-term correlations in stock market returns
- It is difficult to predict which funds will obtained abnormal returns even before fees

Are markets efficient?

Evidence that 'may' reject EMH

- Some trading rules based on past stock prices obtain abnormal returns
 - There is short-term (1 year) return momentum
 - There is long-term return reversal
- Trading rules based on stock market characteristics generate positive abnormal returns
 - Size
 - Value vs growth

Post-earnings announcement drift





Alternative explanation

Alternatives to the conclusion that stock markets are not efficient are

1. Stock price patterns are caused by time-varying risk premium that we cannot measure well
2. Trading rules based on firm specific characteristics are simply loading on riskier stocks. The abnormal returns are in fact NOT abnormal. They are compensation for higher risks which we do not measure well.



So, are markets efficient?

- Probably not completely strong-form efficient
- May not be semi-strong form efficient at all times
- It is weak-form efficient
- Only investors who are effective at consistently finding profiting trading rules and have economy of scales will be able to find inefficiencies
- When a profitable trading rule becomes public information, it no longer works



Behavioral finance

- Individuals make mistake with estimating the probabilities
- Given the incorrect probabilities, investors make suboptimum long-term decisions
- For irrational behavior to affect prices, there needs to be limit to arbitrage



Behavioral finance

- Why do we care?
- We make money off of irrational investors
- If market prices are incorrect, then they are not good indicators of cost of capital and can mislead real investments
- We can improve our pricing equations



Summary

- Is the market efficient?
- What do we mean by efficient?
- Why does it matter?
- How do we test whether markets are efficient?
- What is the verdict?
- There is also a behavioral interpretation