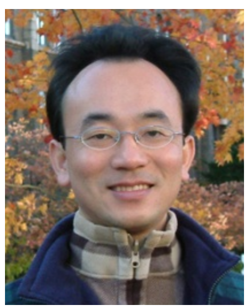
人工智慧投資分析
AI for Investment Analysis

財務金融事件研究法
(Event Studies in Finance)

1082AIIA05
MBA, IMTKU (M2399) (8409) (Spring 2020)
Wed 3, 4 (10:10-12:00) (B206)



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2020-04-01

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2020/03/04	人工智慧投資分析課程介紹 (Course Orientation on AI for Investment Analysis)
2	2020/03/11	AI 金融科技: 金融服務創新應用 (AI in FinTech: Financial Services Innovation and Application)
3	2020/03/18	機器人理財顧問與AI交談機器人 (Robo-Advisors and AI Chatbots)
4	2020/03/25	投資心理學與行為財務學 (Investing Psychology and Behavioral Finance)
5	2020/04/01	財務金融事件研究法 (Event Studies in Finance)
6	2020/04/08	人工智慧投資分析個案研究 I (Case Study on AI for Investment Analysis I)

課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容 (Subject/Topics)

7 2020/04/15 Python AI投資分析基礎
(Foundations of AI Investment Analysis in Python)

8 2020/04/22 Python Pandas 量化投資分析
(Quantitative Investing with Pandas in Python)

9 2020/04/29 期中報告 (Midterm Project Report)

10 2020/05/06 Python Scikit-Learn 機器學習投資分析
(Machine Learning for Investment Analysis with Scikit-Learn In Python)

11 2020/05/13 TensorFlow 深度學習投資分析 I
(Deep Learning for Investment Analysis with TensorFlow I)

12 2020/05/20 TensorFlow 深度學習投資分析 II
(Deep Learning for Investment Analysis with TensorFlow II)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2020/05/27	人工智慧投資分析個案研究 II (Case Study on Artificial Intelligence for Investment Analysis II)
14	2020/06/03	TensorFlow 深度學習投資分析 III (Deep Learning for Investment Analysis with TensorFlow III)
15	2020/06/10	投資組合最佳化與程式交易 (Portfolio Optimization and Algorithmic Trading)
16	2020/06/17	期末報告 I (Final Project Presentation I)
17	2020/06/24	期末報告 II (Final Project Presentation II)
18	2020/07/01	教師彈性補充教學

Event Studies in Finance

Doron Kliger and Gregory Gurevich (2014),

Event Studies for Financial Research:

A Comprehensive Guide,

Palgrave Macmillan

Source: https://www.amazon.com/Event-Studies-Financial-Research-Comprehensive/dp/1137435380/

事件研究法：財務與會計實證研究必備

沈中華、李建然 (2000)

Source: 沈中華、李建然 (2000)，事件研究法：財務與會計實證研究必備，華泰文化

Event Studies for Financial Research

EVENT STUDY METRICS

state-of-the-art

event study software

event studies

Short- and Long-Term Event Studies

Cumulative Abnormal Returns
Buy-and-hod Abnormal Returns
Farma-French Calander Time Portfolios

Parametric and Non-Parametric Tests

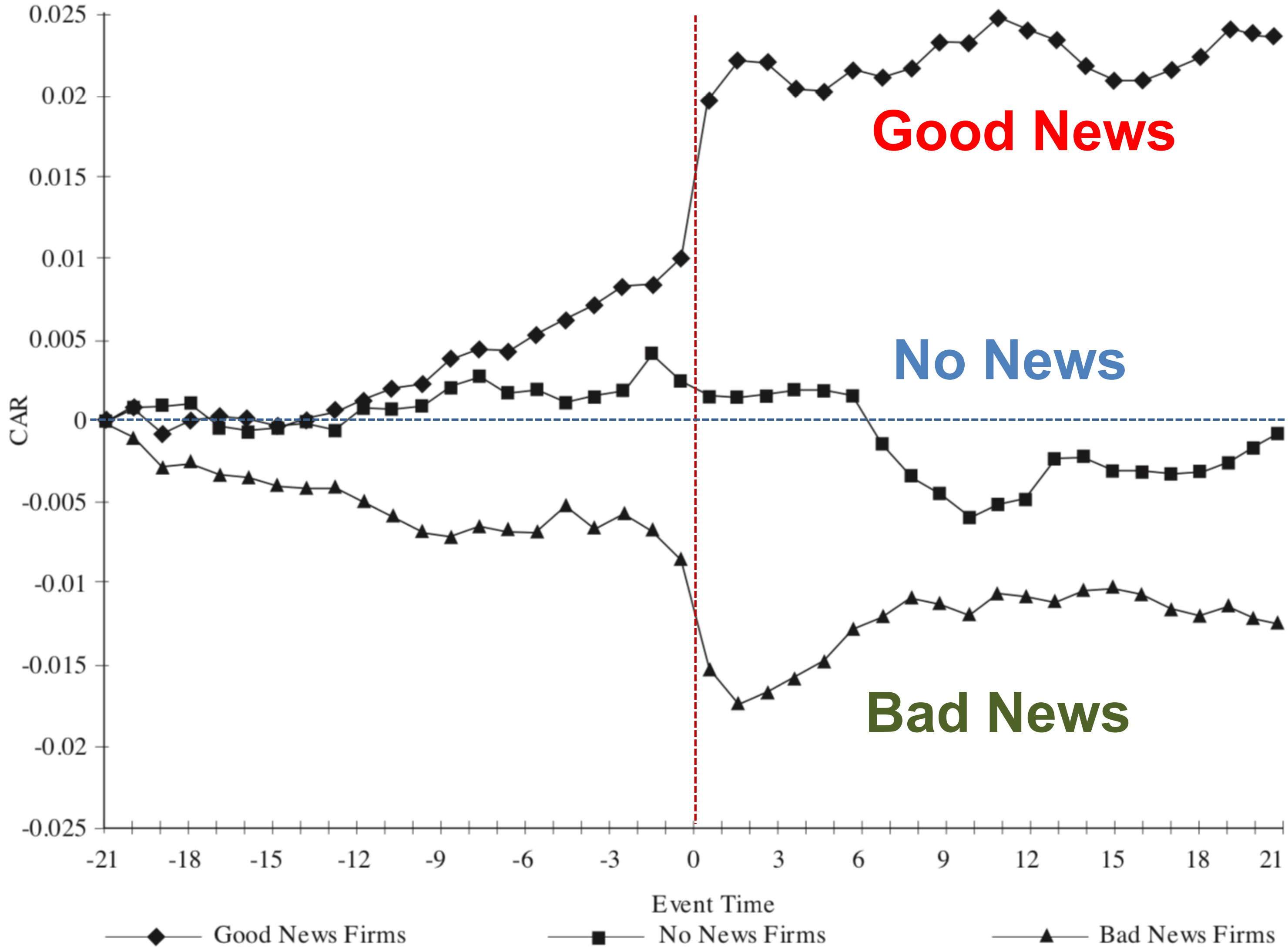
Time-Series t-Test
Cross-Sectional t-Test
Standardized Residual Test
Standardized Cross-Sectional Test
Corrado Rank Test
Generalized Sign Test
Skewness-Adjusted t-Test

Return Models

Constant-Mean
Market Adjusted
Market Model
Factor Model
Matching Models
Stocks and Bonds

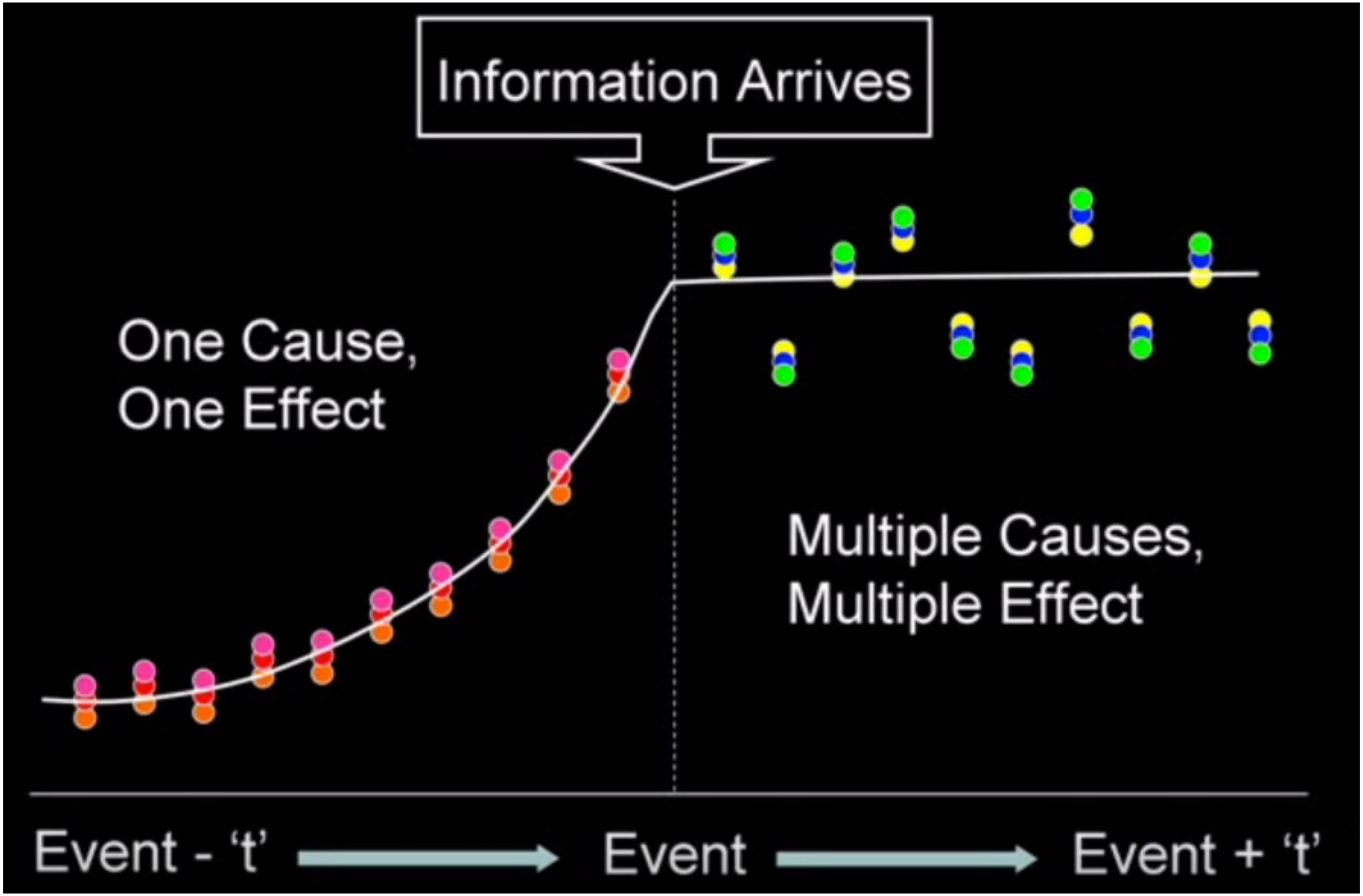
https://eventstudymetrics.com/

Event Studies in Economics and Finance



Source: MacKinlay, A. C. (1997). Event studies in economics and finance. Journal of economic literature, 35(1), 13-39.

Event Study

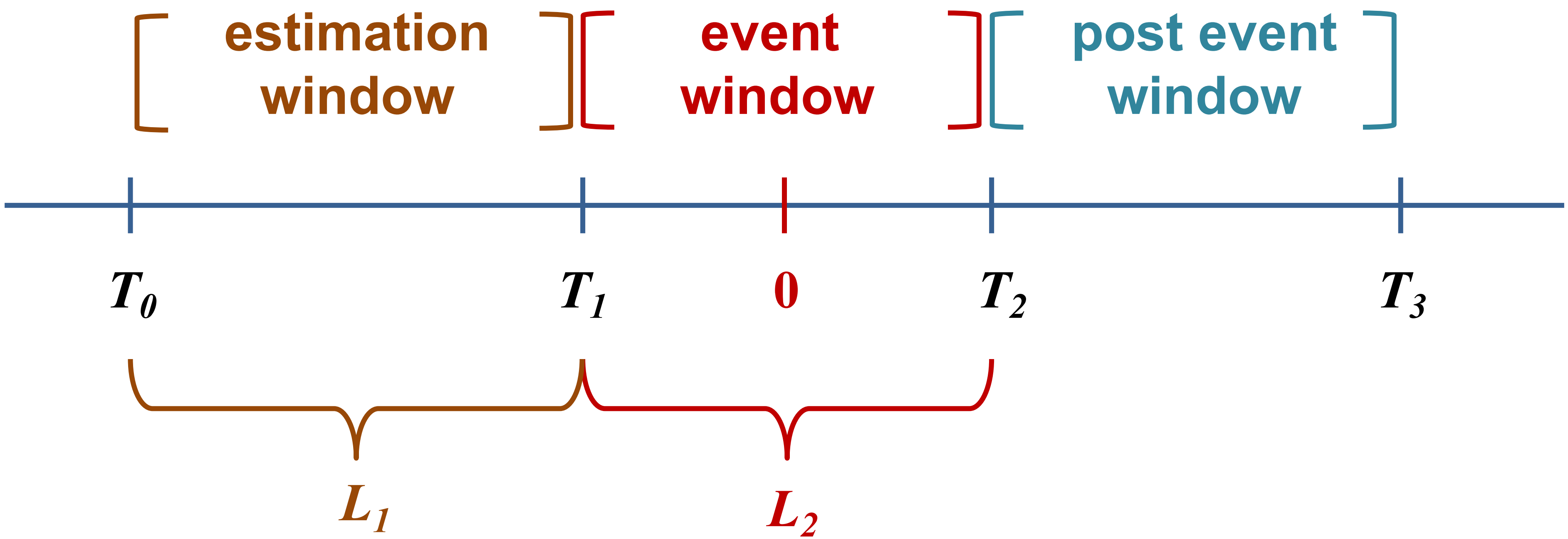


Source: Rajesh Mudholkar (2014), "Event studies: Confirms Market Efficiency or Behavioral Anomalies?", https://www.youtube.com/watch?v=VErwDaQNB74

Event Study
Time line for an event study

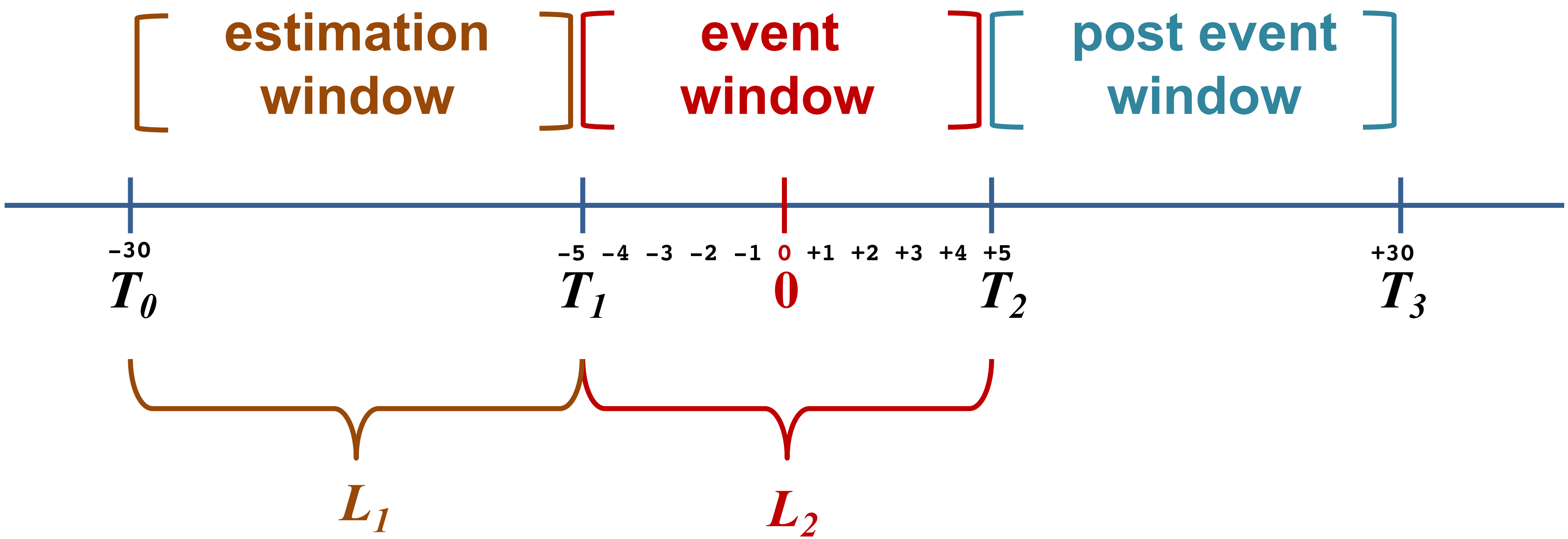
Source: https://eventstudymetrics.com/index.php/event-study-methodology/

Event Study Methodology



Source: https://eventstudymetrics.com/index.php/event-study-methodology/

Event Study Methodology



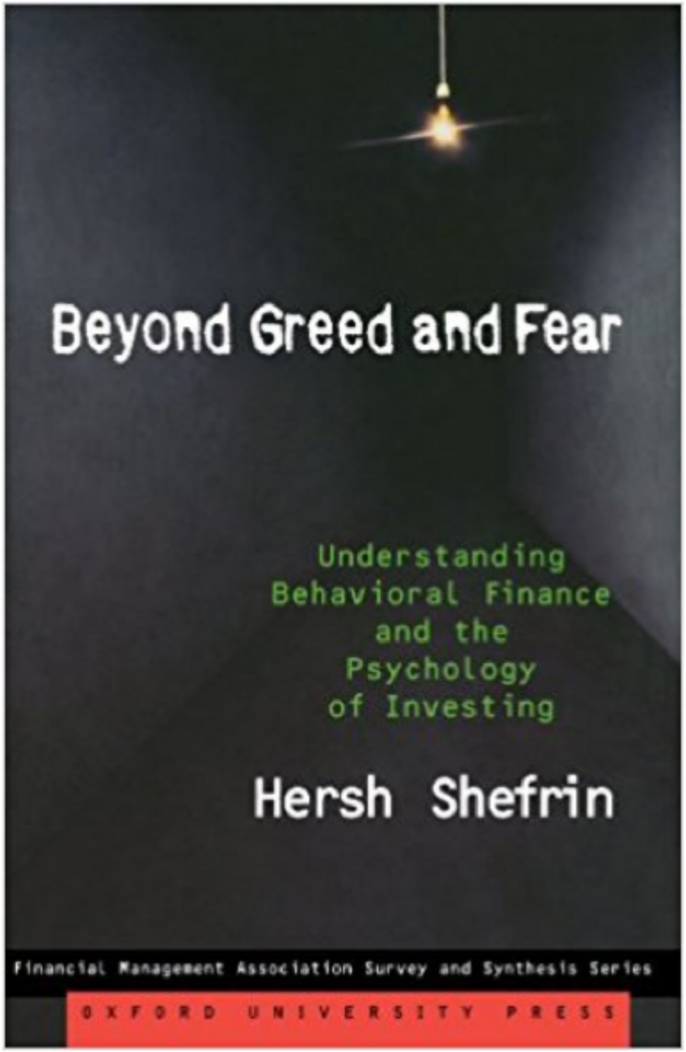
Source: https://eventstudymetrics.com/index.php/event-study-methodology/

Efficient Markets

Behavioral Economics

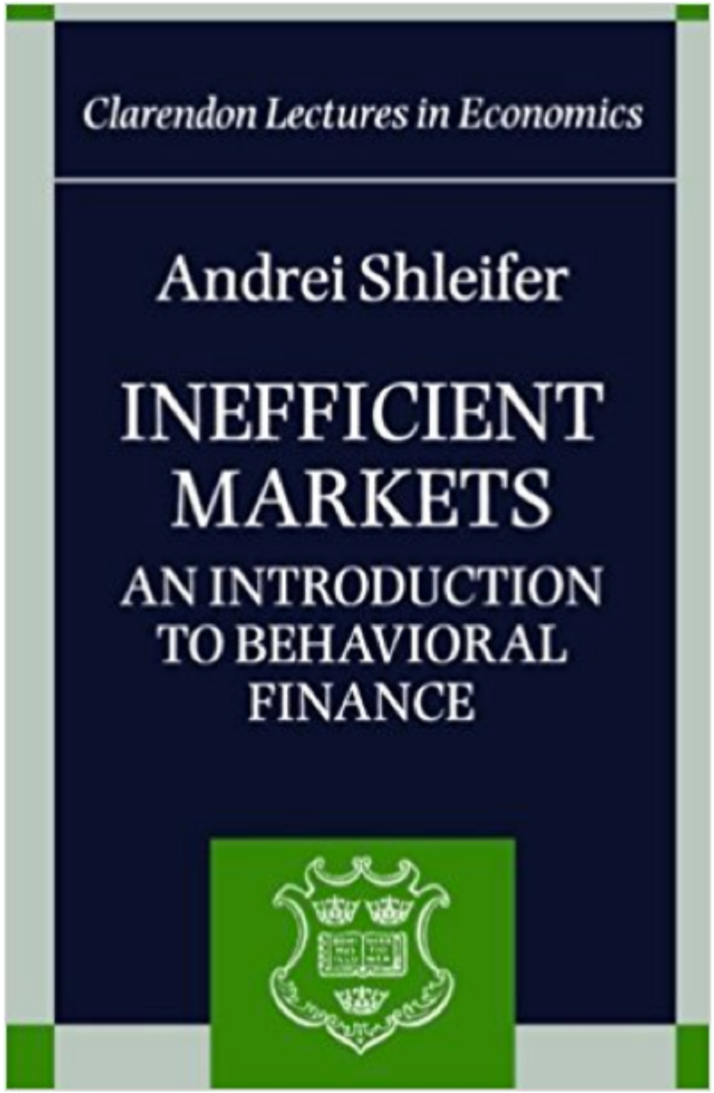
Behavioral Finance

Hersh Shefrin (2007), Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing, Oxford University Press



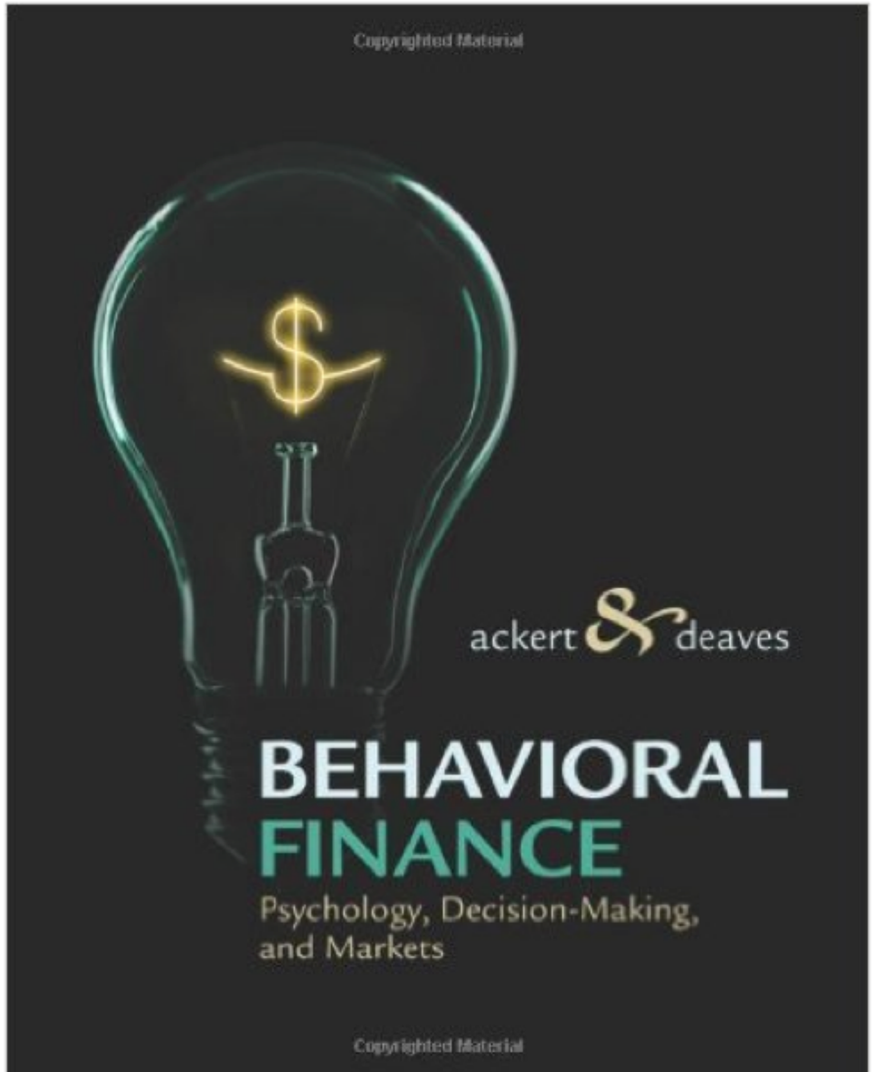
Source: https://www.amazon.com/Beyond-Greed-Fear-Understanding-Association/dp/0195304217

Andrei Shleifer (2000), Inefficient Markets: An Introduction to Behavioral Finance, Oxford University Press



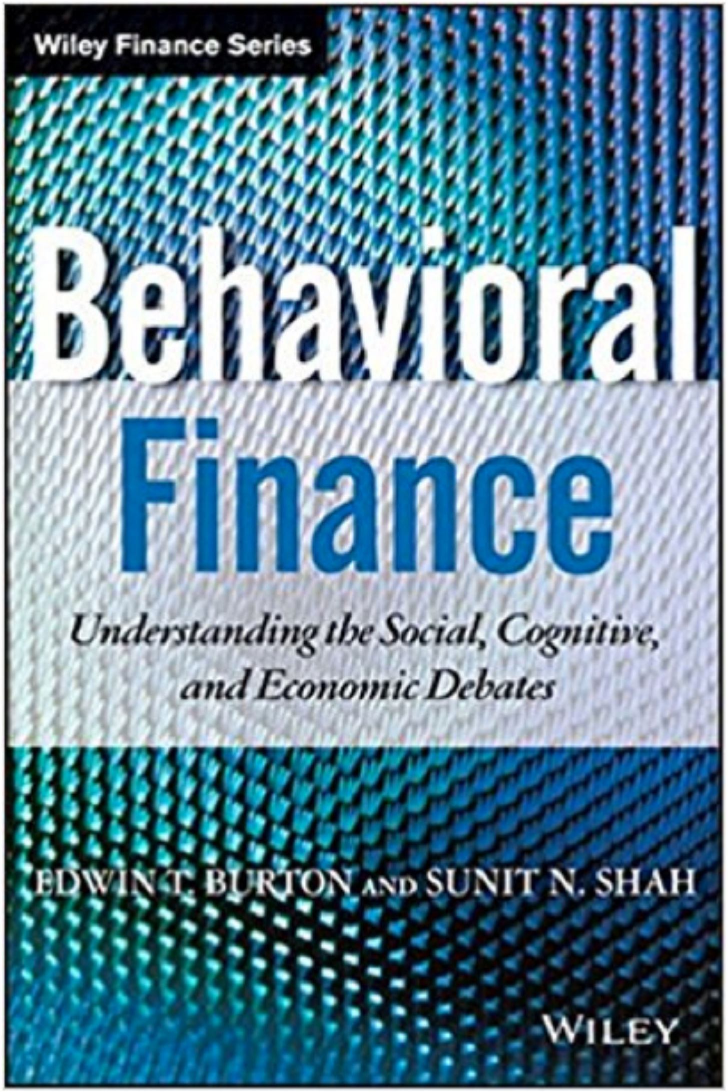
Source: https://www.amazon.com/Inefficient-Markets-Introduction-Behavioral-Clarendon/dp/0198292279

Lucy Ackert and Richard Deaves (2009), Behavioral Finance: Psychology, Decision-Making, and Markets, South-Western College Pub



Source: https://www.amazon.com/Behavioral-Finance-Psychology-Decision-Making-Markets/dp/0324661177

Edwin Burton and Sunit N. Shah (2013)
Behavioral Finance: Understanding the Social, Cognitive, and Economic Debates, Wiley



Source: https://www.amazon.com/Behavioral-Finance-Understanding-Cognitive-Economic/dp/111830019X

Rational Behavior

Irrational Behavior

Emotion

Sentiment

Modern Financial Research

- Theoretical Finance
  – study of logical relationships among assets.
- Empirical Finance
  – study of data in order to infer relationships.
- Behavioral Finance
  – integrates psychology into the investment process.

Source: Robert A. Strong (2004), Practical Investment Management, South-Western

Behavioral Finance Themes

- Heuristic-Driven Bias
- Framing Dependence
- Inefficient Markets

Source: Hersh Shefrin (2007), “Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing”, Oxford University Press.

Efficient Market Hypothesis (EMH)

Efficient Market Hypothesis (EMH) (Fama, 1970)

Efficient capital markets: A review of theory and empirical work

BG Malkiel, EF Fama - The Journal of Finance, 1970 - Wiley Online Library

This paper reviews the theoretical and empirical iterature on the efficient markets model. After a discussion of the theory, empirical work concerned with the adjustment of security prices to three relevant information subsets is considered. First, weak form tests, in which the information set is just historical prices, are discussed. Then semi-strong form tests, in which the concern is whether prices efficiently adjust to other information that is obviously ...

Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Efficient Market Hypothesis (EMH) (Fama, 1970)

SESSION TOPIC: STOCK MARKET PRICE BEHAVIOR

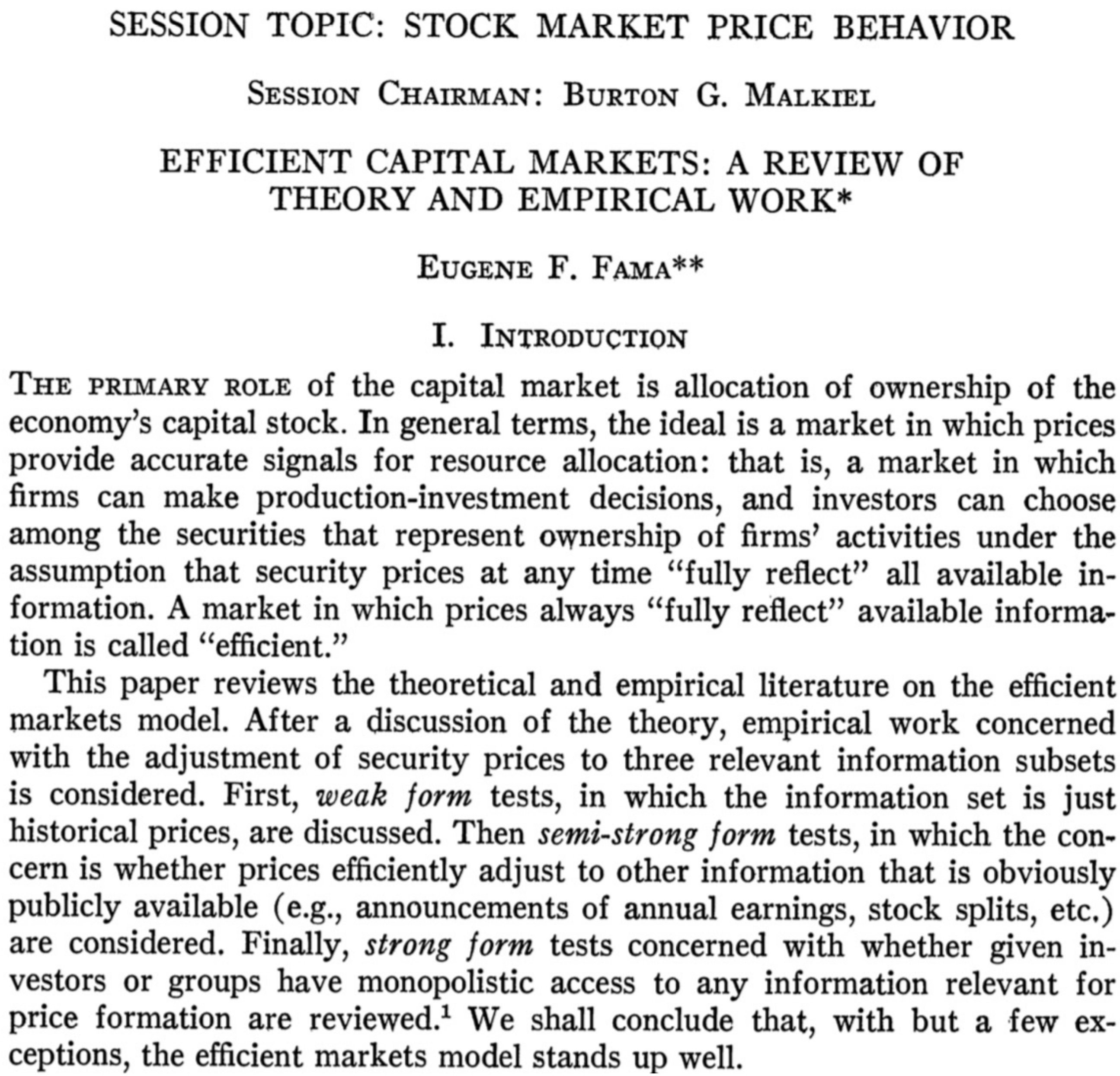
SESSION CHAIRMAN: BURTON G. MALKIEL

EFFICIENT CAPITAL MARKETS: A REVIEW OF THEORY AND EMPIRICAL WORK*

EUGENE F. FAMA**

Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Efficient Market Hypothesis (EMH) (Fama, 1970)


SESSION TOPIC: STOCK MARKET PRICE BEHAVIOR

SESSION CHAIRMAN: BURTON G. MALKIEL

EFFICIENT CAPITAL MARKETS: A REVIEW OF THEORY AND EMPIRICAL WORK*

EUGENE F. FAMA**

I. INTRODUCTION

THE PRIMARY ROLE of the capital market is allocation of ownership of the economy's capital stock. In general terms, the ideal is a market in which prices provide accurate signals for resource allocation: that is, a market in which firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities under the assumption that security prices at any time "fully reflect" all available information. A market in which prices always "fully reflect" available information is called "efficient."

This paper reviews the theoretical and empirical literature on the efficient markets model. After a discussion of the theory, empirical work concerned with the adjustment of security prices to three relevant information subsets is considered. First, *weak form* tests, in which the information set is just historical prices, are discussed. Then *semi-strong form* tests, in which the concern is whether prices efficiently adjust to other information that is obviously publicly available (e.g., announcements of annual earnings, stock splits, etc.) are considered. Finally, *strong form* tests concerned with whether given investors or groups have monopolistic access to any information relevant for price formation are reviewed.[1] We shall conclude that, with but a few exceptions, the efficient markets model stands up well.

Source: Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

TABLE 1 (from [10])
First-order Serial Correlation Coefficients for One-, Four-, Nine-, and Sixteen-Day Changes in Log_e Price

Stock	Differencing Interval (Days) One	Four	Nine	Sixteen
Allied Chemical	.017	.029	—.091	—.118
Alcoa	.118*	.095	—.112	—.044
American Can	—.087*	—.124*	—.060	.031
A. T. & T.	—.039	—.010	—.009	—.003
American Tobacco	.111*	—.175*	.033	.007
Anaconda	.067*	—.068	—.125	.202
Bethlehem Steel	.013	—.122	—.148	.112
Chrysler	.012	.060	—.026	.040
Du Pont	.013	.069	—.043	—.055
Eastman Kodak	.025	—.006	—.053	—.023
General Electric	.011	.020	—.004	.000
General Foods	.061*	—.005	—.140	—.098
General Motors	—.004	—.128*	.009	—.028
Goodyear	—.123*	.001	—.037	.033
International Harvester	—.017	—.068	—.244*	.116
International Nickel	.096*	.038	.124	.041
International Paper	.046	.060	—.004	—.010
Johns Manville	.006	—.068	—.002	.002
Owens Illinois	—.021	—.006	.003	—.022
Procter & Gamble	.099*	—.006	.098	.076
Sears	.097*	—.070	—.113	.041
Standard Oil (Calif.)	.025	—.143*	—.046	.040
Standard Oil (N.J.)	.008	—.109	—.082	—.121
Swift & Co.	—.004	—.072	.118	—.197
Texaco	.094*	—.053	—.047	—.178
Union Carbide	.107*	.049	—.101	.124
United Aircraft	.014	—.190*	—.192*	—.040
U.S. Steel	.040	—.006	—.056	.236*
Westinghouse	—.027	—.097	—.137	.067
Woolworth	.028	—.033	—.112	.040

* Coefficient is twice its computed standard error.

Source: Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Cumulative Average Residuals

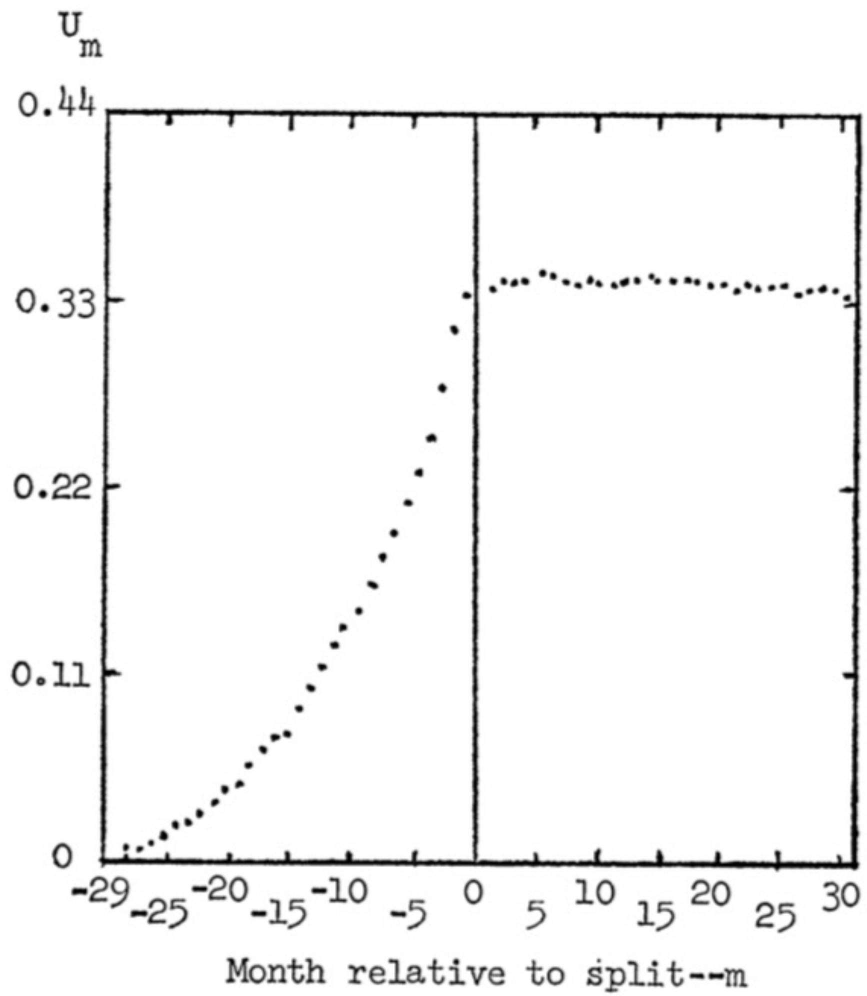


Figure 1a
Cumulative average residuals—all splits.

Source: Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Cumulative Average Residuals

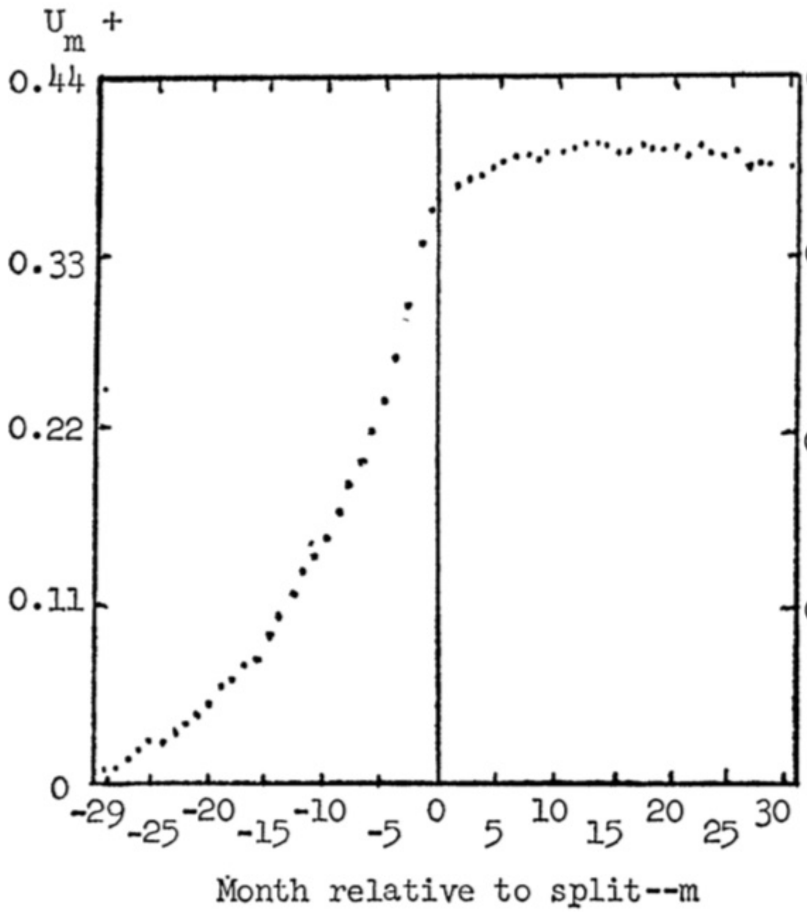


FIGURE 1b
Cumulative average residuals for dividend "increases."

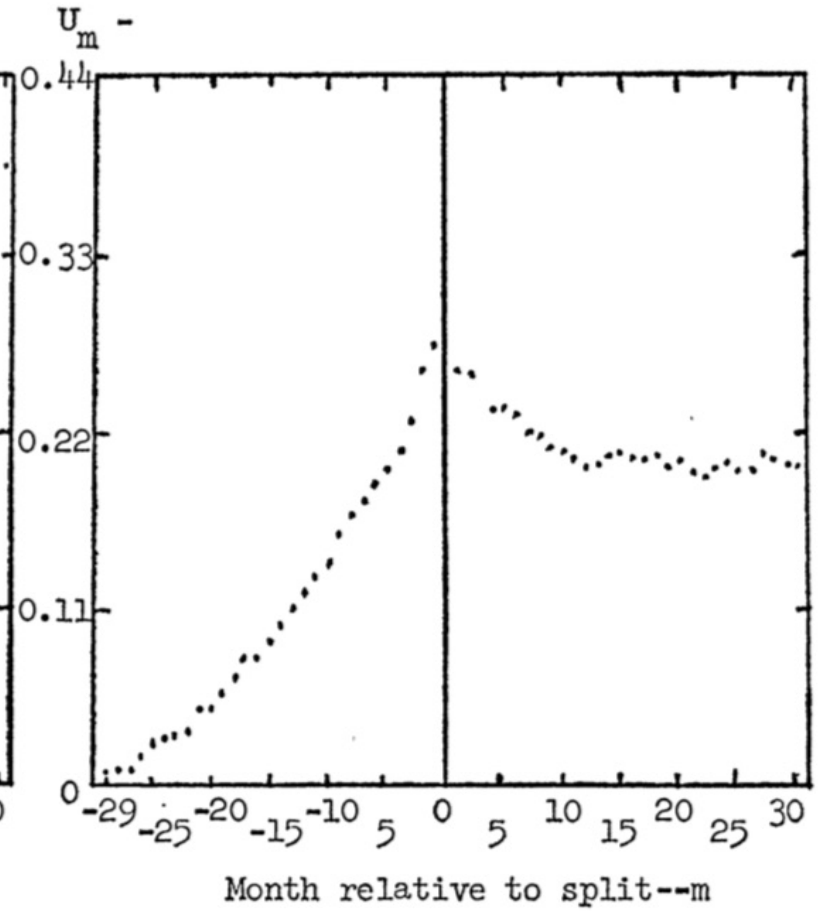


FIGURE 1c
Cumulative average residuals for dividend "decreases."

Source: Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Market Efficiency

The empirical work itself can be divided into three categories depending on the nature of the information subset of interest. *Strong-form* tests are concerned with whether individual investors or groups have monopolistic access to any information relevant for price formation. One would not expect such an extreme model to be an exact description of the world, and it is probably best viewed as a benchmark against which the importance of deviations from market efficiency can be judged. In the less restrictive *semi-strong-form* tests the information subset of interest includes all obviously publicly available information, while in the *weak form* tests the information subset is just historical price or return sequences.

Source: Malkiel, B. G., & Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.

Types of Efficiency Market

- **Weak Form**
  – Security prices reflect all information found in past prices and volume.
- **Semi-Strong Form**
  – Security prices reflect all publicly available information.
- **Strong Form**
  – Security prices reflect all information—public and private.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Can Financing Decisions Create Value?

What Sort of Financing Decisions?

- Typical financing decisions include:
  - How much debt and equity to sell
  - When (or if) to pay dividends
  - When to sell debt and equity
- Just as we can use NPV criteria to evaluate investment decisions, we can use NPV to evaluate financing decisions.

How to Create Value through Financing

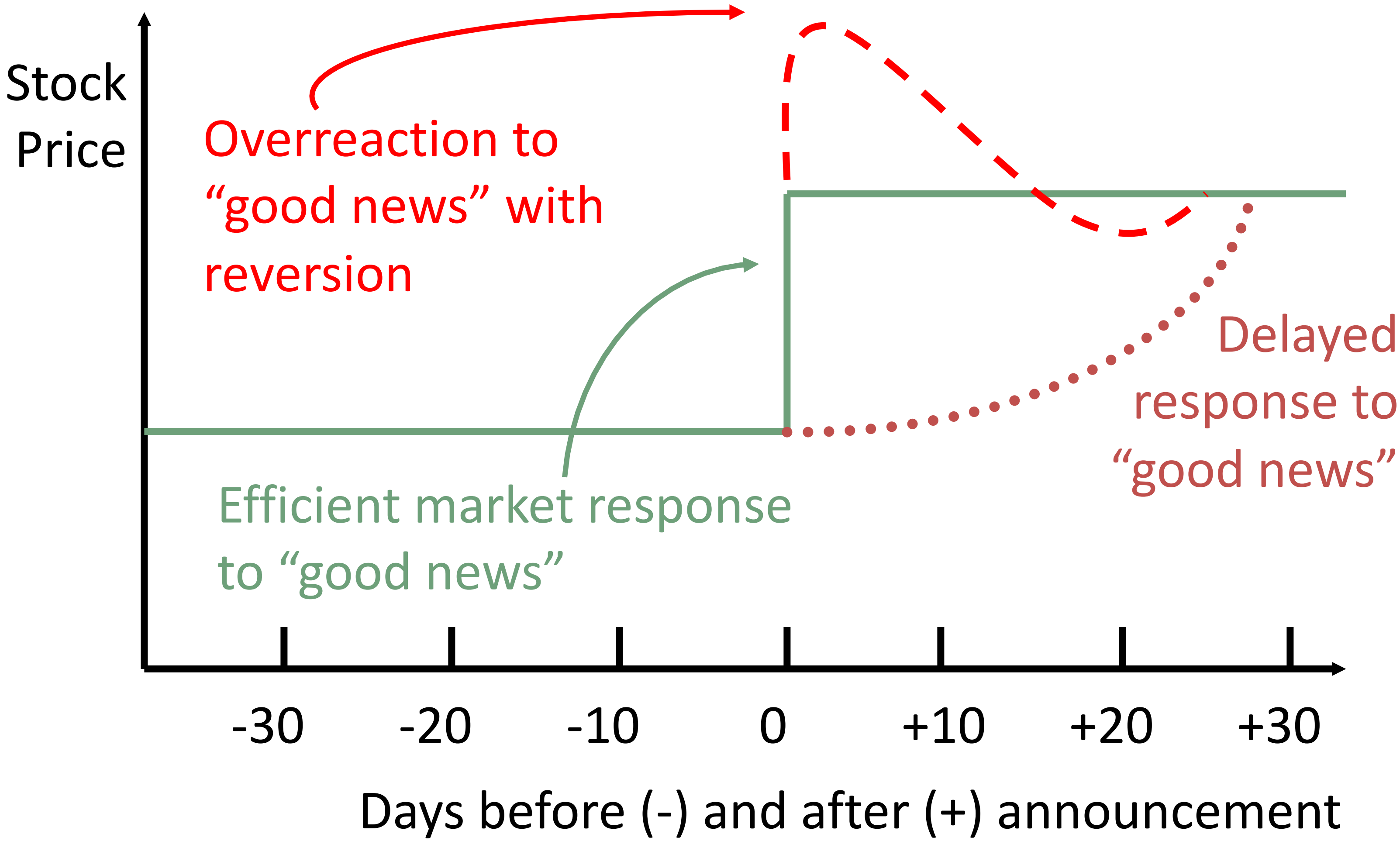
- Fool Investors
  - Empirical evidence suggests that it is hard to fool investors consistently.
- Reduce Costs or Increase Subsidies
  - Certain forms of financing have tax advantages or carry other subsidies.
- Create a New Security
  - Sometimes a firm can find a previously-unsatisfied clientele and issue new securities at favorable prices.
  - In the long-run, this value creation is relatively small, however.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Efficient Capital Markets

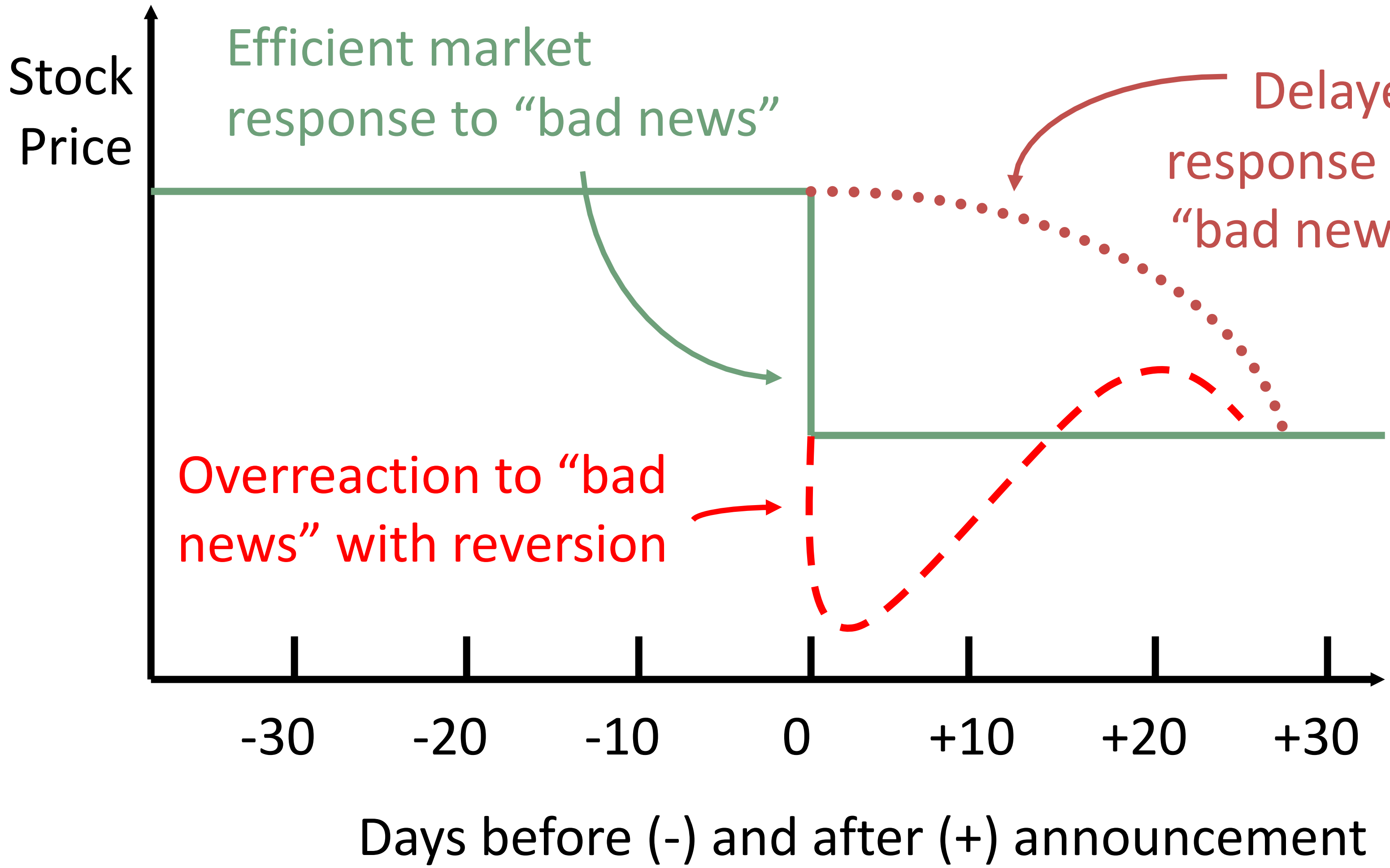
- An efficient capital market is one in which stock prices fully reflect available information.
- The EMH has implications for investors and firms.
  - Since information is reflected in security prices quickly, knowing information when it is released does an investor no good.
  - Firms should expect to receive the fair value for securities that they sell. Firms cannot profit from fooling investors in an efficient market.

Reaction of Stock Price to New Information in Efficient and Inefficient Markets



Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

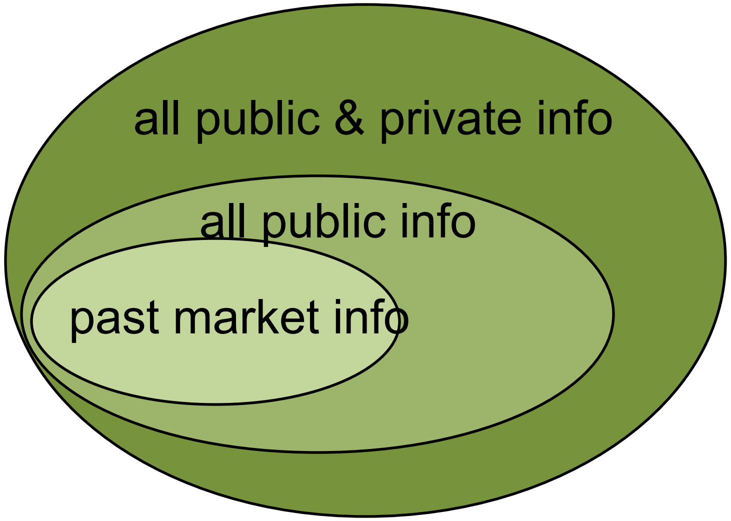
Reaction of Stock Price to New Information in Efficient and Inefficient Markets



Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

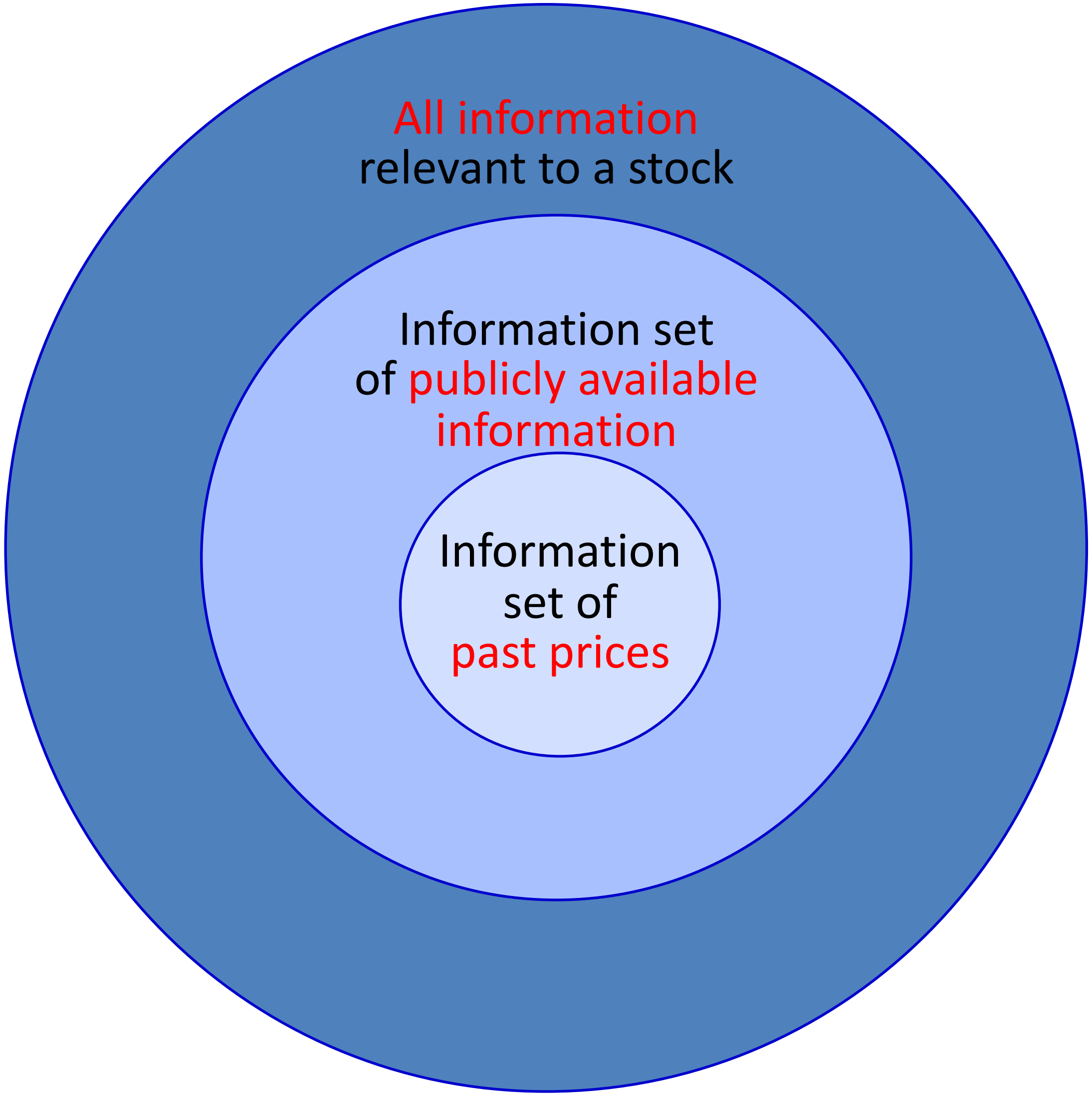
Versions of EMH/Info-Efficiency

- Weak-form efficiency:
  – Prices reflect all information contained in past prices
- Semi-strong-form efficiency:
  – Prices reflect all publicly available information
- Strong-form efficiency:
  – Prices reflect all relevant information, include private (insider) information



Source: Markus K. Brunnermeier (2015), “Lecture 10: Market Efficiency”, Finance 501: Asset Pricing, Princeton University

Relationship among Three Different Information Sets



Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Efficient Market

- An efficient market incorporates information in security prices.
- There are three forms of the EMH:
  - Weak-Form EMH

    Security prices reflect past price data.
  - Semistrong-Form EMH

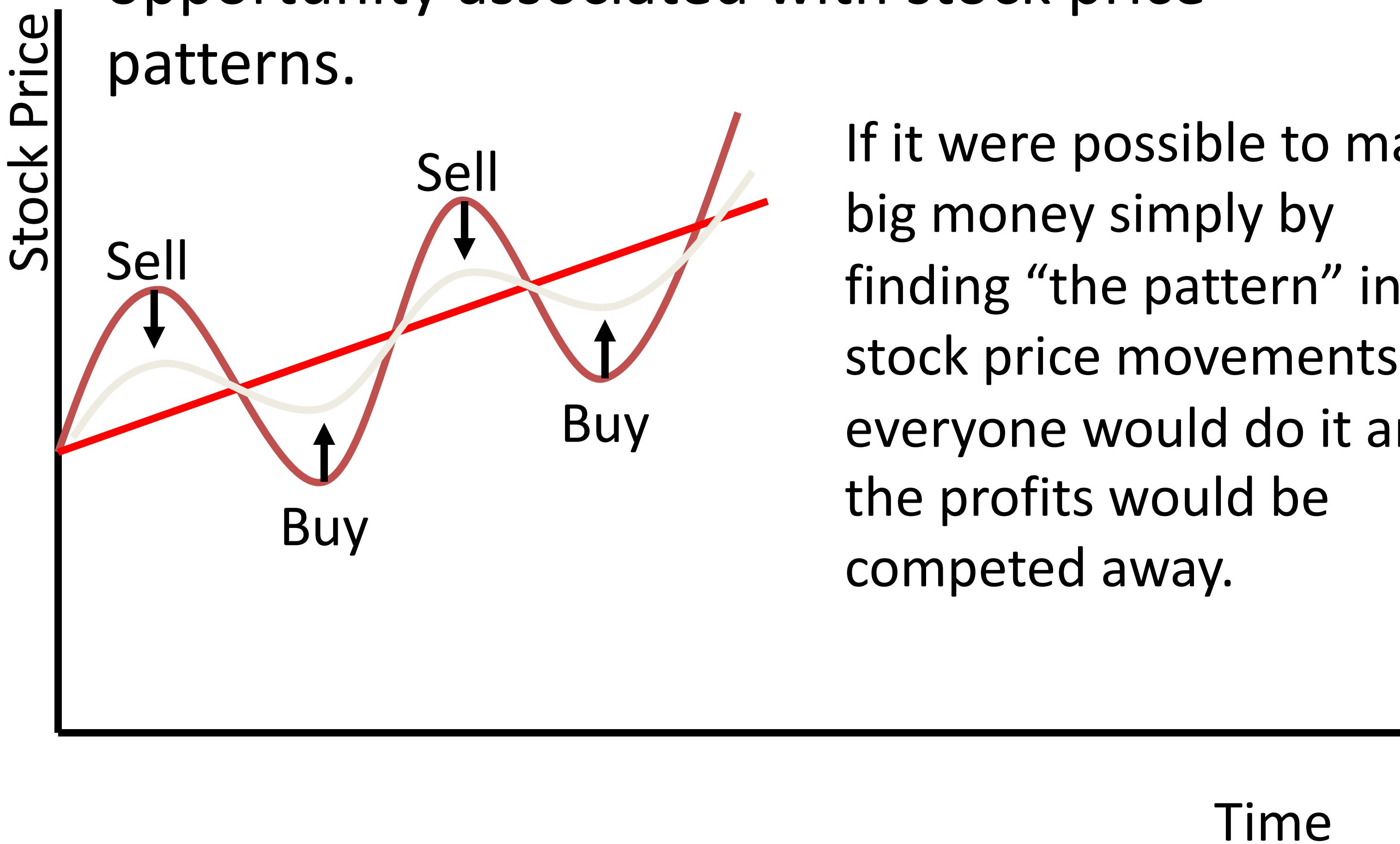
    Security prices reflect publicly available information.
  - Strong-Form EMH

    Security prices reflect all information.
- There is abundant evidence for the first two forms of the EMH.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Why Technical Analysis Fails

Investor behavior tends to eliminate any profit opportunity associated with stock price patterns.



If it were possible to make big money simply by finding “the pattern” in the stock price movements, everyone would do it and the profits would be competed away.

Evidence on Market Efficiency

- Return Predictability Studies
- Event Studies
- Performance Studies

Event Studies

- Objective
  - Examine if new (company specific) information is incorporated into the stock price in one single price jump upon public release?

Event Studies Methodology

1. Define as day "zero" the day the information is released
2. Calculate the daily returns R_{it} the 30 days around day "zero": t = -30, -29,…-1, 0, 1,…, 29, 30
3. Calculate the daily returns R_{mt} for the same days on the market (or a comparison group of firms of similar industry and risk)
4. Define Abnormal Returns (AR) as the difference $AR_{it} = R_{it} - R_{mt}$
5. Calculate Average Abnormal Returns (AAR) over all N events in the sample for all 60 reference days $$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{it}$$
6. Cumulate the returns on the first T days to CAAR $$CAAR_T = \sum_{t=-30}^{T} AAR_t$$

Event Studies Methodology

Step 1.

Define as day "zero" the day the information is released

Event Studies Methodology

Step 2.

Calculate the daily returns R_{it}

the 30 days around day “zero”:

t = -30, -29,…-1, 0, 1,…, 29, 30

Event Studies Methodology

Step 3.

Calculate the daily returns R_{mt} for the same days on the market (or a comparison group of firms of similar industry and risk)

Event Studies Methodology

Step 4.

Define

Abnormal Returns (AR)

as the difference

$$AR_{it} = R_{it} - R_{mt}$$

Source: Markus K. Brunnermeier (2015), "Lecture 10: Market Efficiency", Finance 501: Asset Pricing, Princeton University

Event Studies Methodology

Step 5.

Calculate

Average Abnormal Returns (AAR)

over all N events in the sample for all 60 reference days

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{it}$$

Event Studies Methodology

Step 6.

Cumulate the returns on the first T days to

Cumulative Average Abnormal Returns (CAAR)

$$CAAR_T = \sum_{t=-30}^{T} AAR_t$$

Source: Markus K. Brunnermeier (2015), “Lecture 10: Market Efficiency”, Finance 501: Asset Pricing, Princeton University

Event Studies Methodology

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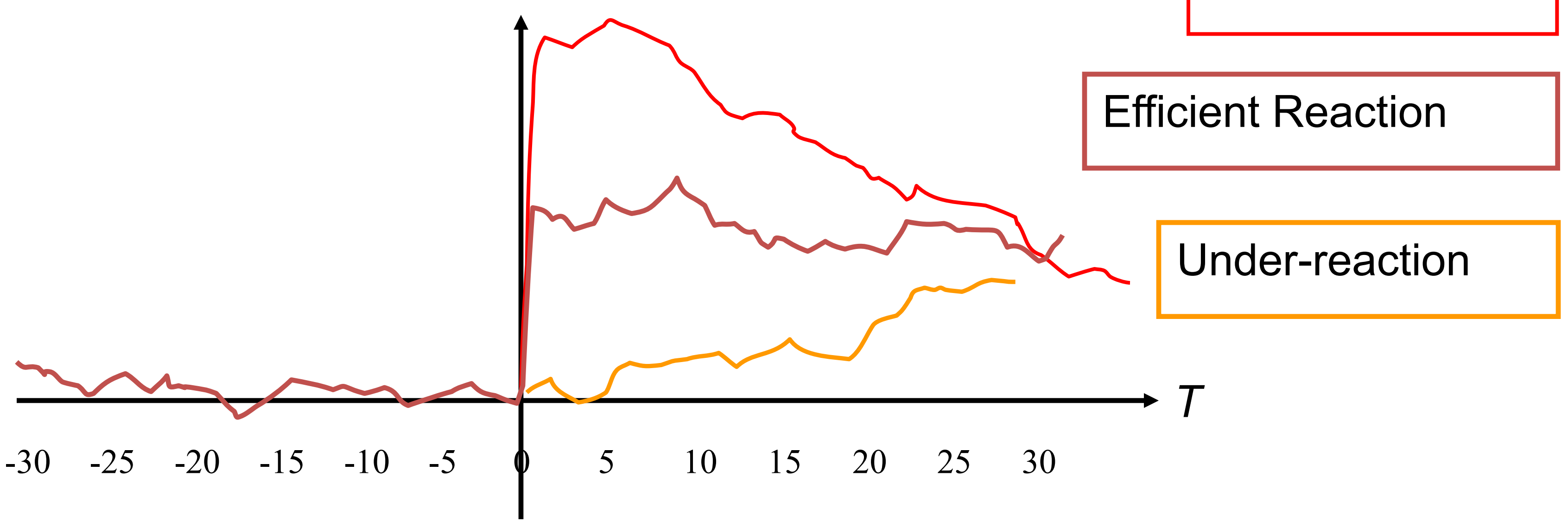
Source: Markus K. Brunnermeier (2015), "Lecture 10: Market Efficiency", Finance 501: Asset Pricing, Princeton University

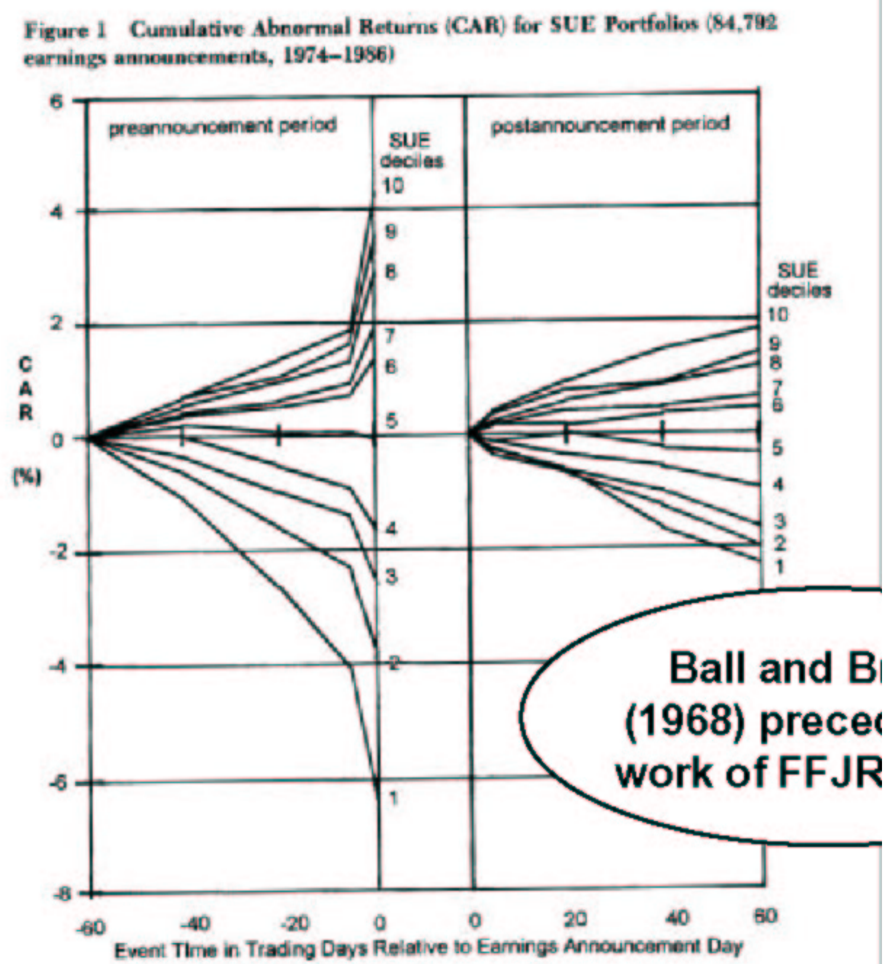
Market Efficiency in Event Studies

$$CAAR_T = \sum_{t=-30}^{T} AAR_t$$



Source: Markus K. Brunnermeier (2015), "Lecture 10: Market Efficiency", Finance 501: Asset Pricing, Princeton University

Event Study: Earning Announcements



Event Study by
Ball and Brown (1968)
Pre-announcement drift prior to earnings due to insider trading

! against strong-form

Post-announcement drift

! against semi-strong form

Event Study: Earning Announcement

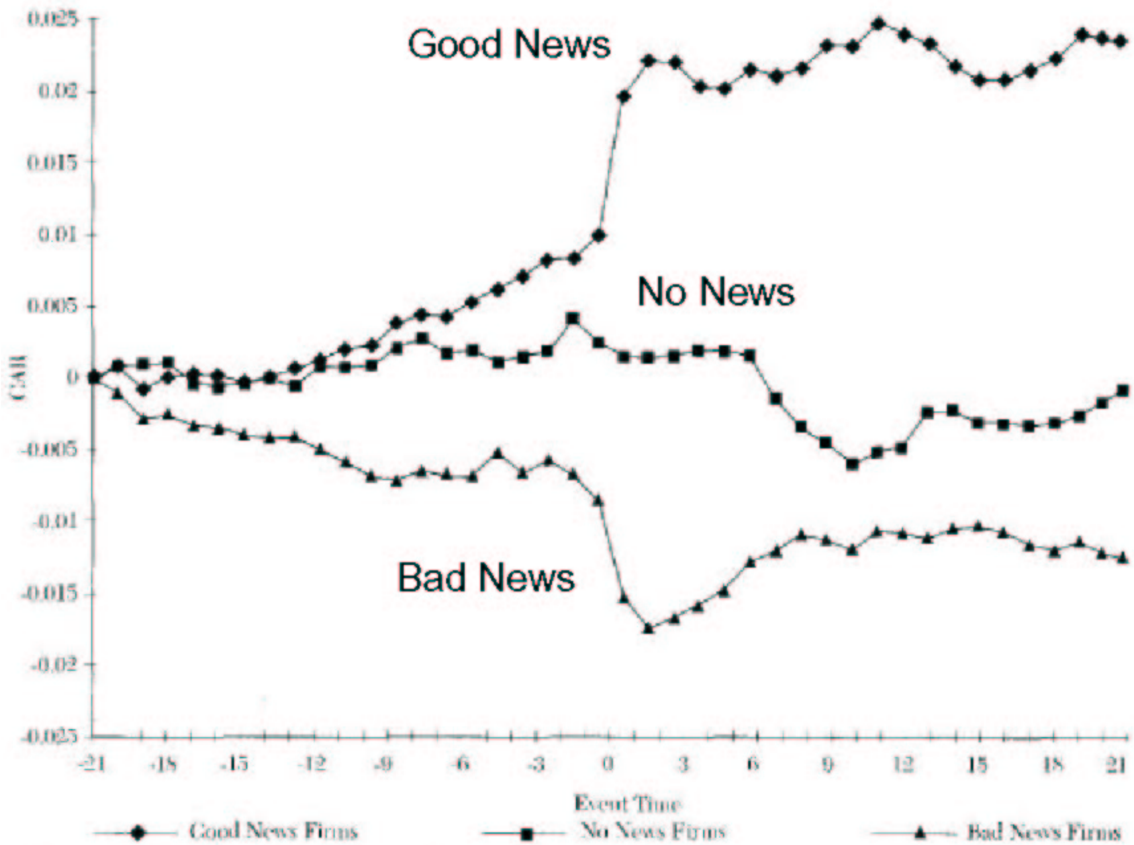
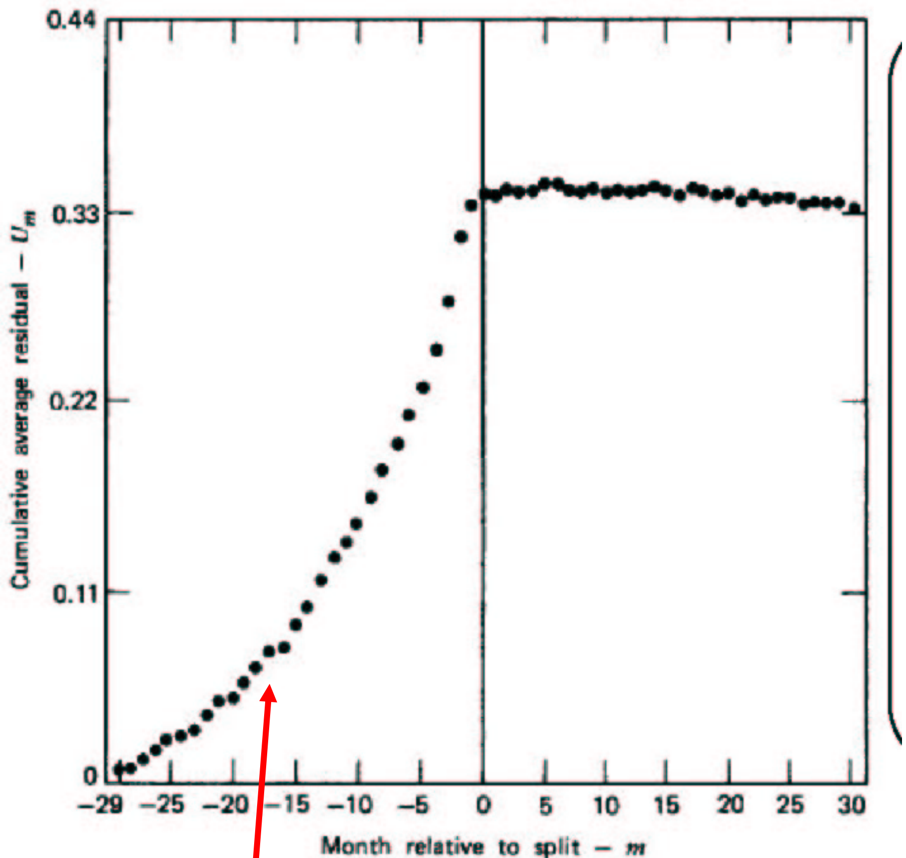


Figure 2a. Plot of cumulative abnormal return for earning announcements from event day -20 to event day 20. The abnormal return is calculated using the market model as the normal return measure.

Cumulative abnormal returns around earning announcements

(MacKinlay 1997)

Event Study: Stock Splits



Selection bias or
Insider trading

Event Study on Stock Splits by Fama-French-Fischer-Jensen-Roll (1969)

Split is a signal of good profit

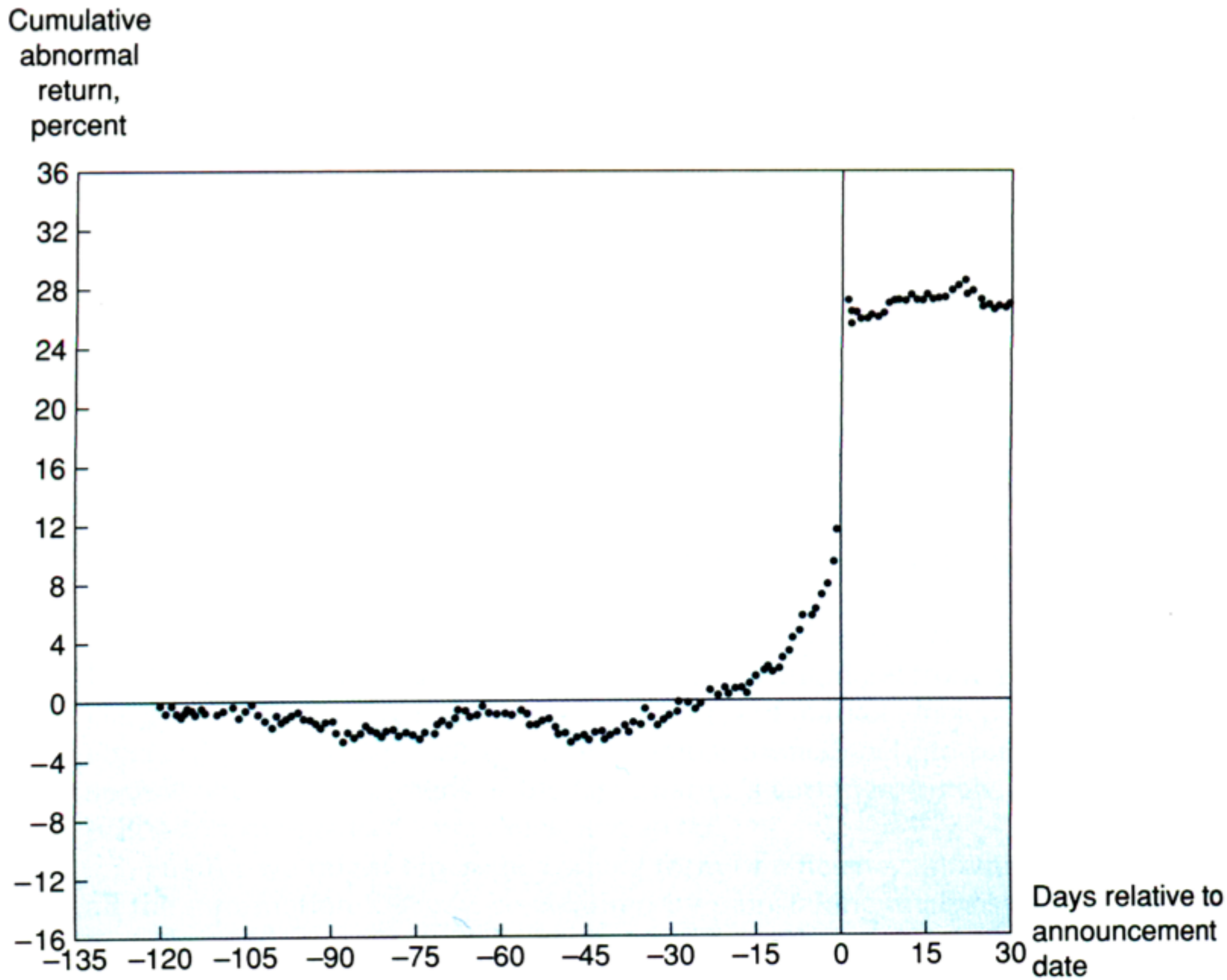
Pre-announcement drift can be due to selection bias (only good firms split) or insider trading.

! inconclusive

No post-announcement drift

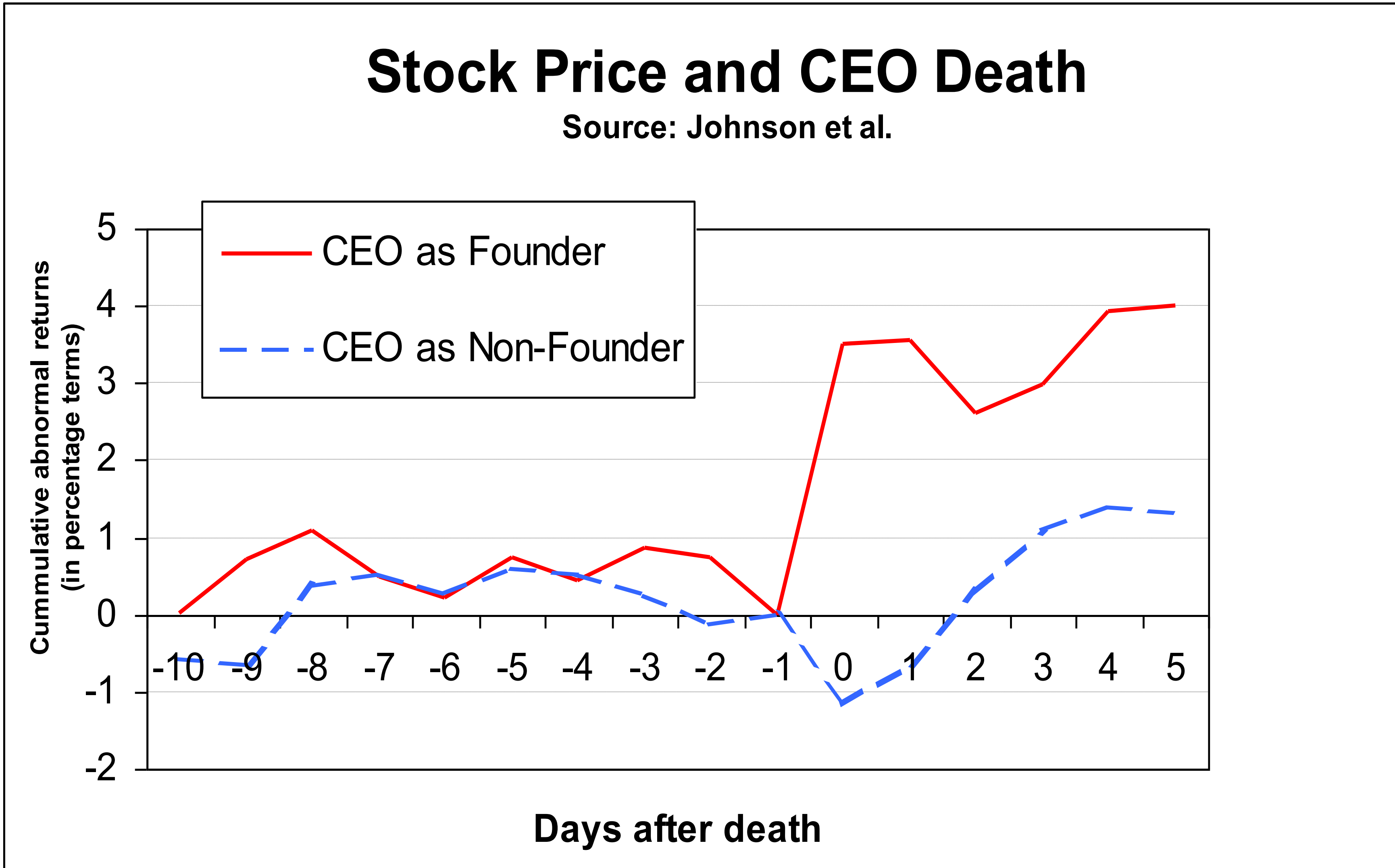
! for weak form

Event Study: Take-over



Source: Markus K. Brunnermeier (2015), "Lecture 10: Market Efficiency", Finance 501: Asset Pricing, Princeton University

Event Study: Death of CEO



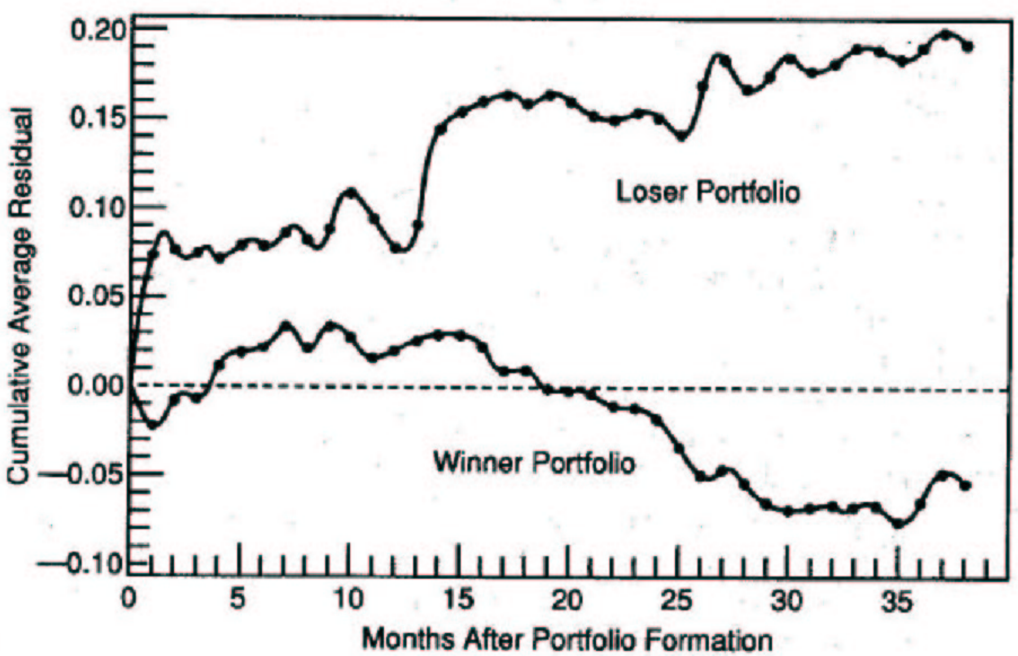
Evidence I: Predictabilities Studies

- Statistical variables have only low forecasting power, but
  - But some forecasting power for P/E or B/M
  - Short-run momentum and long-run reversals
- Calendar specific abnormal returns due to Monay effect, January effect etc.
- CAVEAT: Data mining: Find variables with spurious forecasting power if we search enough

Source: Markus K. Brunnermeier (2015), "Lecture 10: Market Efficiency", Finance 501: Asset Pricing, Princeton University

Long-Run Reversals

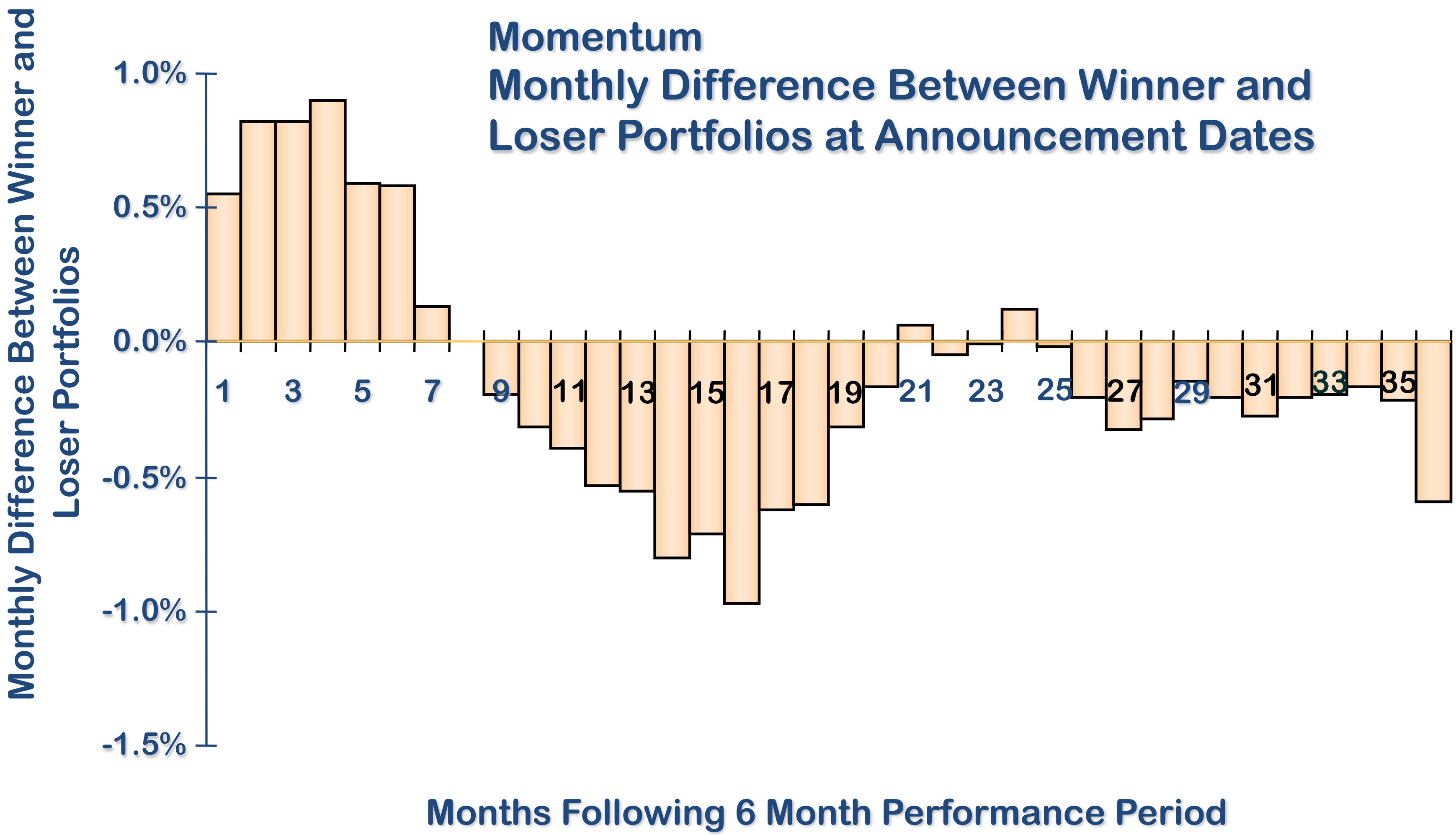
Figure 1 Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1–36 months into the test period)



Long-run Reversals

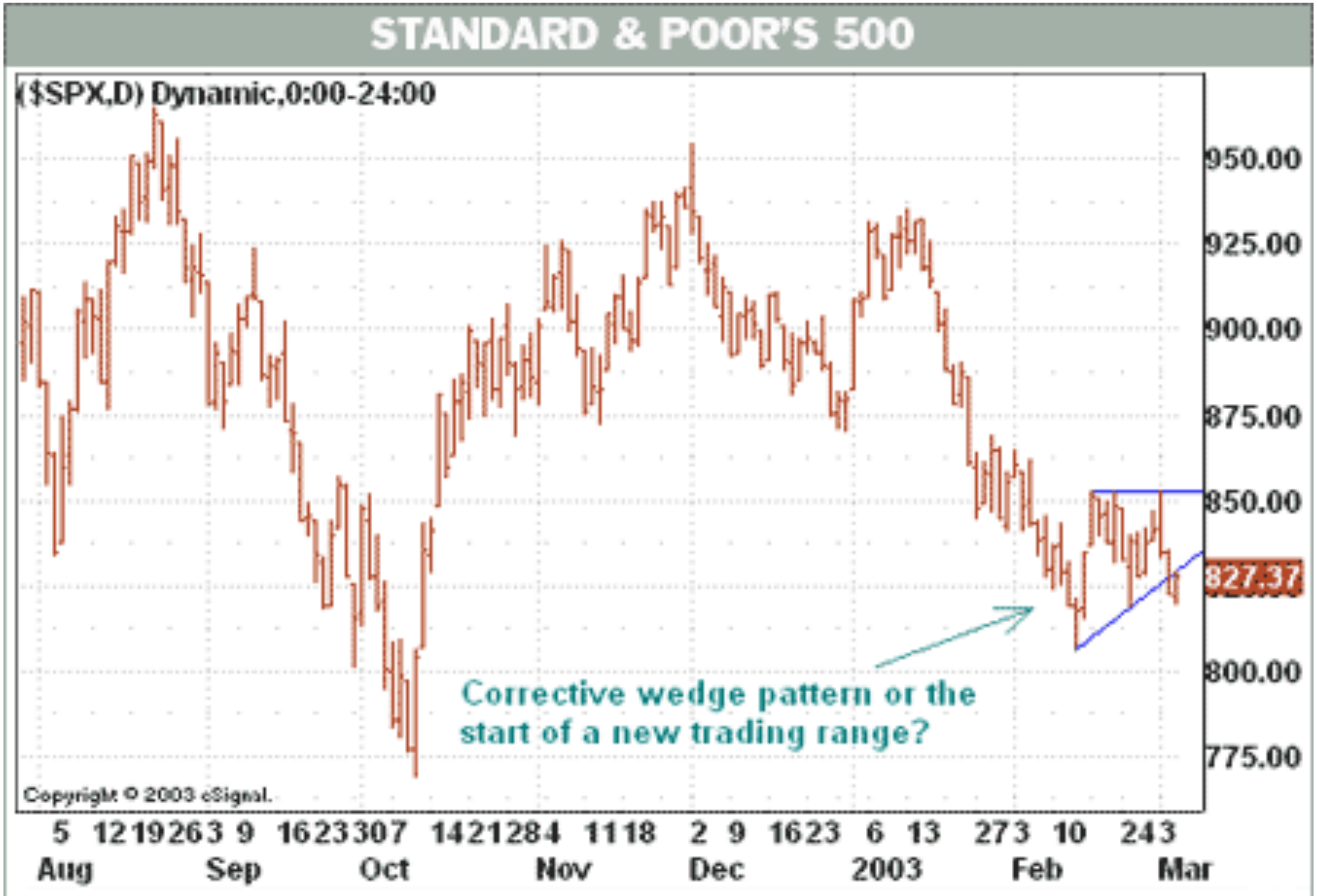
Returns to previous 5 year's winner-loser stocks (market adjusted returns)

Short-run Momentum



Source: Markus K. Brunnermeier (2015), “Lecture 10: Market Efficiency”, Finance 501: Asset Pricing, Princeton University

Getting Technical
Barron's March 5, 2003



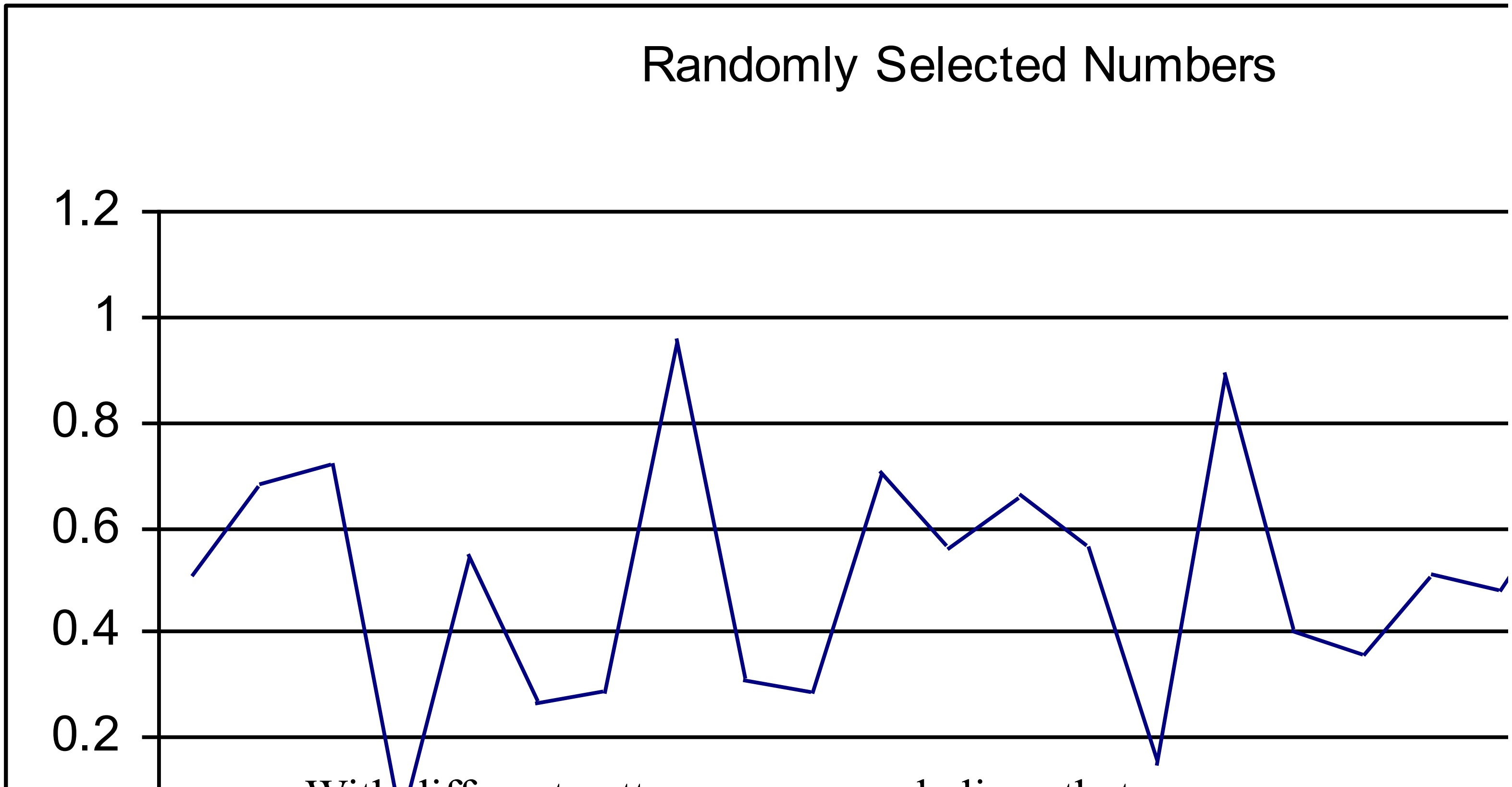
Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Getting Technical

Back to Buy Low, Sell High *Barron's March 12, 2003*

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

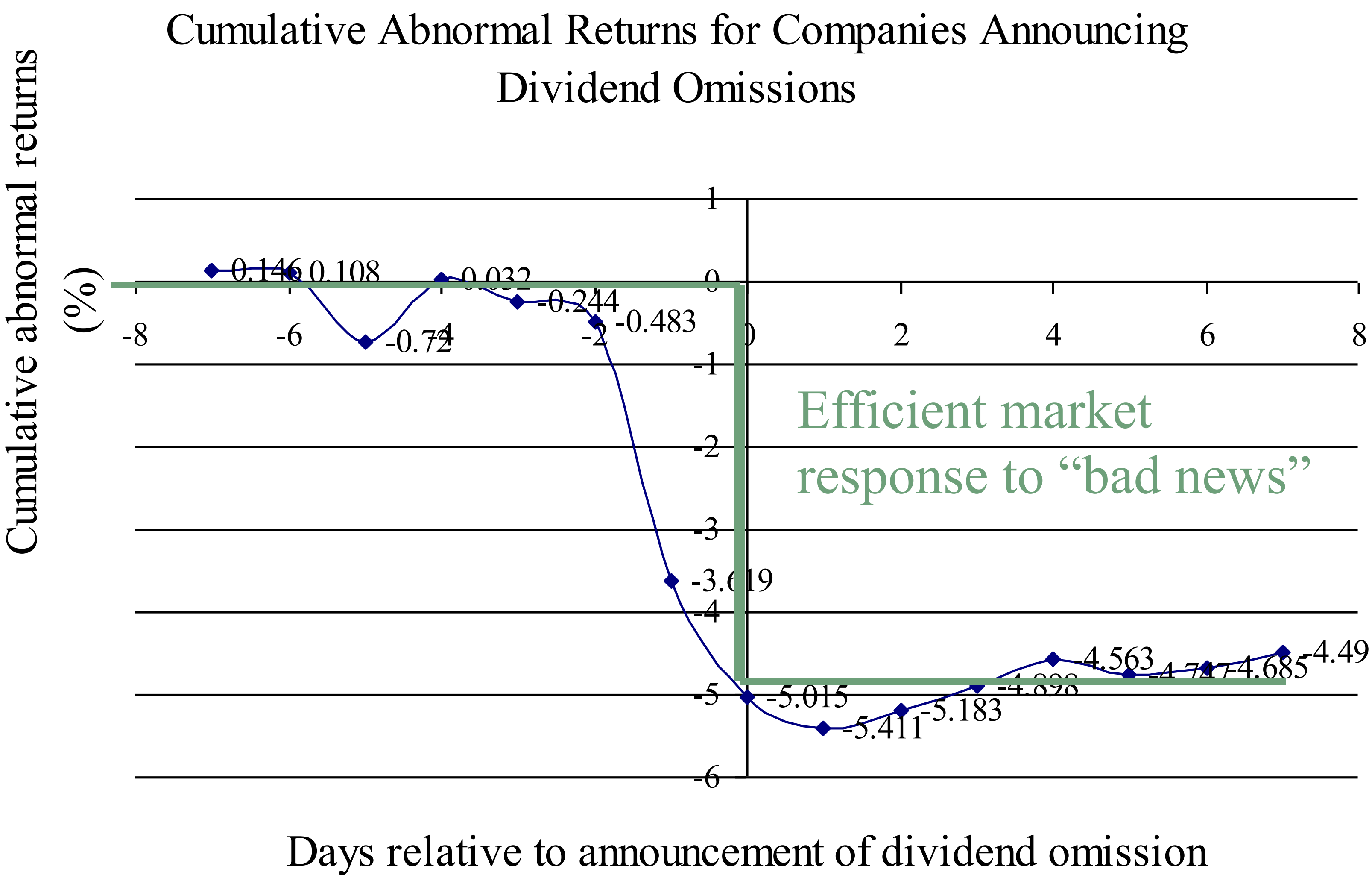
What Pattern Do You See?



With different patterns, you may believe that you can predict the next value in the series—even though you *know* it is random.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

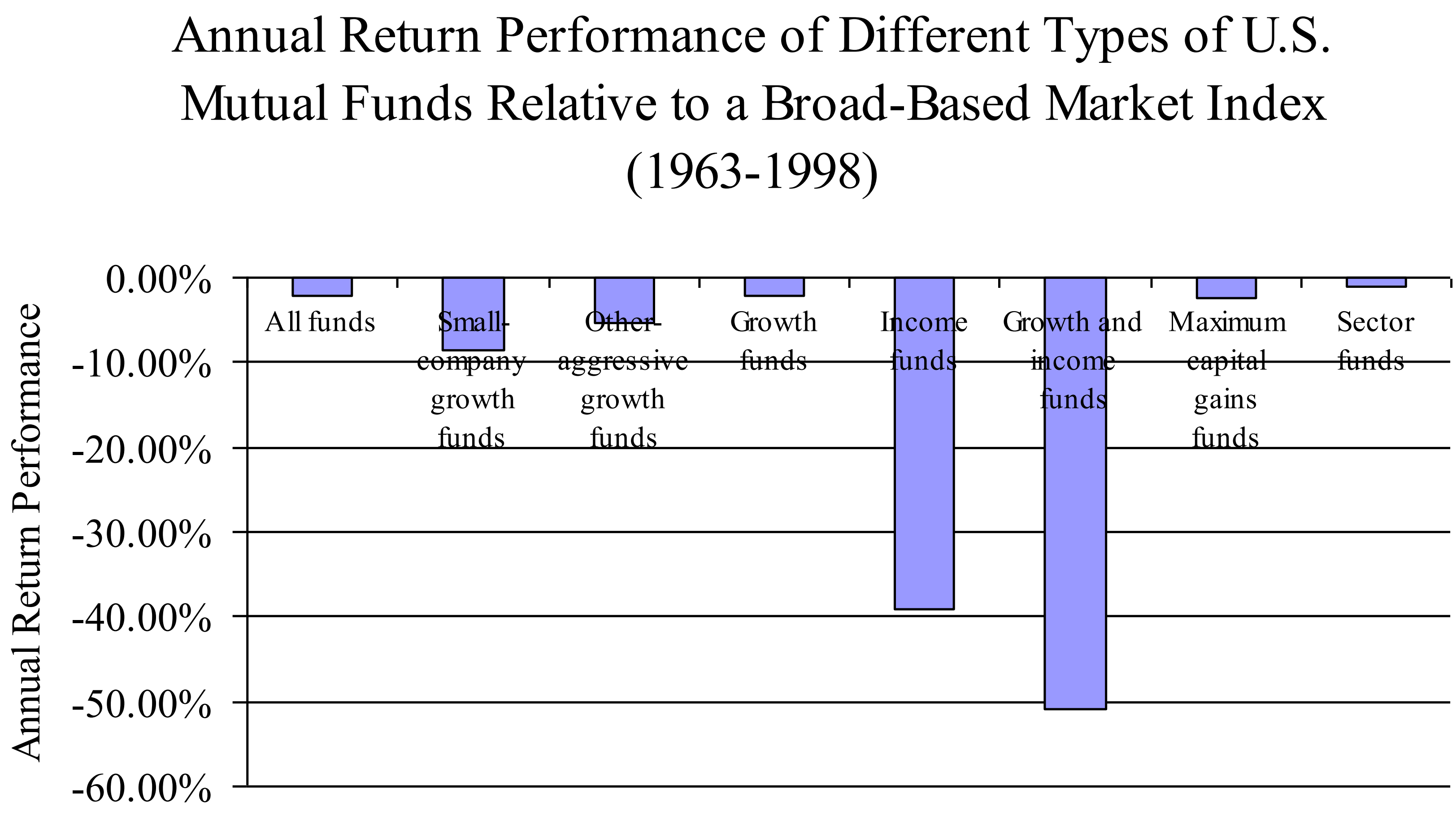
Event Studies: Dividend Omissions



S.H. Szewczyk, G.P. Tsetsekos, and Z. Santout “Do Dividend Omissions Signal Future Earnings or Past Earnings?” *Journal of Investing* (Spring 1997)

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

The Record of Mutual Funds



Taken from Lubos Pastor and Robert F. Stambaugh, "Evaluating and Investing in Equity Mutual Funds," unpublished paper, Graduate School of Business, University of Chicago (March 2000).

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Weak Form Market Efficiency

- Security prices reflect all information found in past prices and volume.
- If the weak form of market efficiency holds, then technical analysis is of no value.
- Often weak-form efficiency is represented as
- $P_t = P_{t-1}$ + Expected return + random error t
- Since stock prices only respond to new information, which by definition arrives randomly, stock prices are said to follow a random walk.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Market Efficiency

- One group of studies of strong-form market efficiency investigates insider trading.
- A number of studies support the view that insider trading is abnormally profitable.
- Thus, strong-form efficiency does not seem to be substantiated by the evidence

Why Doesn’t Everybody Believe the EMH?

- There are optical illusions, mirages, and apparent patterns in charts of stock market returns.
- The truth is less interesting.
- There is some evidence against market efficiency:
  - Seasonality
  - Small versus Large stocks
  - Value versus growth stocks
- The tests of market efficiency are weak.

Source: Ross et al. (2005), "Corporate Finance", 7th Edition, McGraw−Hill

Efficient Markets

Inefficient Markets

Behavioral Finance

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