

人工智慧財務金融應用

AI in Financial Application



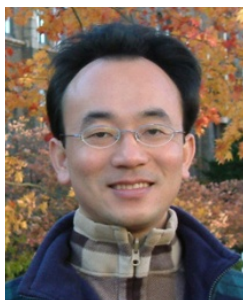
Tamkang
Universit
淡江大學

財務金融事件研究法 (Event Studies in Finance)

1081AIFA04

EMBA, IMTKU (M2457) (8413) (Fall 2019)

Fri 12,13,14 (19:20-22:10) (D301)



Min-Yuh Day

戴敏育

Associate Professor

副教授

Dept. of Information Management, Tamkang University

淡江大學 資訊管理學系

<http://mail.tku.edu.tw/myday/>

2019-10-18



課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2019/09/13	中秋節 (Mid-Autumn Festival) 放假一天 (Day off)
2	2019/09/20	人工智慧財務金融應用課程介紹 (Course Orientation for AI in Financial Application)
3	2019/09/27	人工智慧投資分析與機器人理財顧問 (Artificial Intelligence for Investment Analysis and Robo-Advisors)
4	2019/10/04	金融科技對話式商務與智慧型交談機器人 (Conversational Commerce and Intelligent Chatbots for Fintech)
5	2019/10/11	國慶日補假 (Bridge Holiday for National Day, Extra Day Off)
6	2019/10/18	財務金融事件研究法 (Event Studies in Finance)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2019/10/25	人工智慧財務金融應用個案研究 I (Case Study on AI in Financial Application I)
8	2019/11/01	Python AI智慧金融分析基礎 (Foundations of AI in Finance Big Data Analytics with Python)
9	2019/11/08	Python Pandas 量化投資分析 (Quantitative Investing with Pandas in Python)
10	2019/11/15	期中報告 (Midterm Project Report)
11	2019/11/22	Python Scikit-Learn 機器學習財務金融應用 (Machine Learning in Finance Application with Scikit-Learn In Python)
12	2019/11/29	TensorFlow 深度學習財務金融應用 I (Deep Learning for Finance Application with TensorFlow I)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2019/12/06	人工智慧財務金融應用個案研究 II (Case Study on AI in Financial Application II)
14	2019/12/13	TensorFlow 深度學習財務金融應用 II (Deep Learning for Finance Application with TensorFlow II)
15	2019/12/20	TensorFlow 深度學習財務金融應用 III (Deep Learning for Finance Application with TensorFlow III)
16	2019/12/27	社會網絡分析財務金融應用 (Social Network Analysis for Finance Application)
17	2020/01/03	期末報告 I (Final Project Presentation I)
18	2020/01/10	期末報告 II (Final Project Presentation II)

Event Studies in Finance

Doron Kliger and Gregory Gurevich (2014),
Event Studies for Financial Research:
A Comprehensive Guide,
Palgrave Macmillan



事件研究法：

財務與會計實證研究必備

沈中華、李建然 (2000)



Event Studies for Financial Research

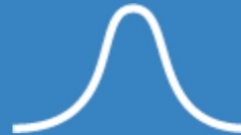
state-of-the-art event study software

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

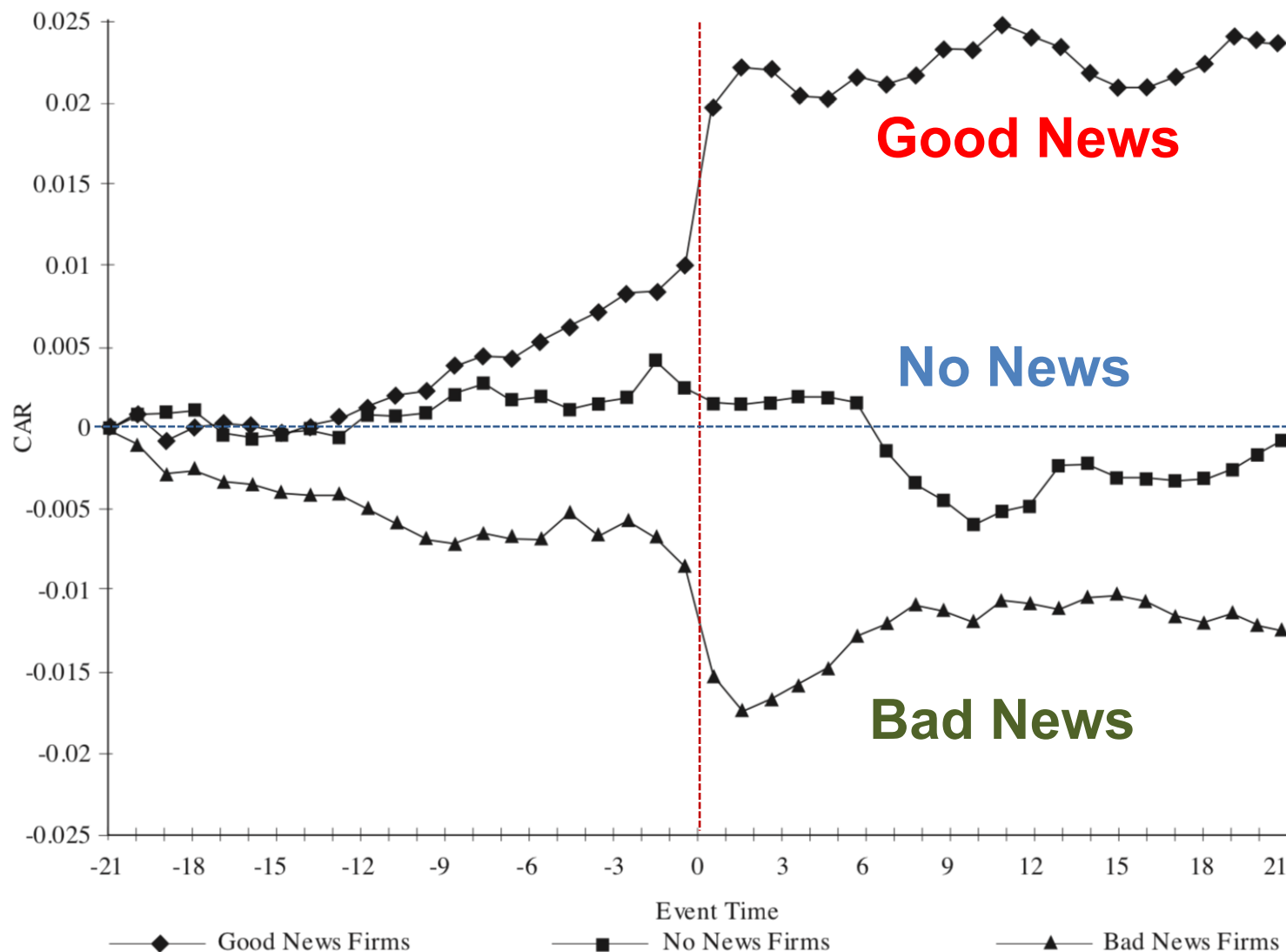
Time-Series t-Test
Cross-Sectional t-Test
Standardized Residual Test
Standardized Cross-Sectional Test
Corrado Rank Test
Generalized Sign Test
Skewness-Adjusted t-Test



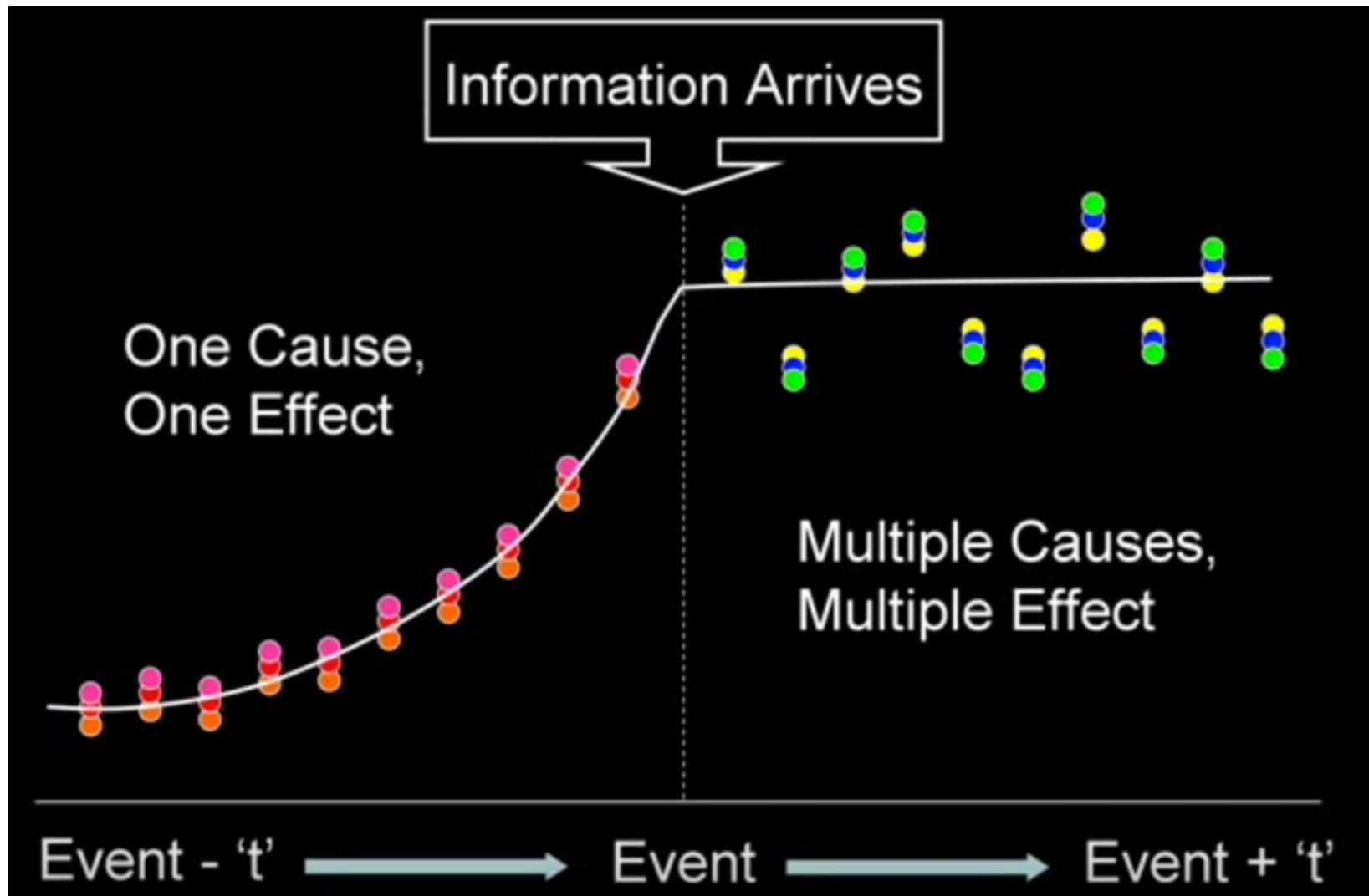
Return Models

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

Event Studies in Economics and Finance



Event Study

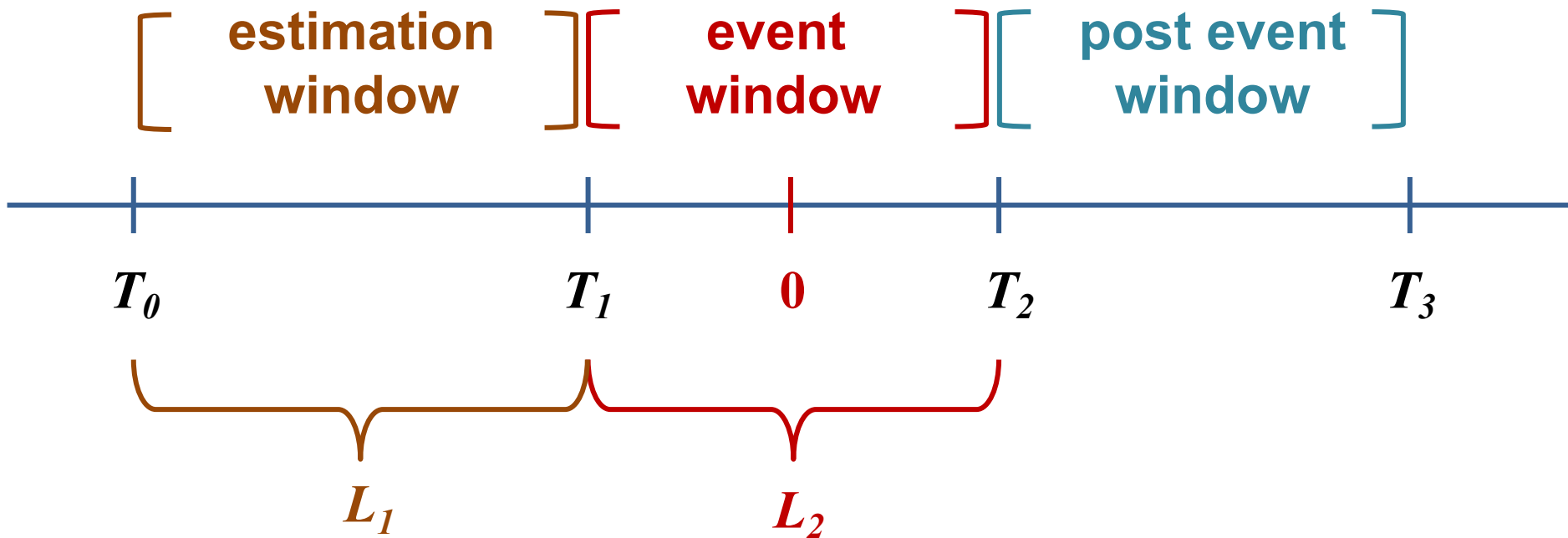


Event Study

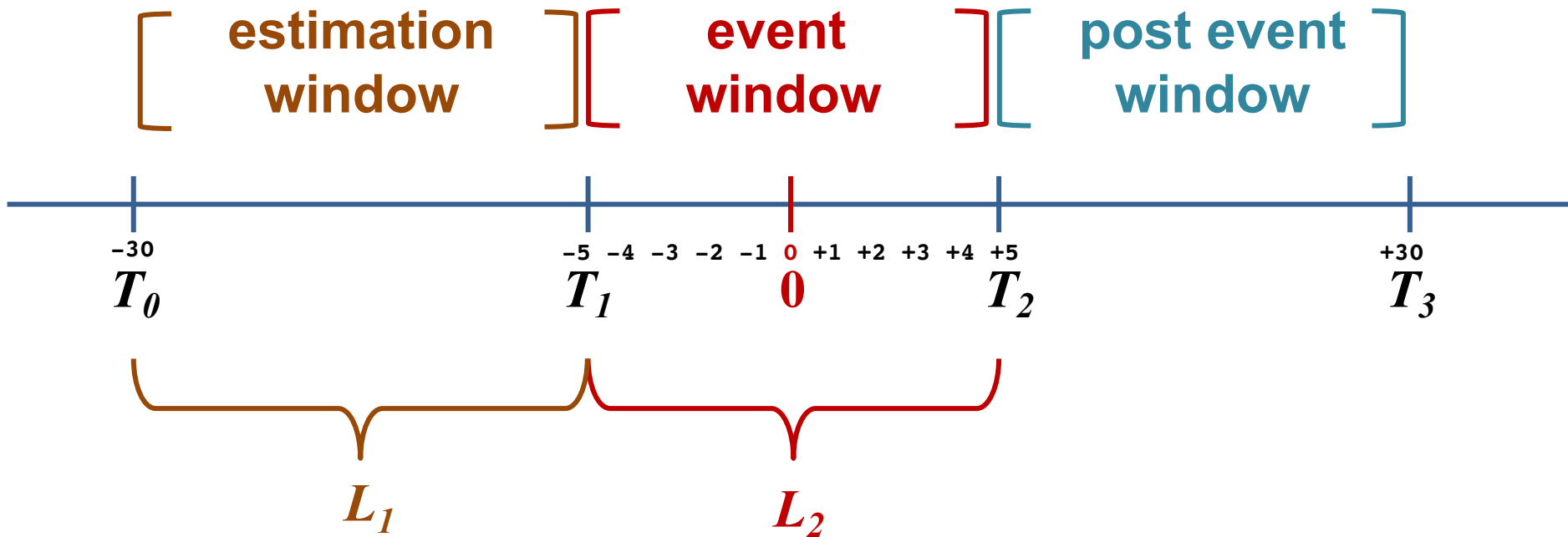
Time line for an event study



Event Study Methodology



Event Study Methodology

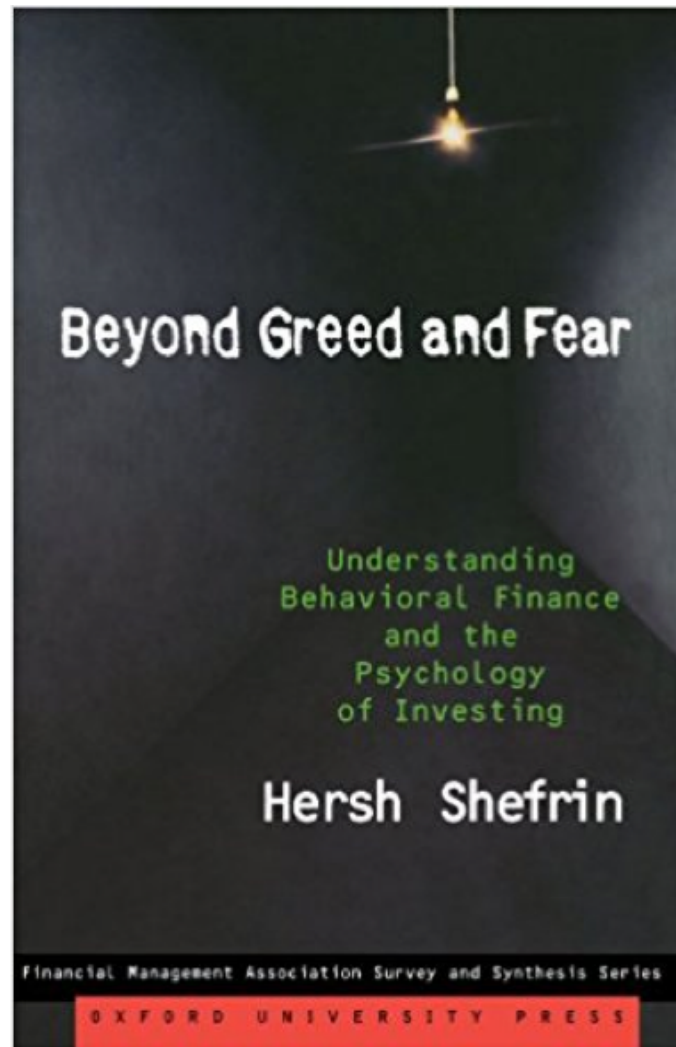


Efficient Markets

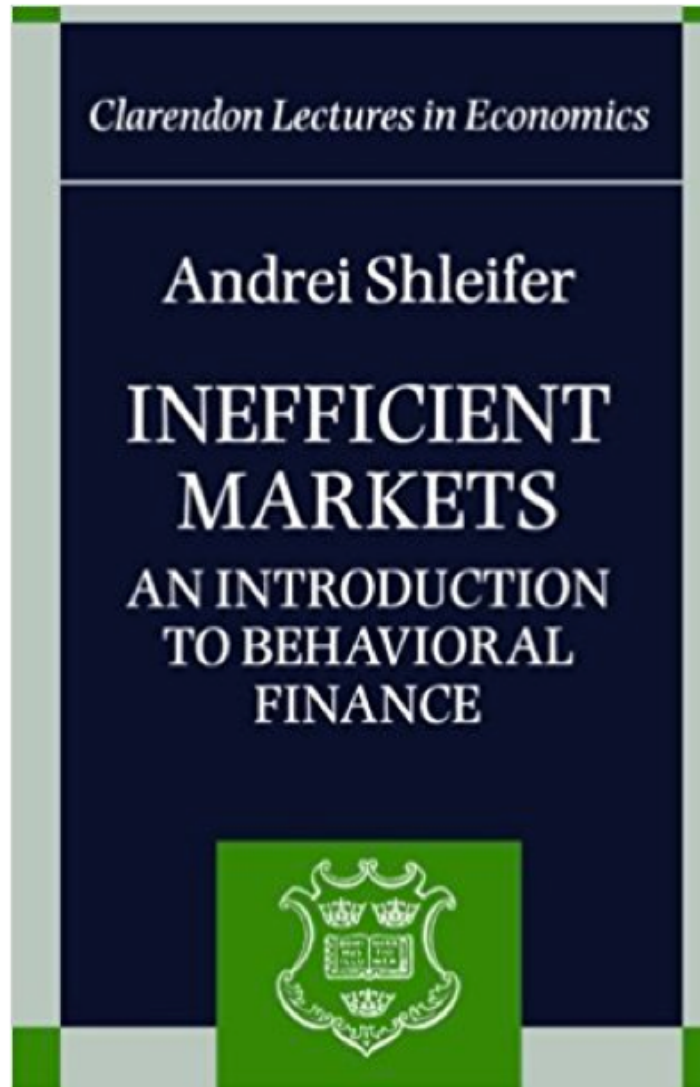
Behavioral Economics

Behavioral Finance

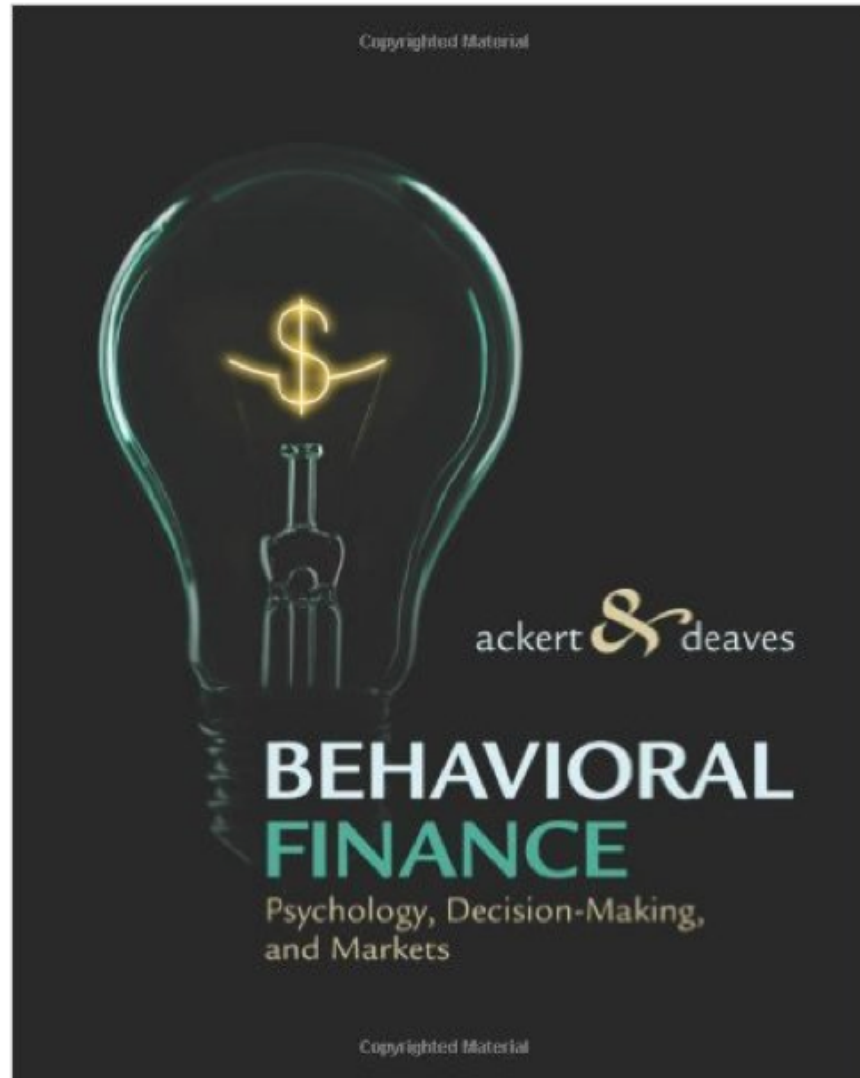
Hersh Shefrin (2007),
Beyond Greed and Fear:
Understanding Behavioral Finance and the Psychology of Investing, Oxford
University Press



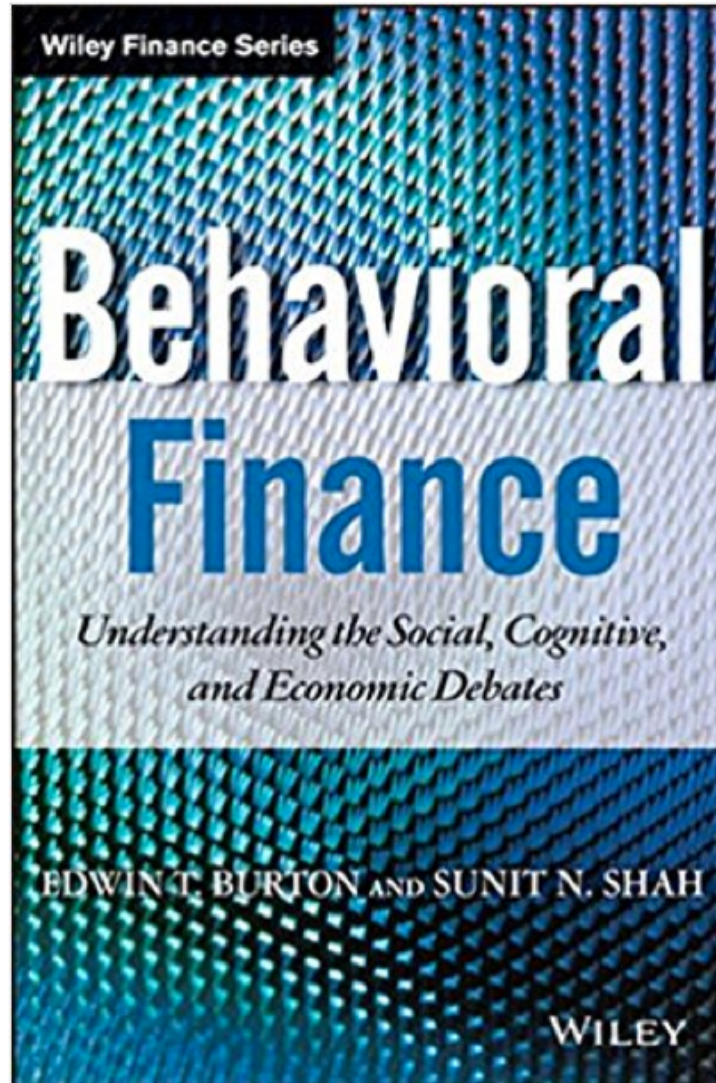
Andrei Shleifer (2000),
Inefficient Markets: An Introduction to Behavioral Finance,
Oxford University Press



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



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



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**.

Behavioral Finance Themes

- Heuristic-Driven Bias
- Framing Dependence
- Inefficient Markets

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 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 ...

[Cited by 20928](#) [Related articles](#) [All 28 versions](#)

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.

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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.

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.

Cumulative Average Residuals

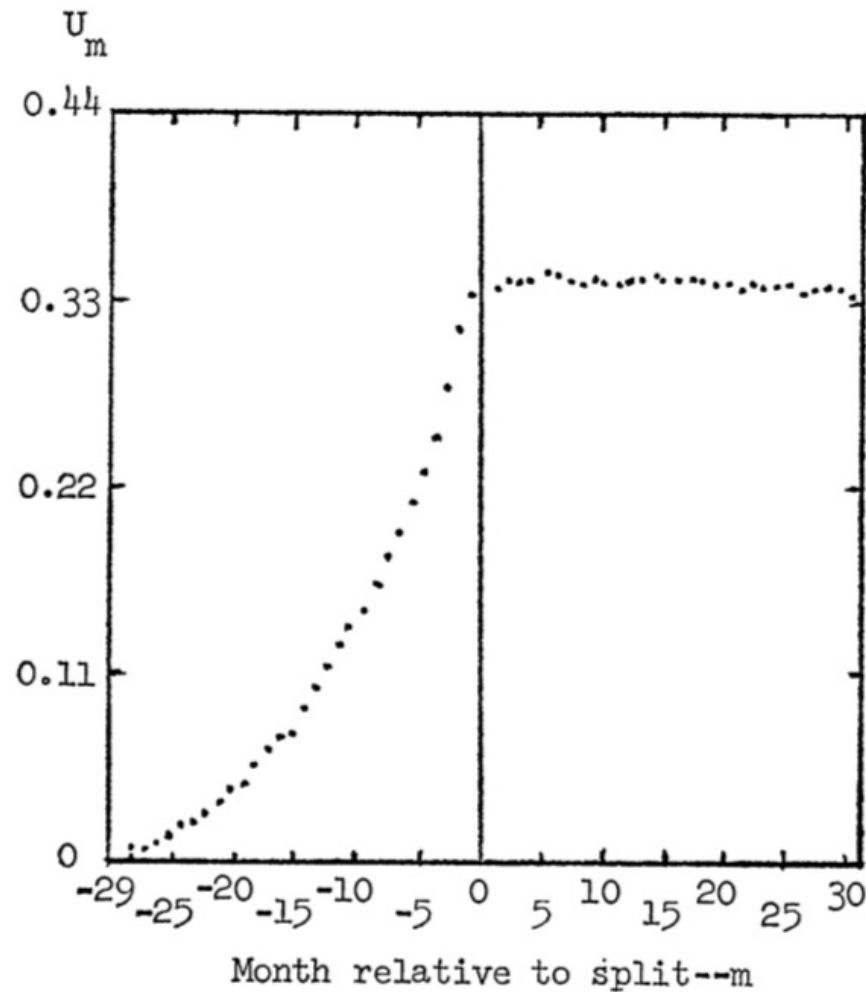


FIGURE 1a
Cumulative average residuals—all splits.

Cumulative Average Residuals

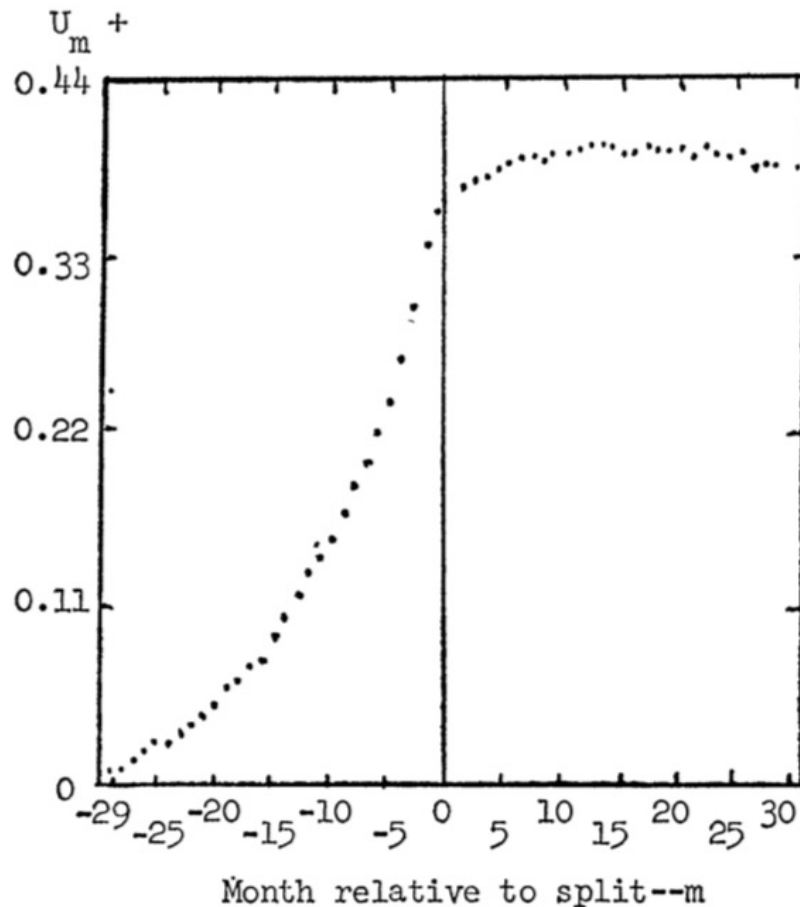


FIGURE 1b
Cumulative average residuals for dividend
"increases."

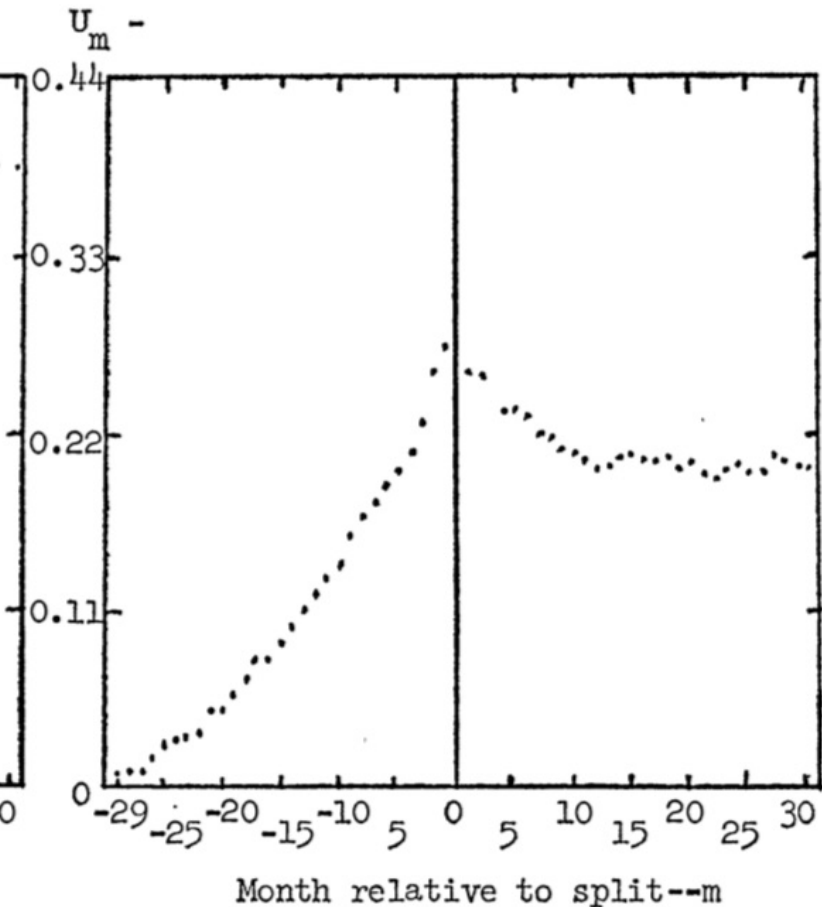


FIGURE 1c
Cumulative average residuals for dividend
"decreases."

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.

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**.

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.

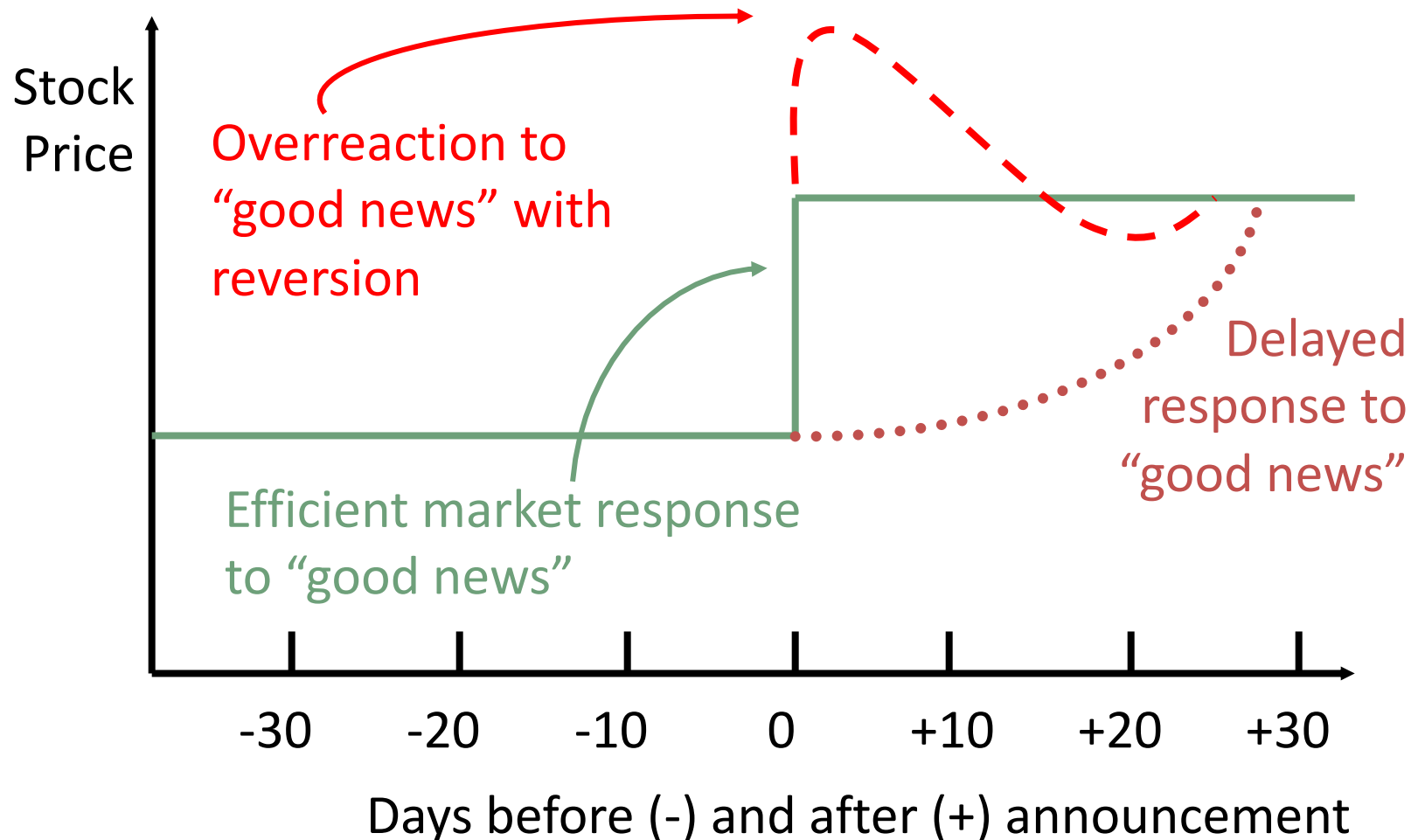
How to Create Value through Financing

- 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.

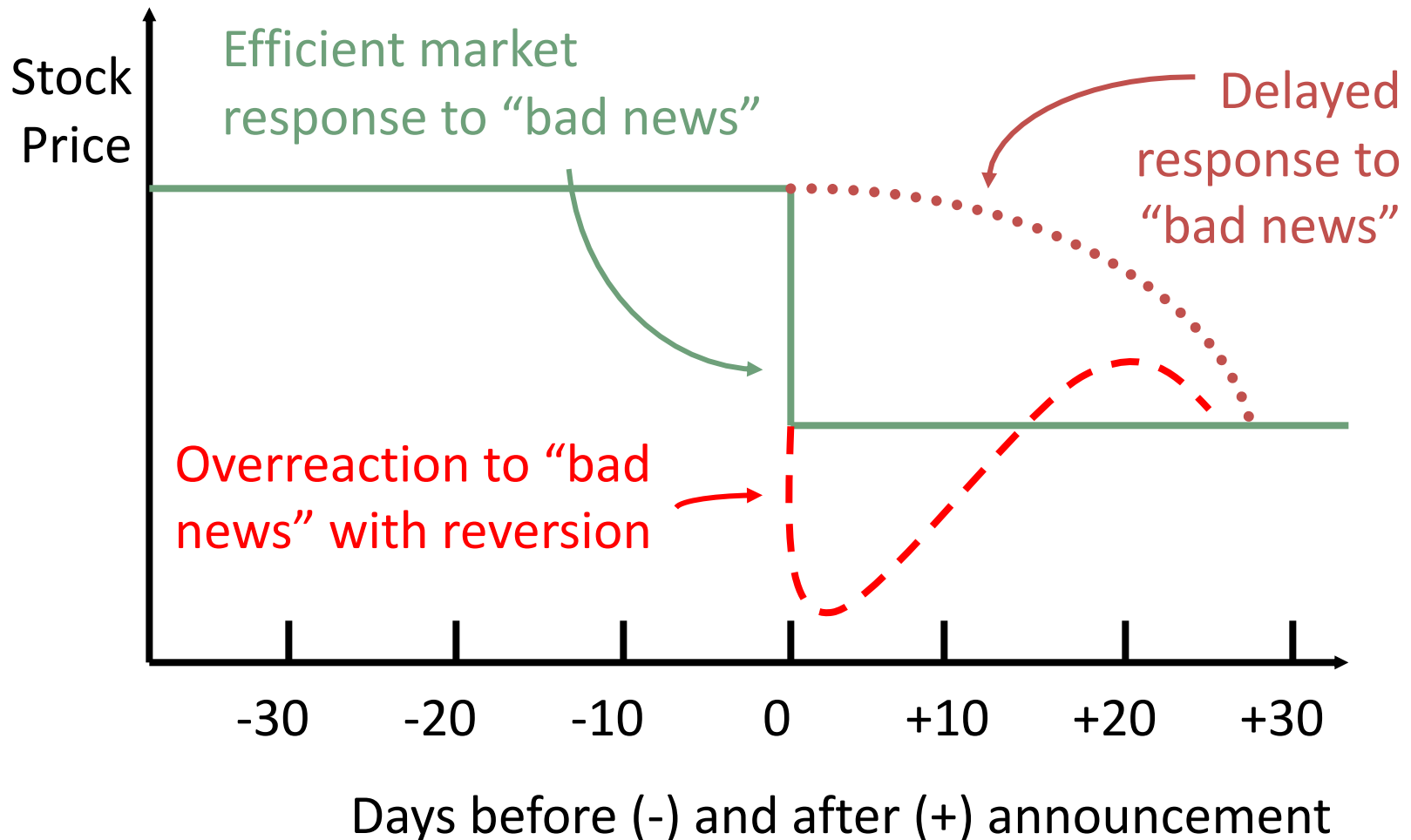
Efficient Capital Markets

- 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

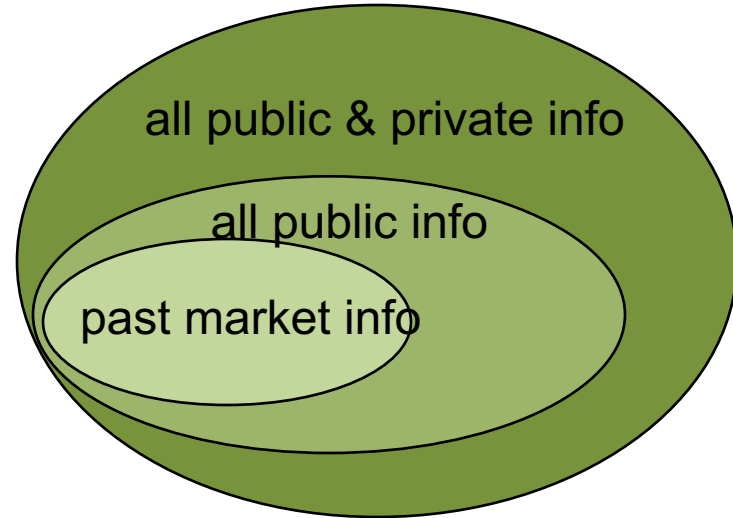


Reaction of Stock Price to New Information in Efficient and Inefficient Markets

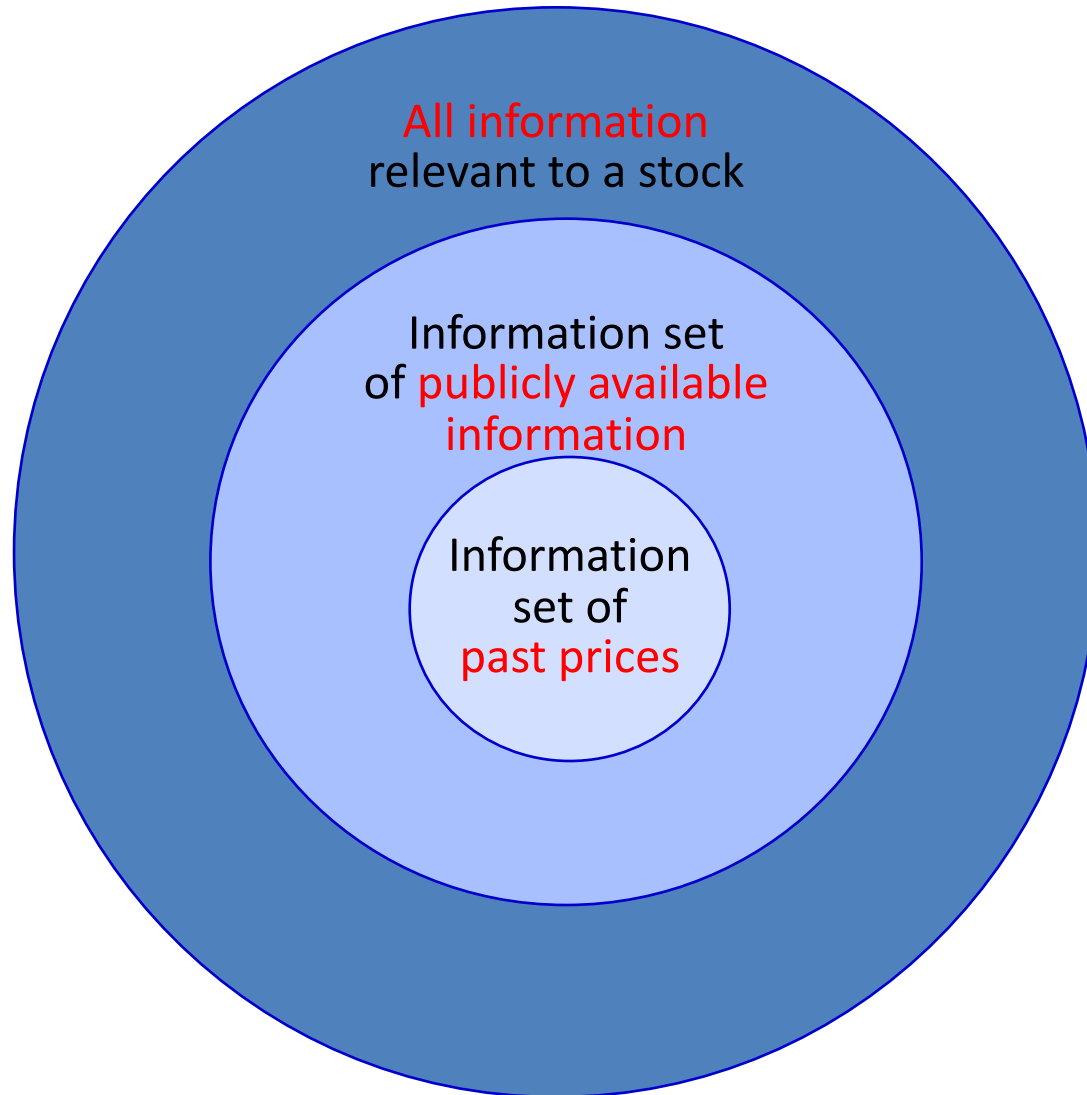


Versions of EMH/Info-Efficiency

- **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



Relationship among Three Different Information Sets

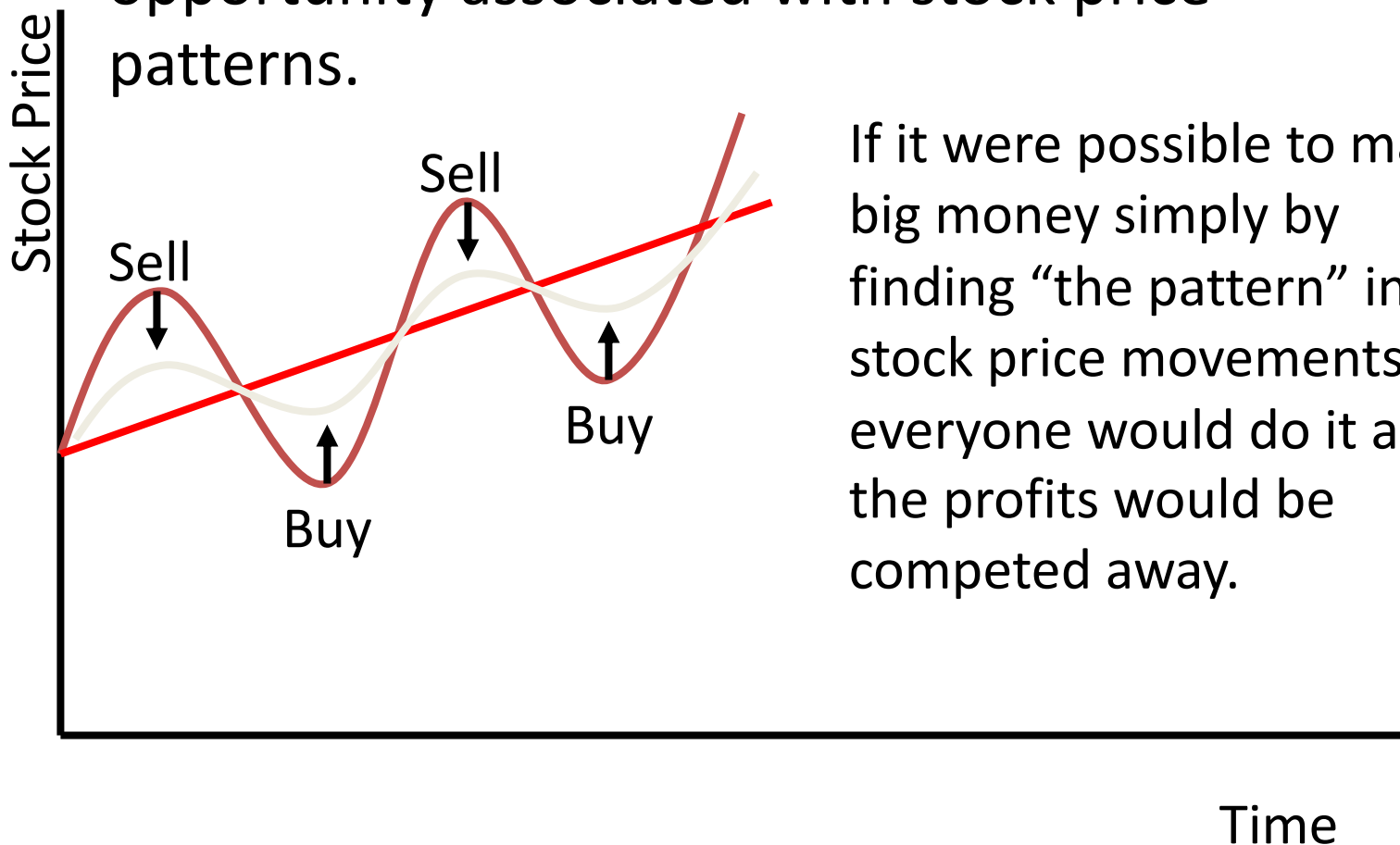


Efficient Market

- 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.

Why Technical Analysis Fails

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



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”:
 $t = -30, -29, \dots, -1, 0, 1, \dots, 29, 30$
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”:
 $t = -30, -29, \dots, -1, 0, 1, \dots, 29, 30$

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

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

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)

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

Event Studies Methodology

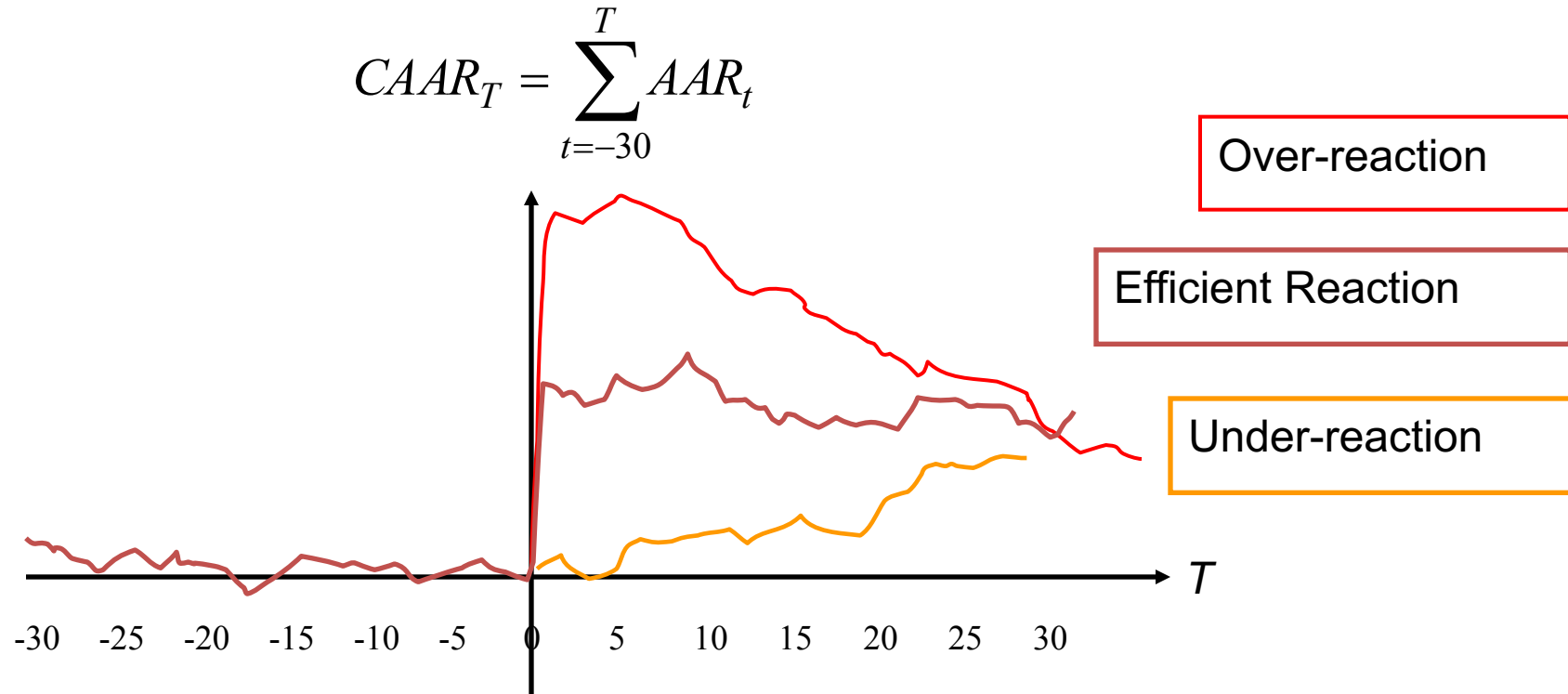
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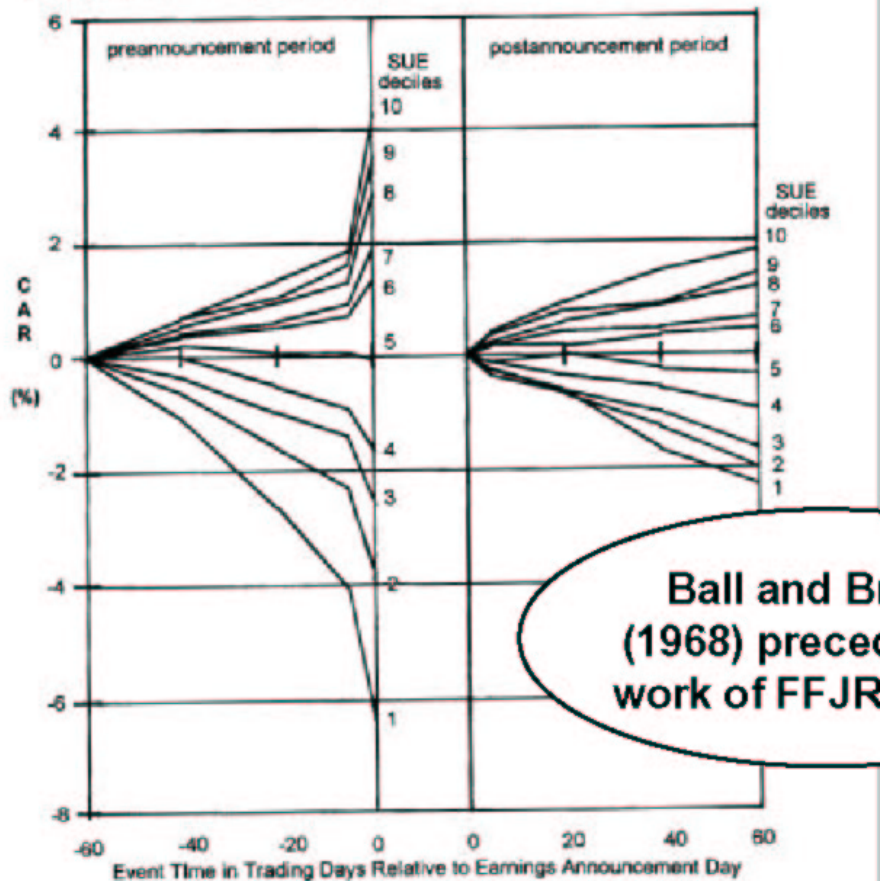
$$CAAR_T = \sum_{t=-30}^T AAR_t$$

Market Efficiency in Event Studies



Event Study: Earning Announcements

Figure 1 Cumulative Abnormal Returns (CAR) for SUE Portfolios (84,792 earnings announcements, 1974–1986)



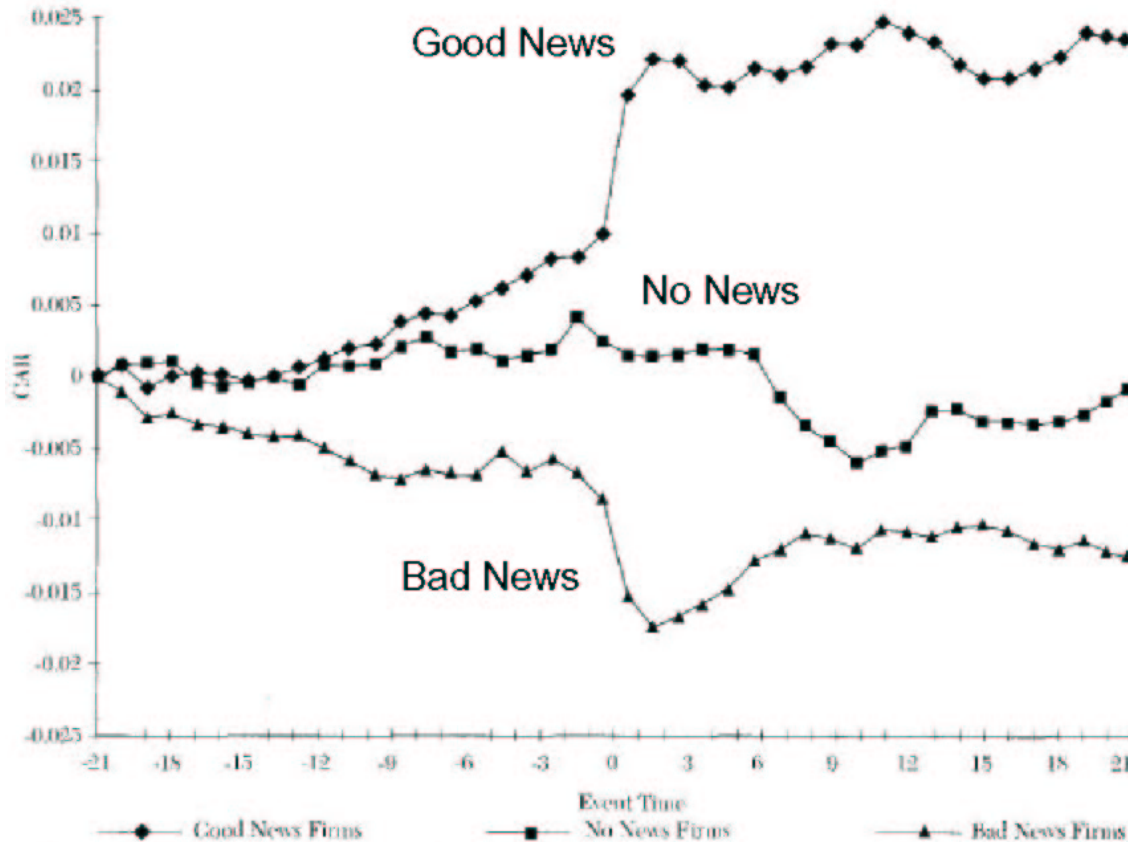
Event Study by
Ball and Brown (1968)
Pre-announcement drift prior to
earnings due to insider trading

! against strong-form

Post-announcement drift

! against semi-strong form

Event Study: Earning Announcement

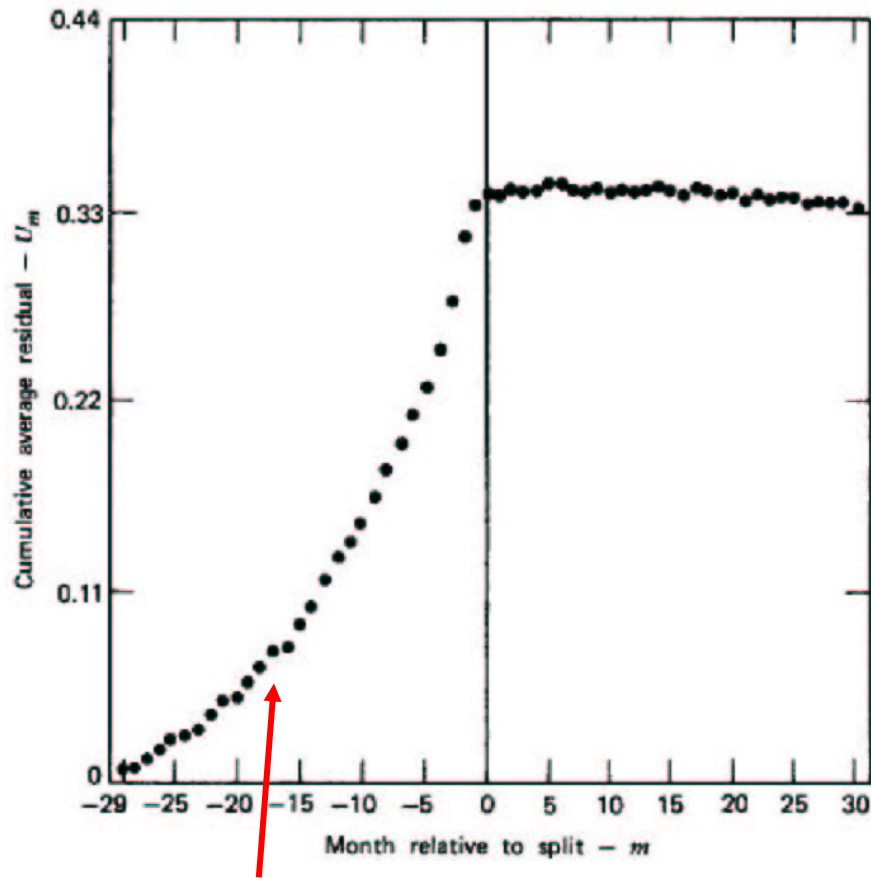


Cumulative abnormal returns around earning announcements

(MacKinlay 1997)

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.

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

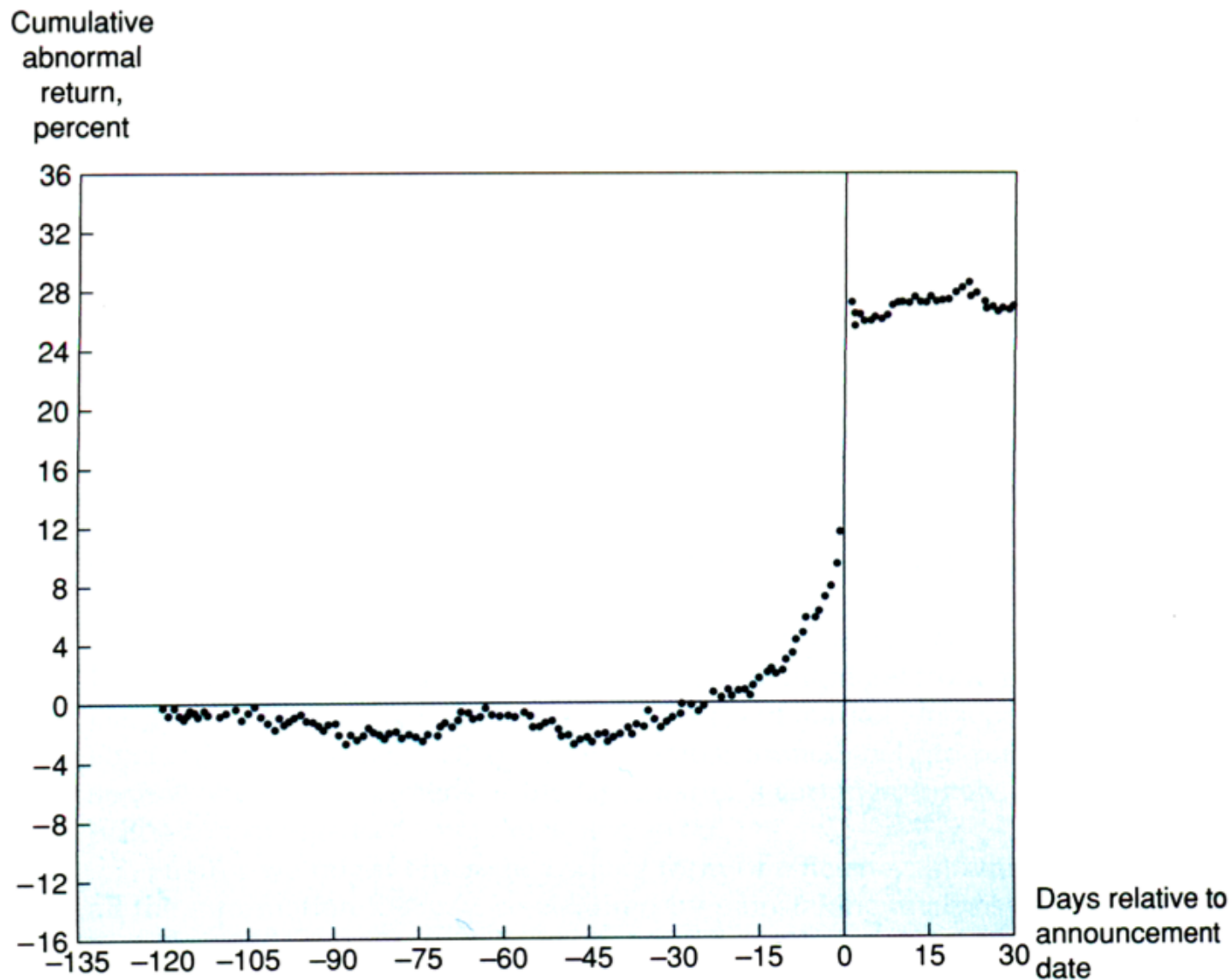
Pre-announcement drift can be due
to selection bias (only good firms
split) or insider trading.

! inconclusive

No post-announcement drift

! for weak form

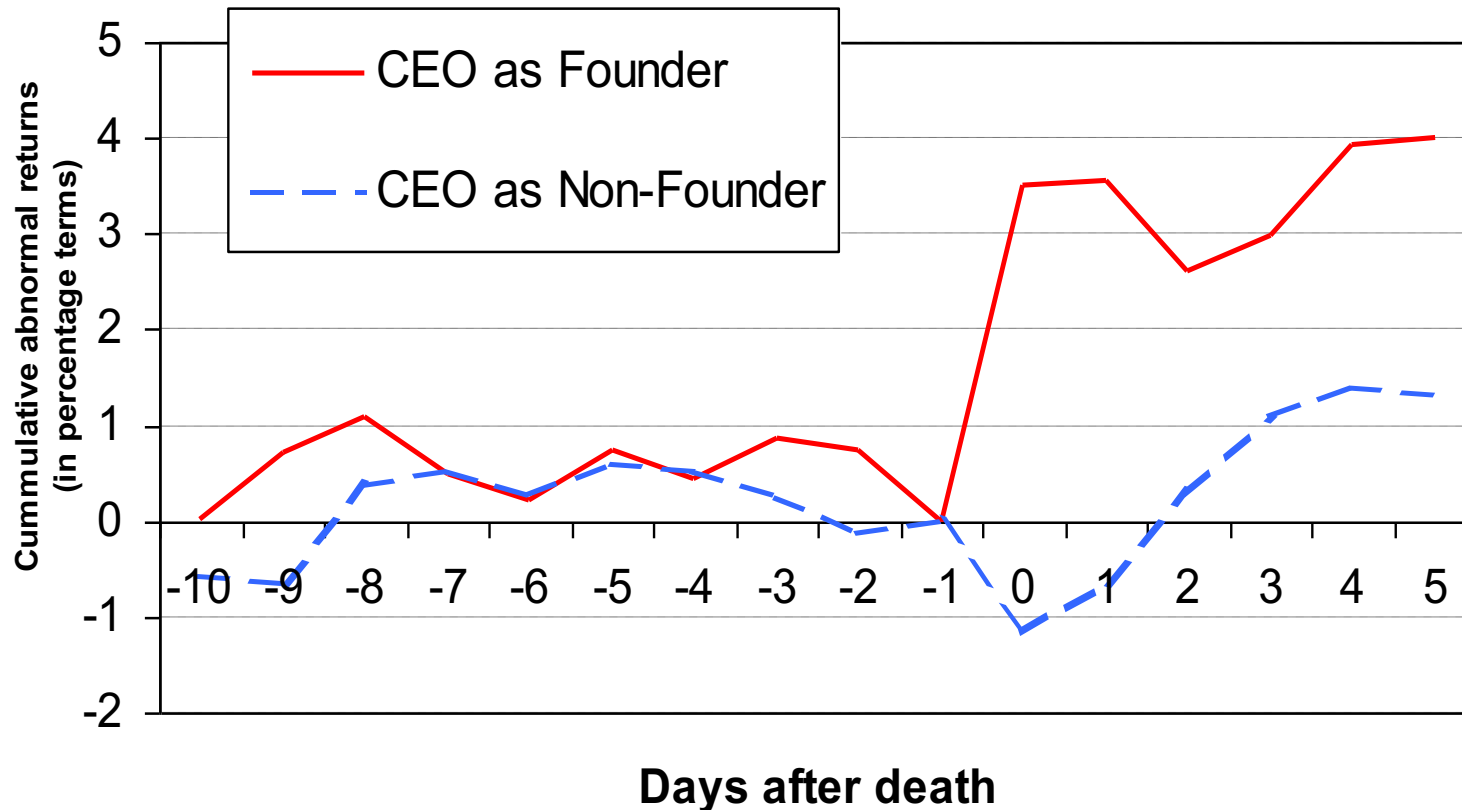
Event Study: Take-over



Event Study: Death of CEO

Stock Price and CEO Death

Source: Johnson et al.

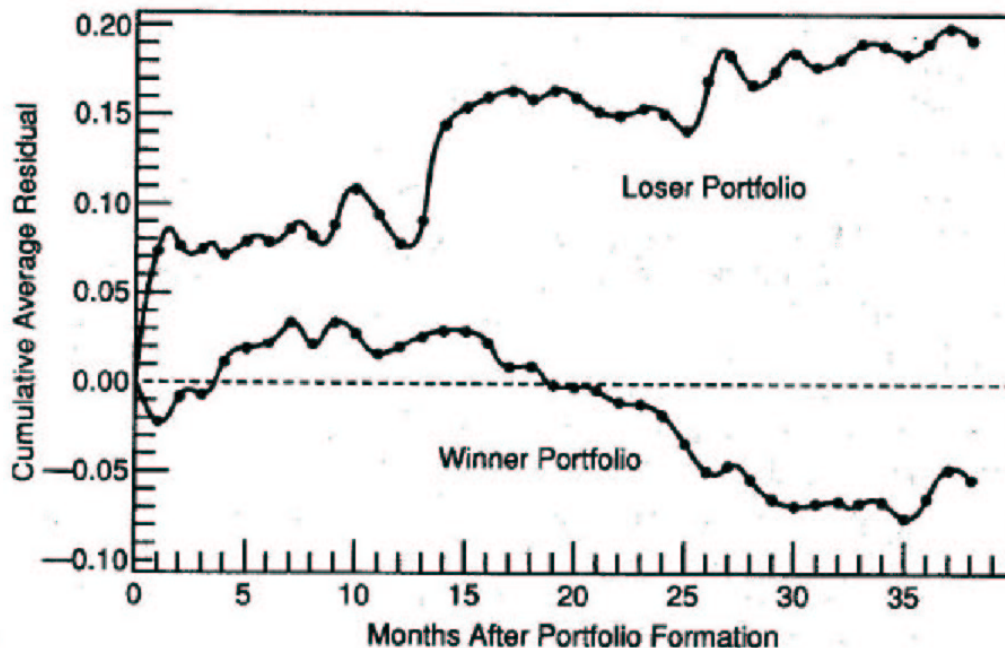


Evidence I: Predictabilities Studies

- 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 Monday effect, January effect etc.
- CAVEAT: Data mining: Find variables with spurious forecasting power if we search enough

Long-Run Reversals

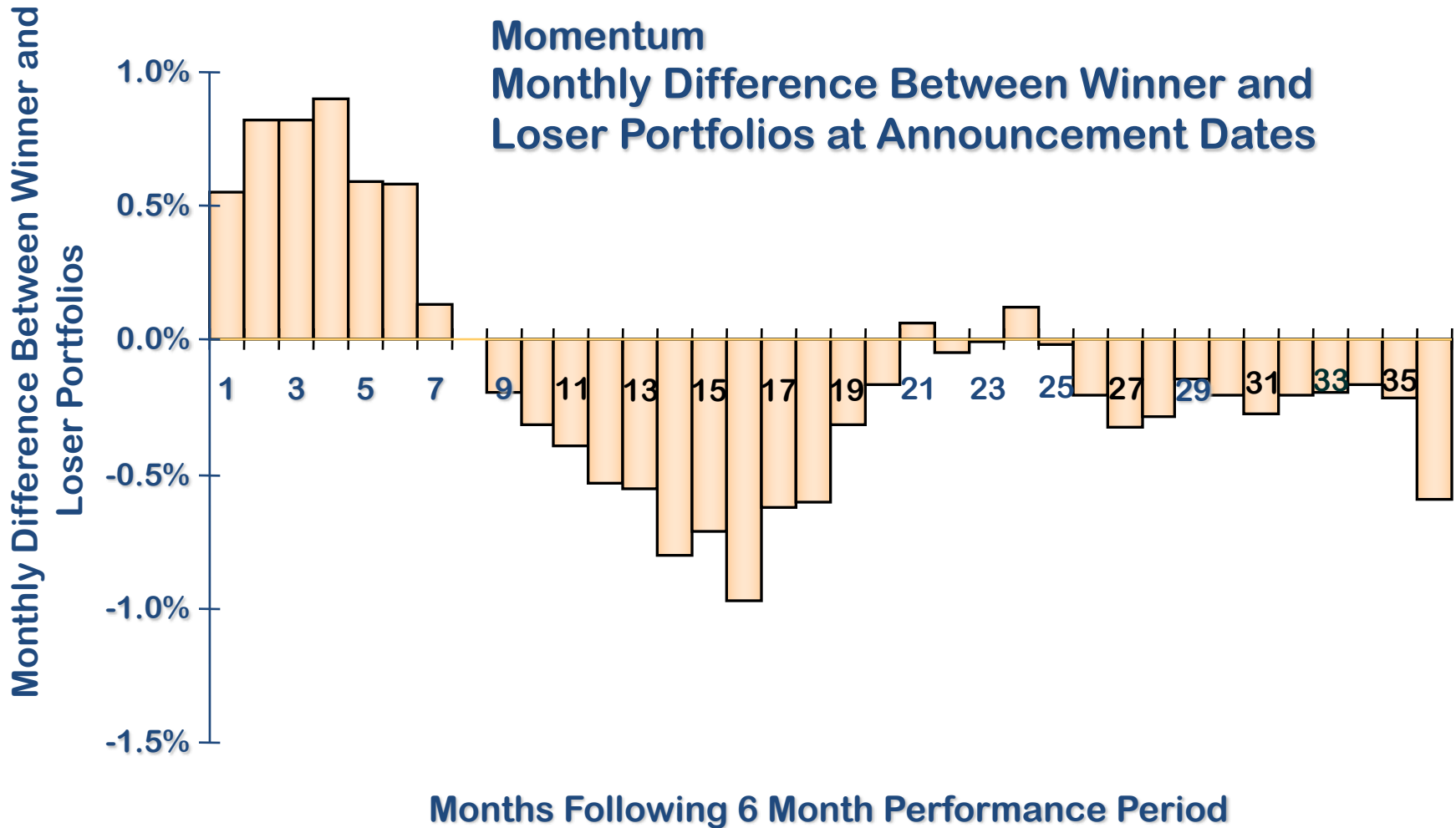
Figure 1 Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1–36 months into the test period)



Long-run
Reversals

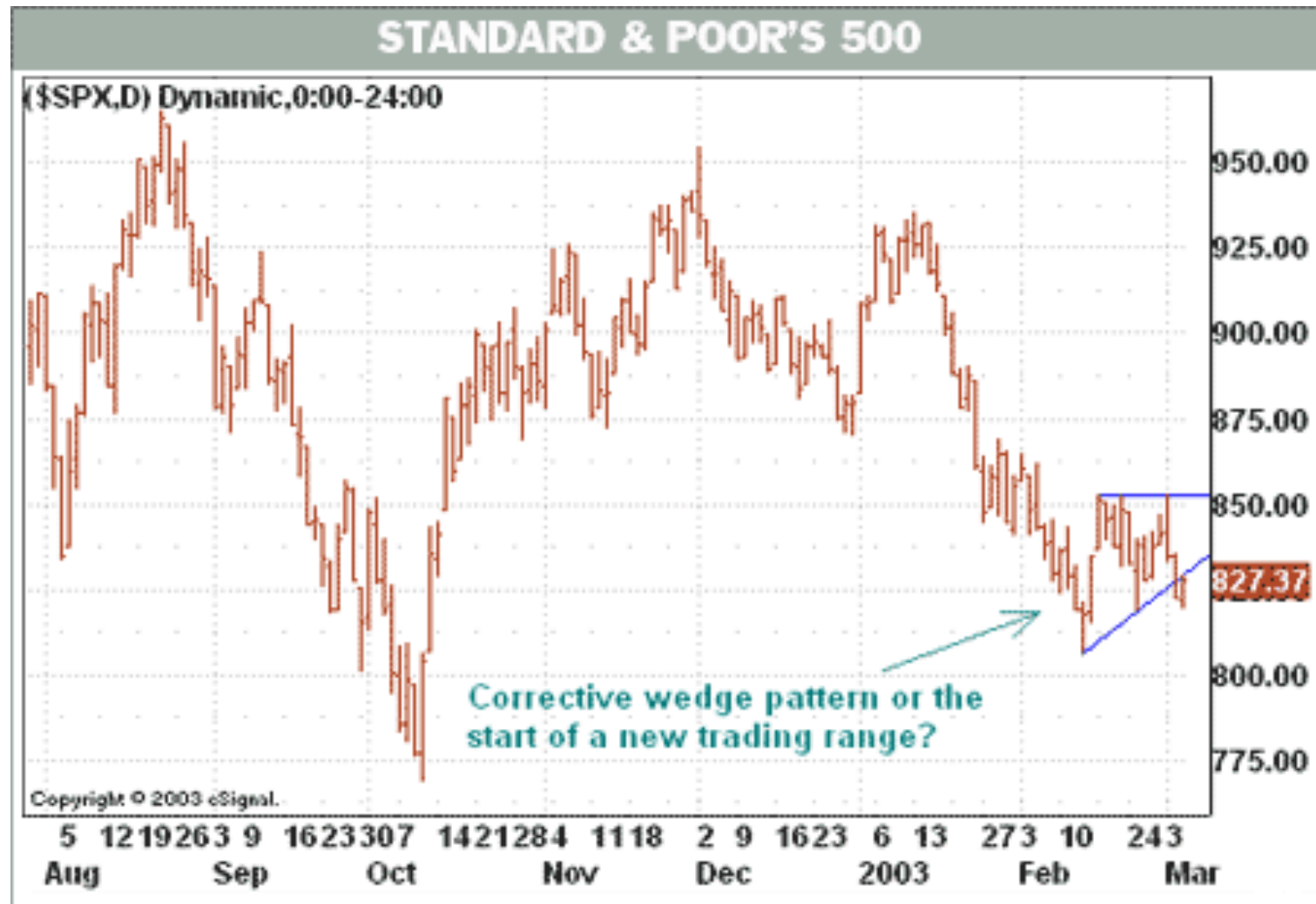
Returns to
previous 5 year's
winner-loser
stocks
(market adjusted
returns)

Short-run Momentum



Getting Technical

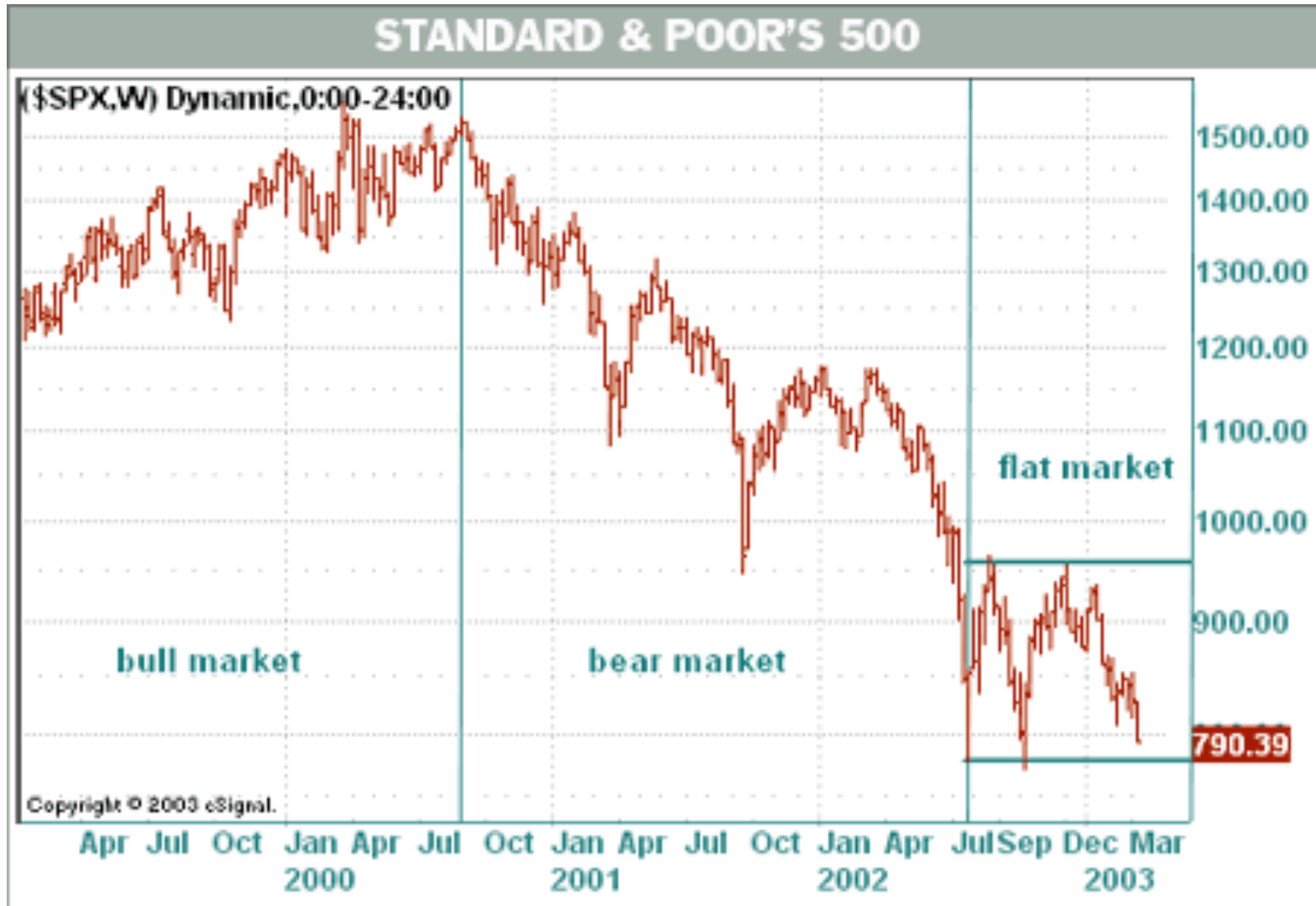
Barron's March 5, 2003



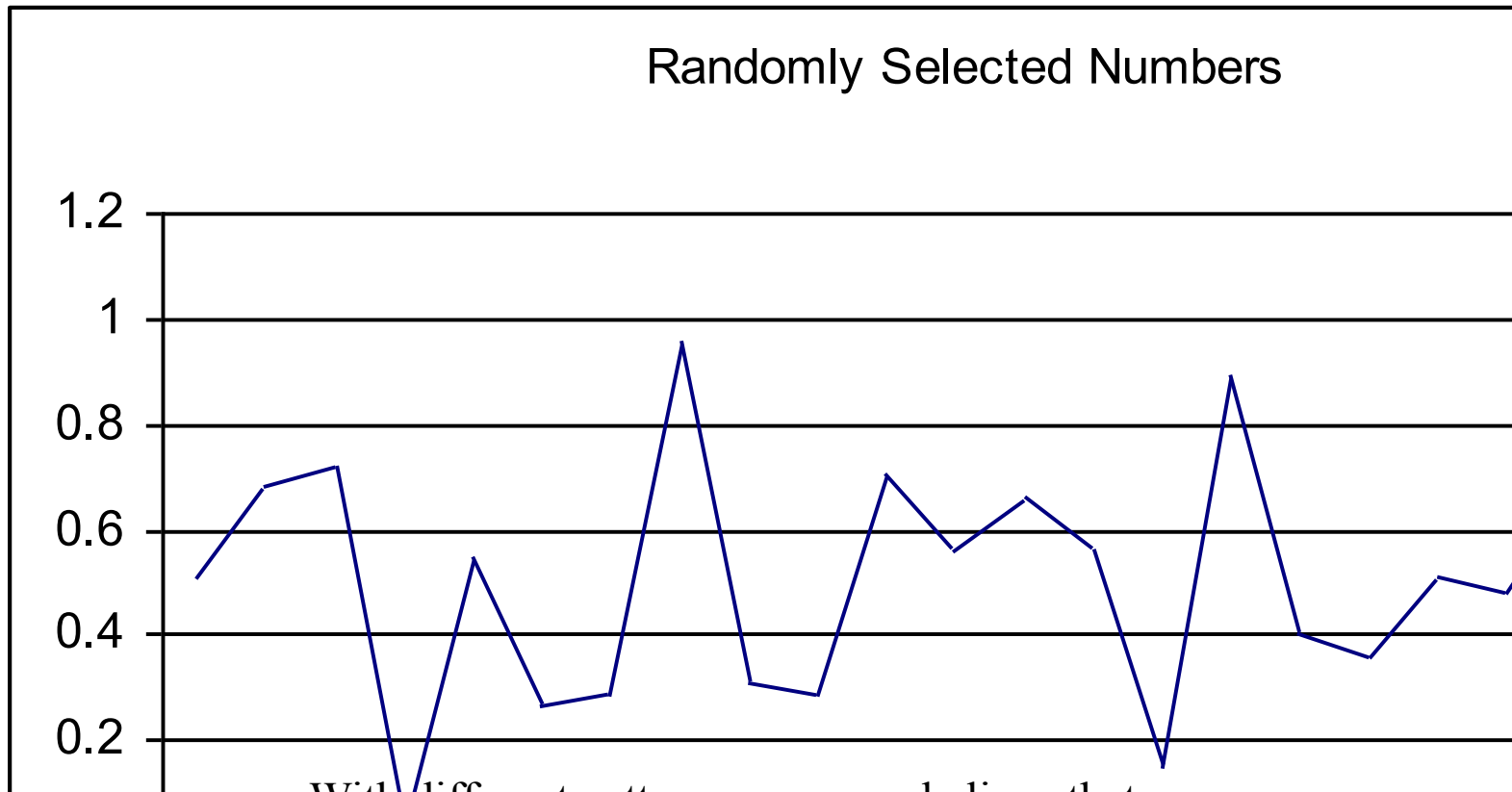
Getting Technical

Back to Buy Low, Sell High

Barron's March 12, 2003

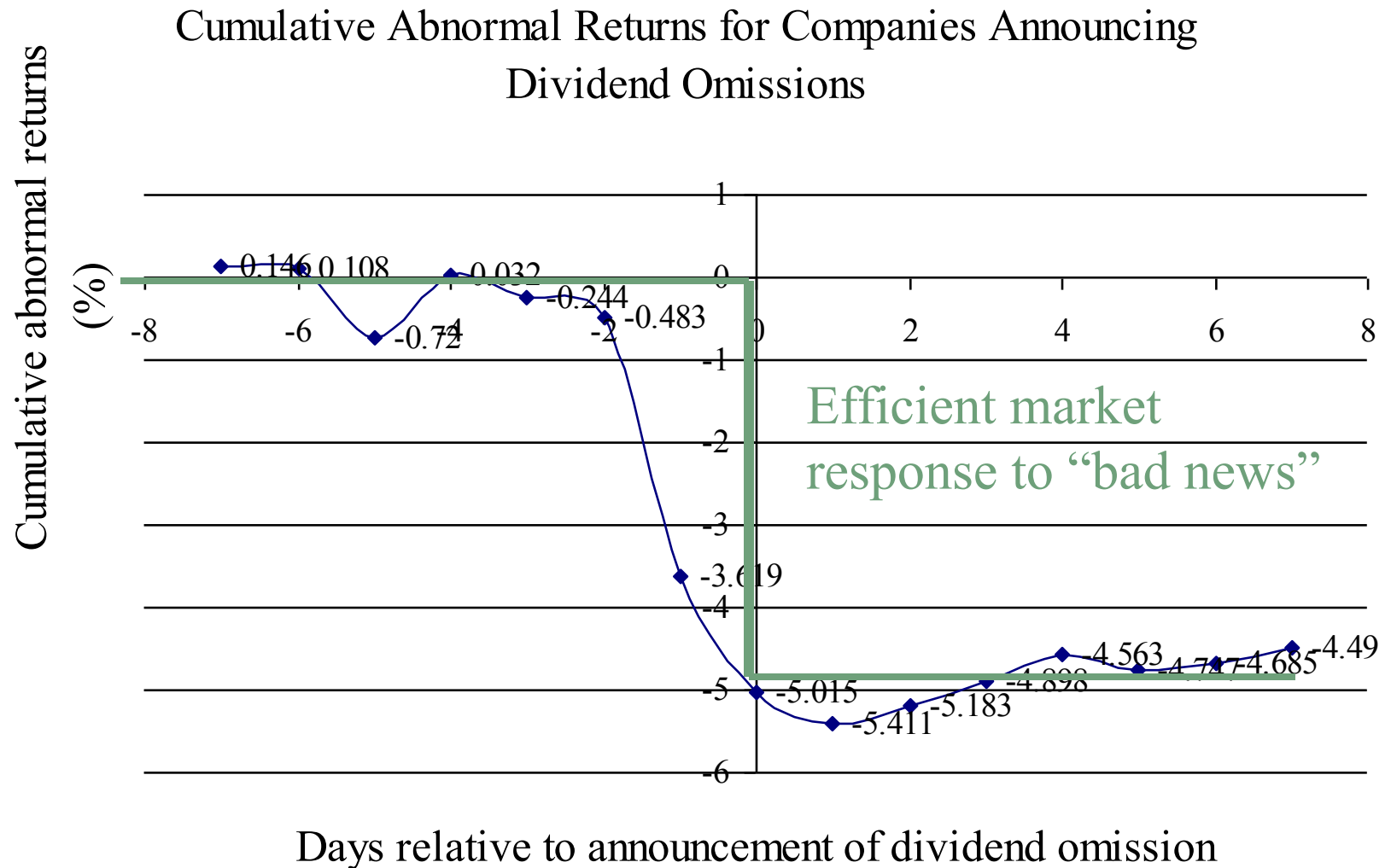


What Pattern Do You See?



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

Event Studies: Dividend Omissions

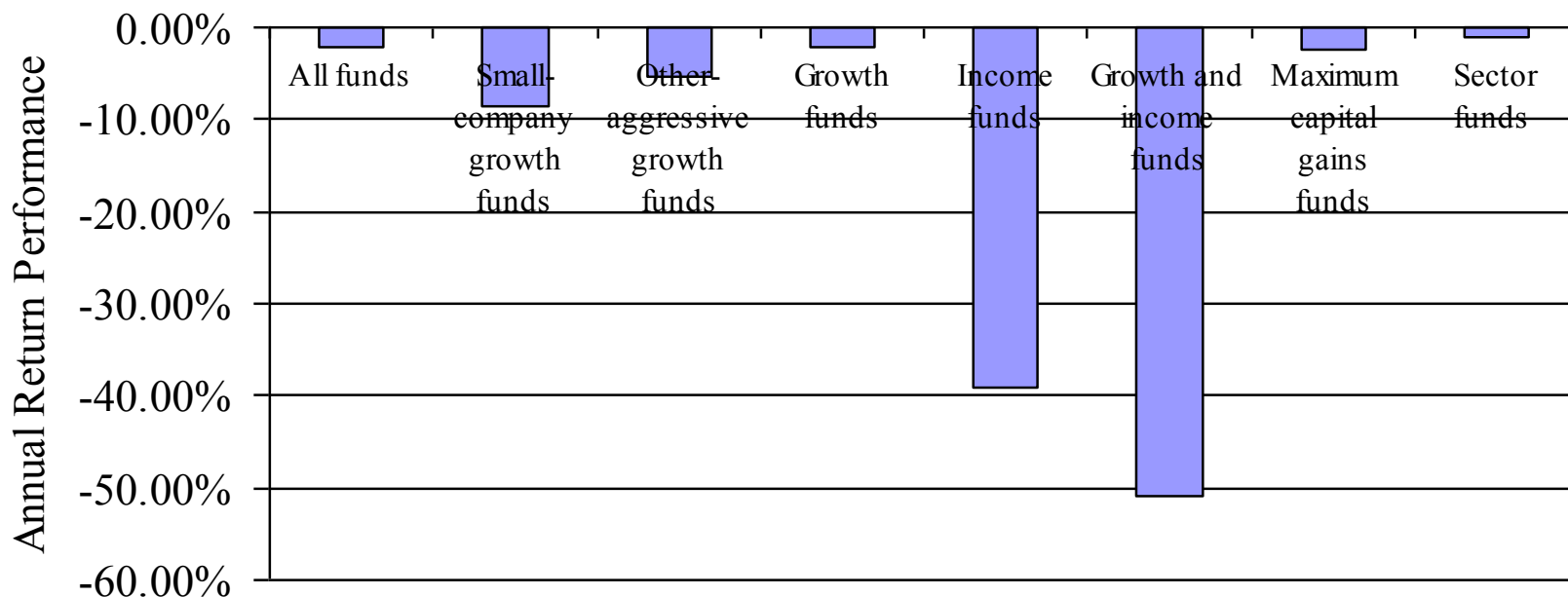


S.H. Szewczyk, G.P. Tsetsekos, and Z. Santout “Do Dividend Omissions Signal Future Earnings or Past Earnings?” *Journal of Investing* (Spring 1997)

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

The Record of Mutual Funds

Annual Return Performance of Different Types of U.S. Mutual Funds Relative to a Broad-Based Market Index (1963-1998)



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).

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
- $P_t = P_{t-1} + \text{Expected return} + \text{random error } t$
- Since stock prices only respond to new information, which by definition arrives randomly, stock prices are said to follow a **random walk**.

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.

Efficient Markets

Inefficient Markets

Behavioral Finance

References

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