

# 人工智慧投資分析



Tamkang  
Universit

淡江大學

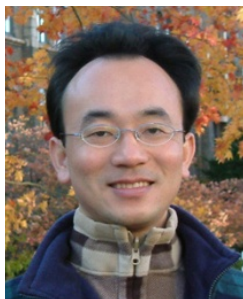
Artificial Intelligence for Investment Analysis

## 財務金融事件研究法 (Event Studies in Finance)

1071AIIA05

EMBA, IMTKU (M2399) (8540)

Thu 12,13,14 (19:20-22:10) (D503)



Min-Yuh Day

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2018-10-11



# 課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2018/09/13	人工智慧投資分析課程介紹 (Course Orientation on Artificial Intelligence for Investment Analysis)
2	2018/09/20	AI 金融科技: 金融服務創新應用 (AI in FinTech: Financial Services Innovation and Application)
3	2018/09/27	機器人理財顧問與AI交談機器人 (Robo-Advisors and AI Chatbots)
4	2018/10/04	投資心理學與行為財務學 (Investing Psychology and Behavioral Finance)
5	2018/10/11	財務金融事件研究法 (Event Studies in Finance)
6	2018/10/18	人工智慧投資分析個案研究 I (Case Study on Artificial Intelligence for Investment Analysis I)

# 課程大綱 (Syllabus)

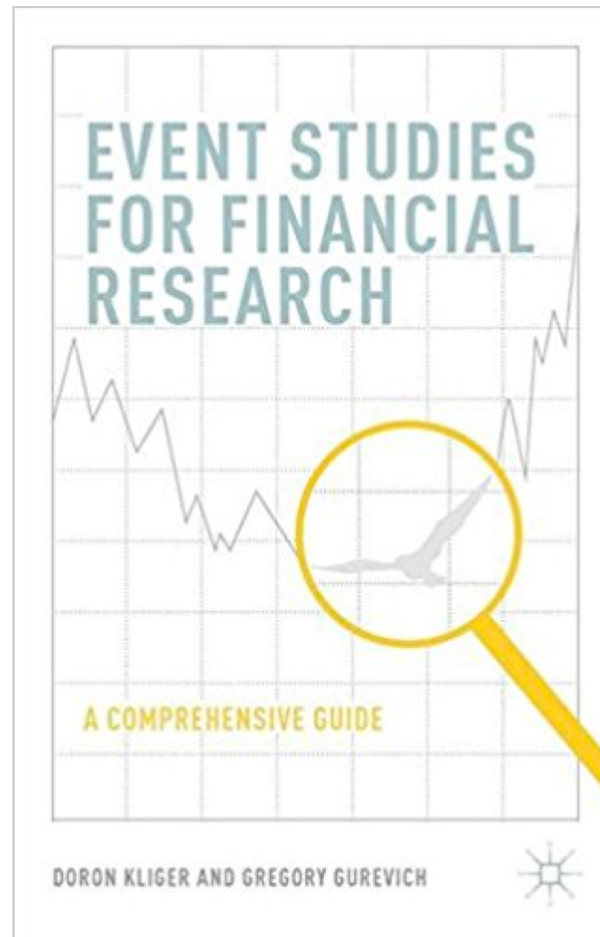
週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2018/10/25	Python AI投資分析基礎 (Foundations of AI Investment Analysis in Python)
8	2018/11/01	Python Pandas 量化投資分析 (Quantitative Investing with Pandas in Python)
9	2018/11/08	Python Scikit-Learn 機器學習 (Machine Learning with Scikit-Learn In Python)
10	2018/11/15	期中報告 (Midterm Project Report)
11	2018/11/22	TensorFlow 深度學習財務時間序列預測 I (Deep Learning for Financial Time Series Forecasting with TensorFlow I)
12	2018/11/29	TensorFlow 深度學習財務時間序列預測 II (Deep Learning for Financial Time Series Forecasting with TensorFlow II)

# 課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2018/12/06	人工智慧投資分析個案研究 II (Case Study on Artificial Intelligence for Investment Analysis II)
14	2018/12/13	TensorFlow 深度學習財務時間序列預測 III (Deep Learning for Financial Time Series Forecasting with TensorFlow III)
15	2018/12/20	投資組合最佳化與程式交易 (Portfolio Optimization and Algorithmic Trading)
16	2018/12/27	自然語言處理 (Natural Language Processing)
17	2019/01/03	期末報告 I (Final Project Presentation I)
18	2019/01/10	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**



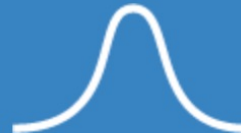
state-of-the-art  
**event study software**

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**

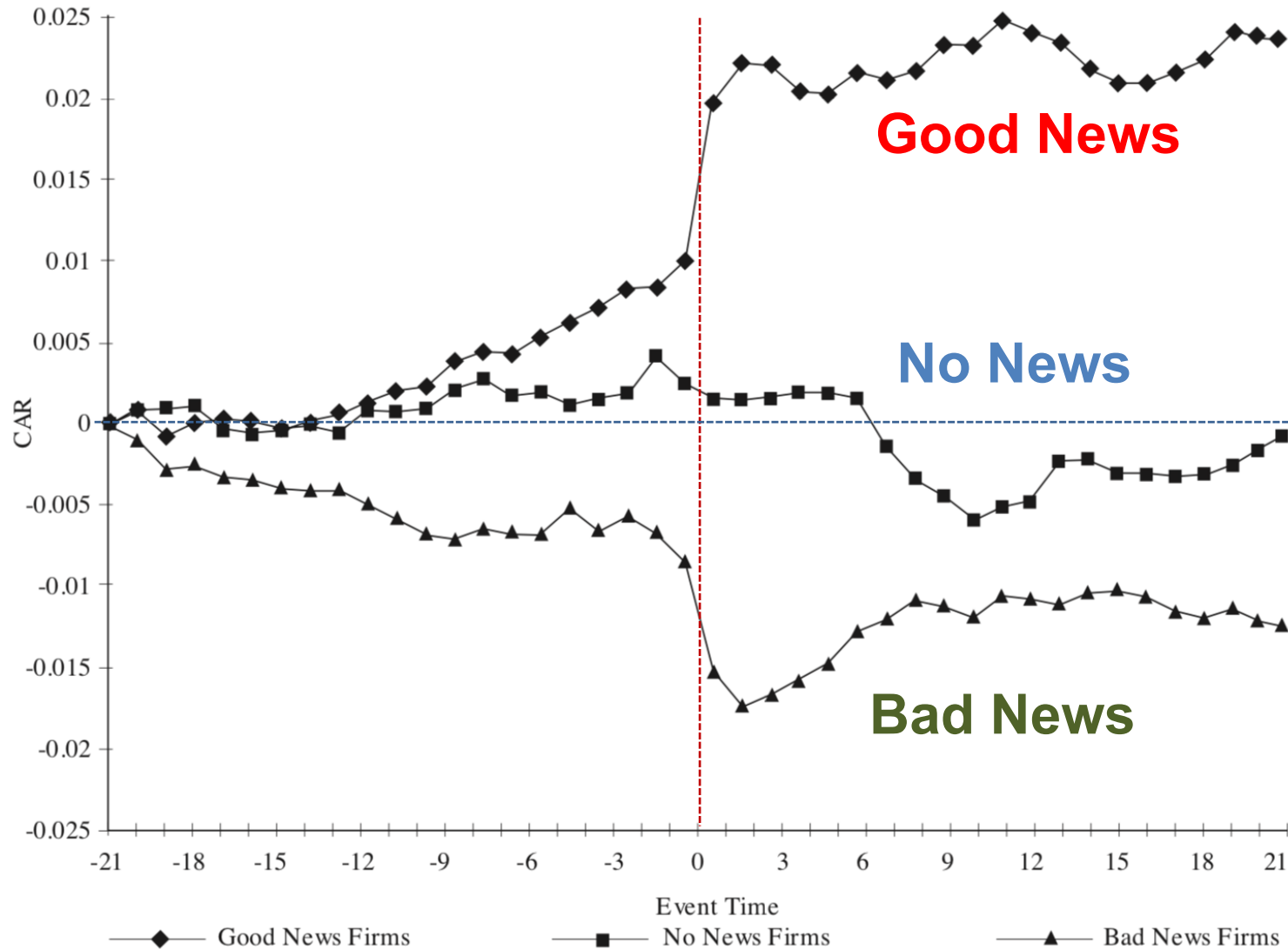
Time-Series t-Test  
Cross-Sectional t-Test  
Standardized Residual Test  
Standardized Cross-Sectional Test  
Corrado Rank Test  
Generalized Sign Test  
Skewness-Adjusted t-Test



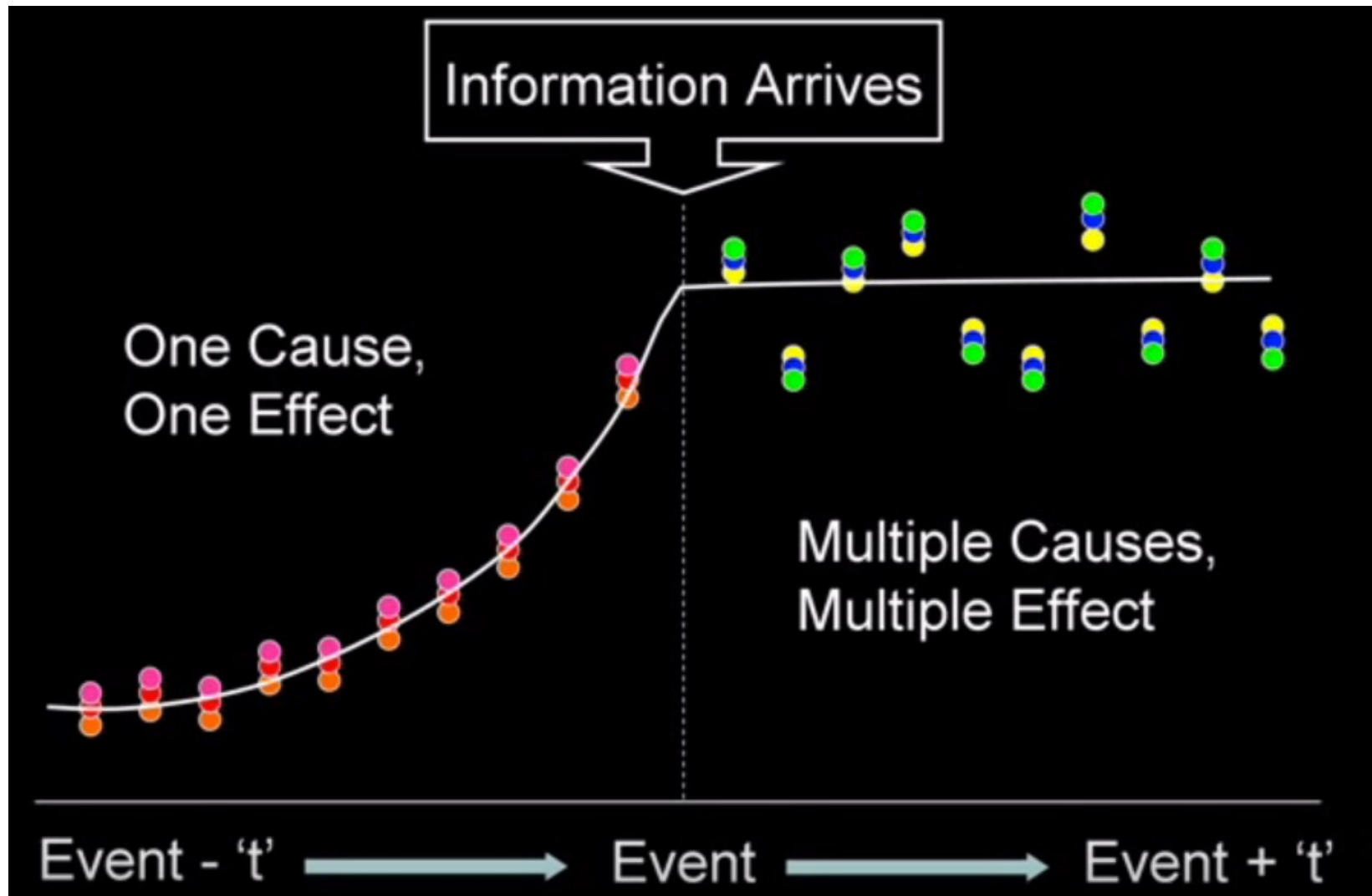
### **Return Models**

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

# Event Studies in Economics and Finance



# Event Study

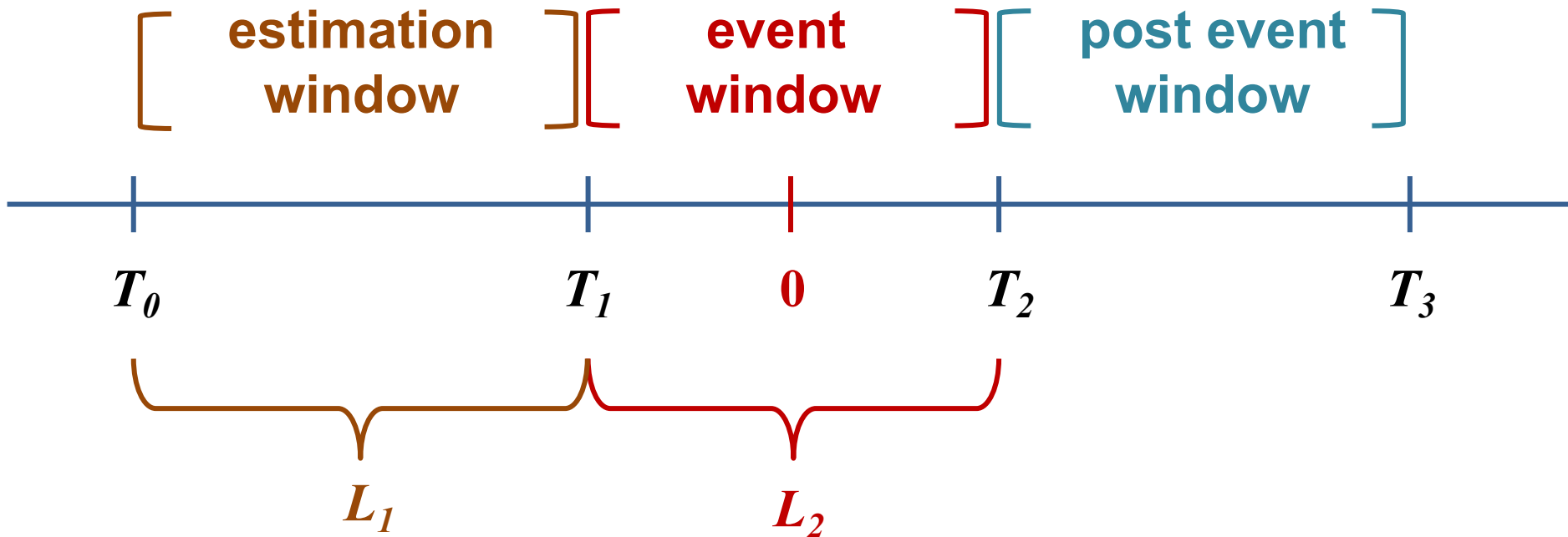


# Event Study

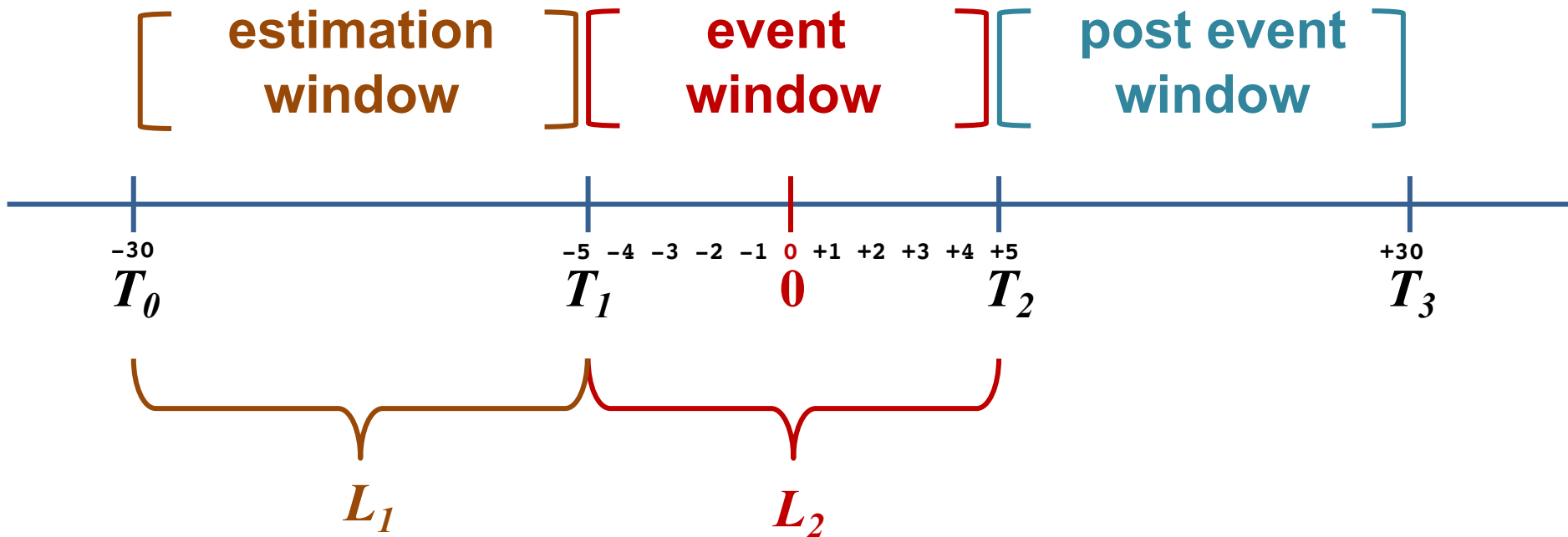
## Time line for an event study



# Event Study Methodology



# Event Study Methodology



# Efficient Markets

# Behavioral Economics



# Behavioral Finance

# 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.

# Efficient Market Hypothesis (EMH) (Fama, 1970)

SESSION TOPIC: STOCK MARKET PRICE BEHAVIOR

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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."

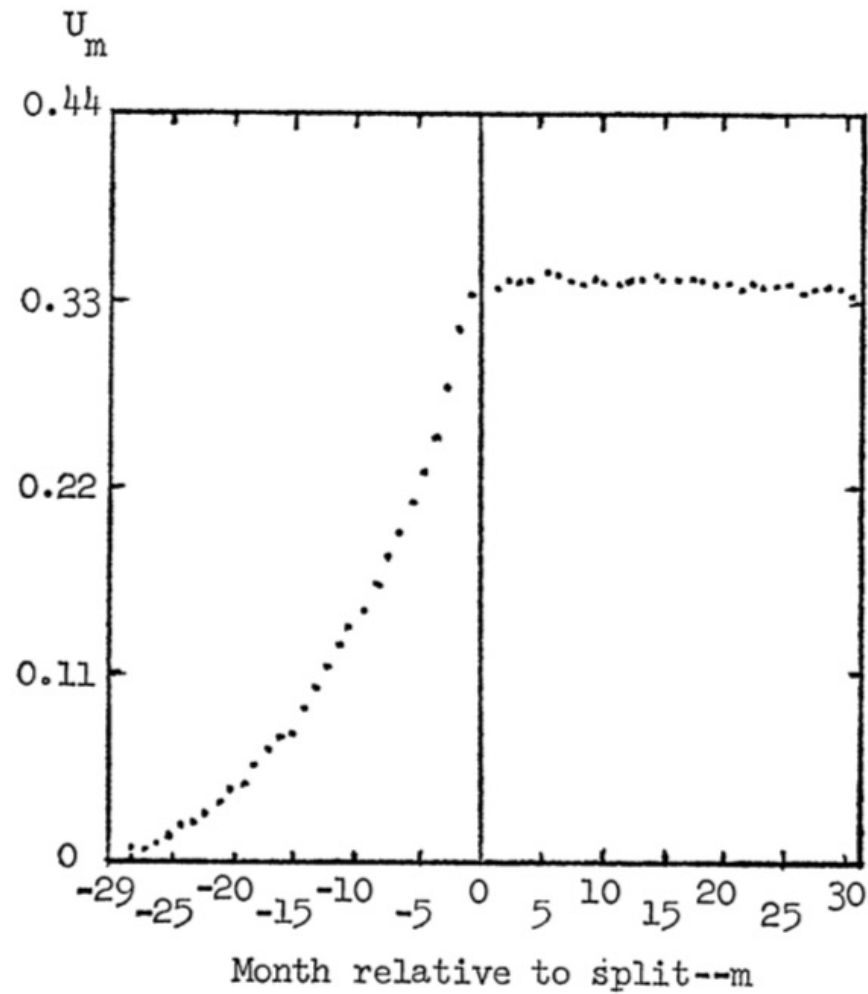
This paper reviews the theoretical and empirical literature on the efficient markets model. After a discussion of the theory, empirical work concerned with the adjustment of security prices to three relevant information subsets is considered. First, *weak form* tests, in which the information set is 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.<sup>1</sup> 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  $\text{Log}_e$  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

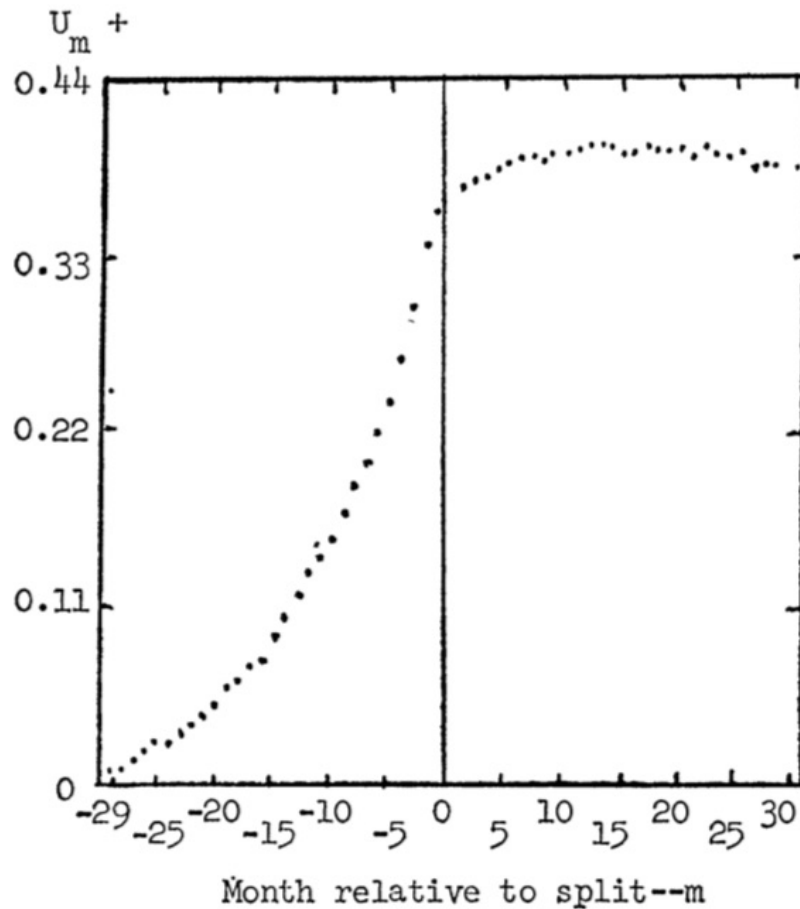
\* Coefficient is twice its computed standard error.

# Cumulative Average Residuals

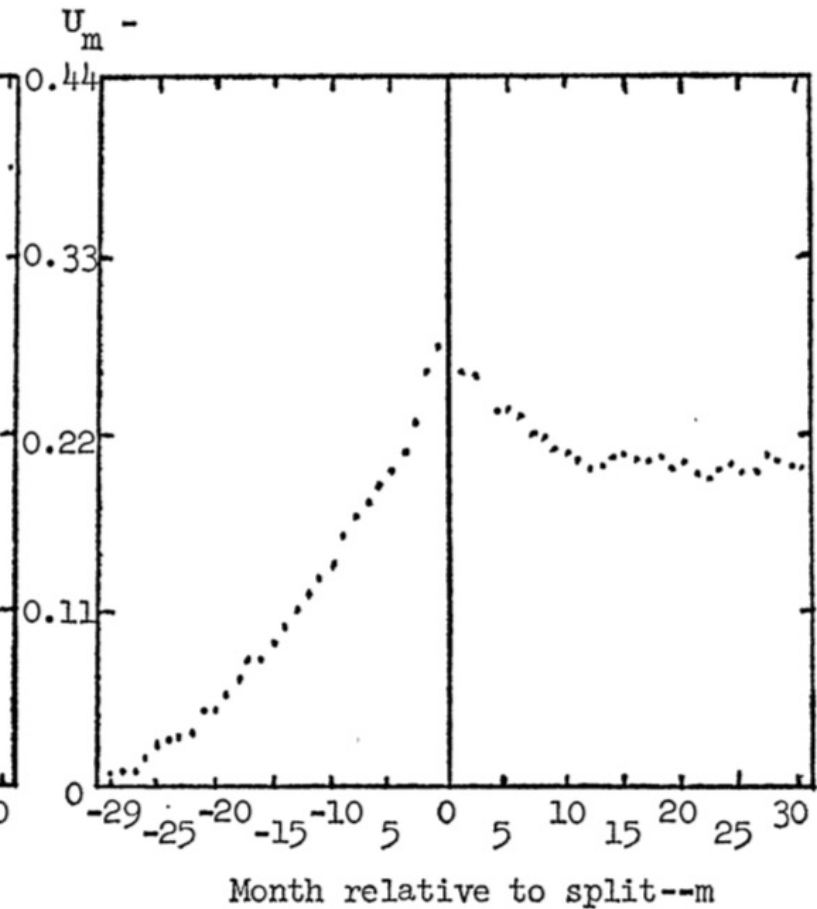


**FIGURE 1a**  
Cumulative average residuals—all splits.

# 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.

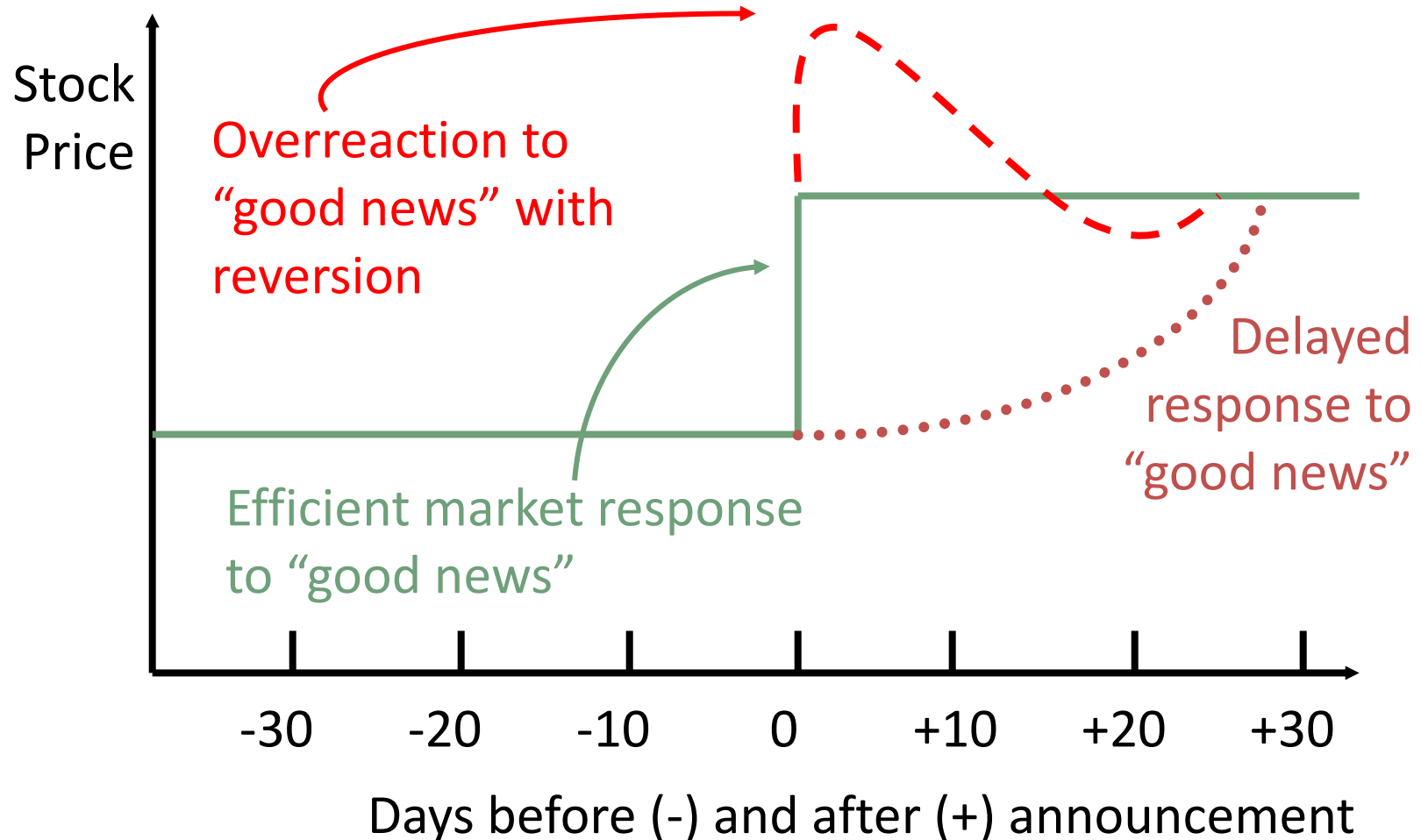
# How to Create Value through Financing

- 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.

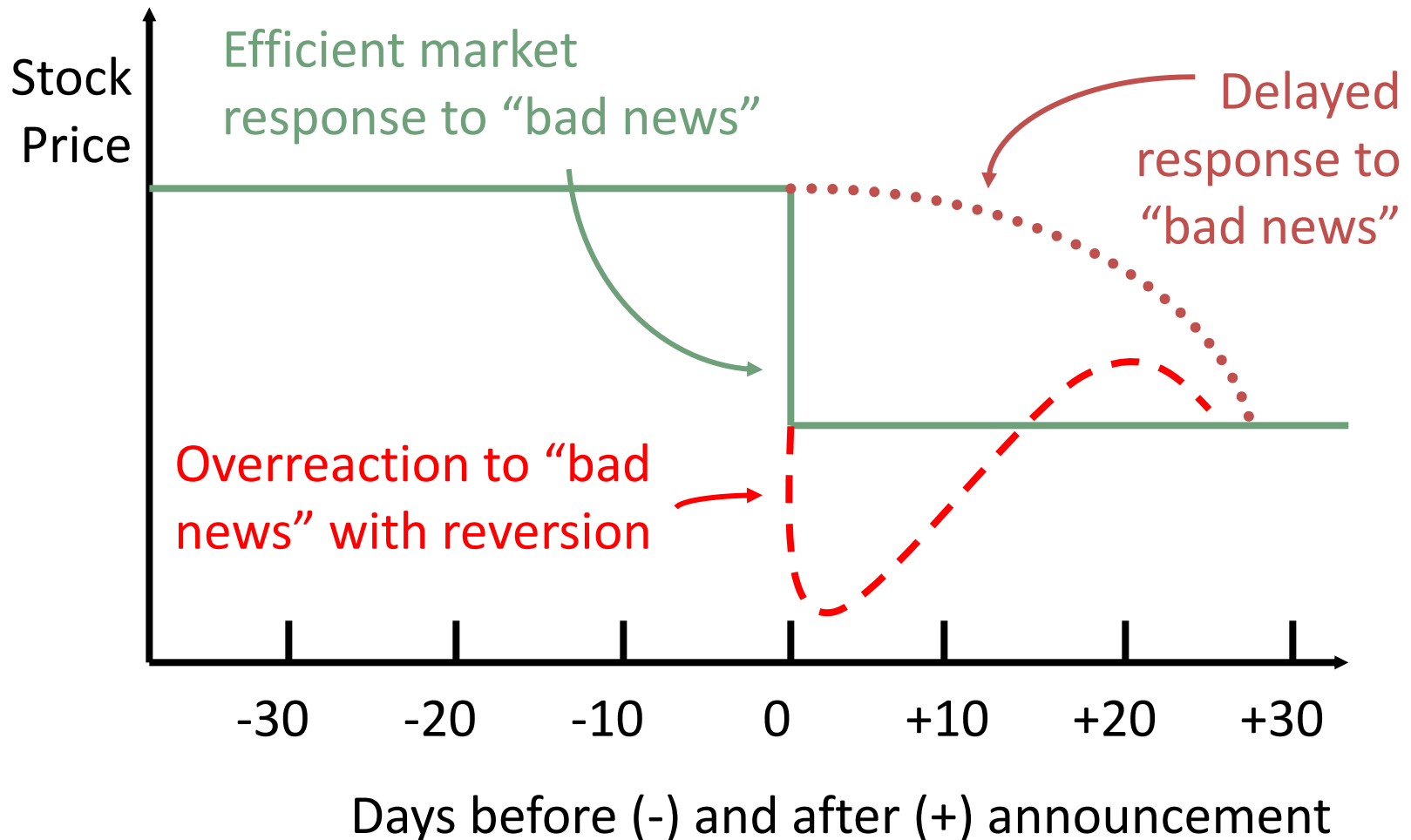
# Efficient Capital Markets

- 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



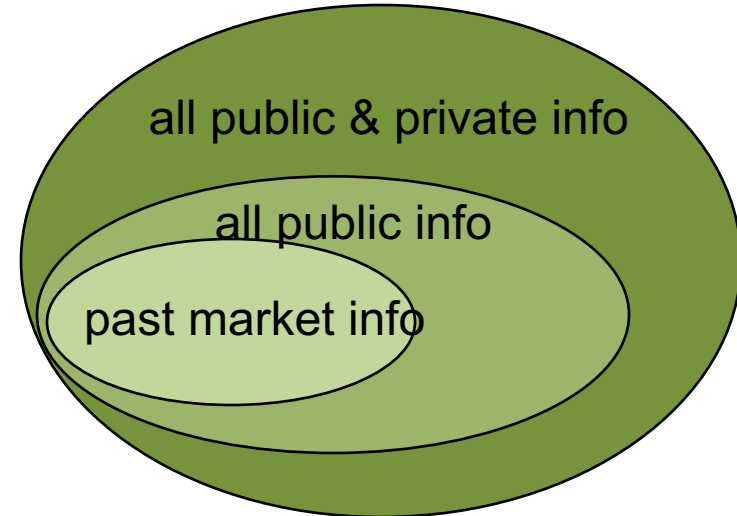
# Reaction of Stock Price to New Information in Efficient and Inefficient Markets



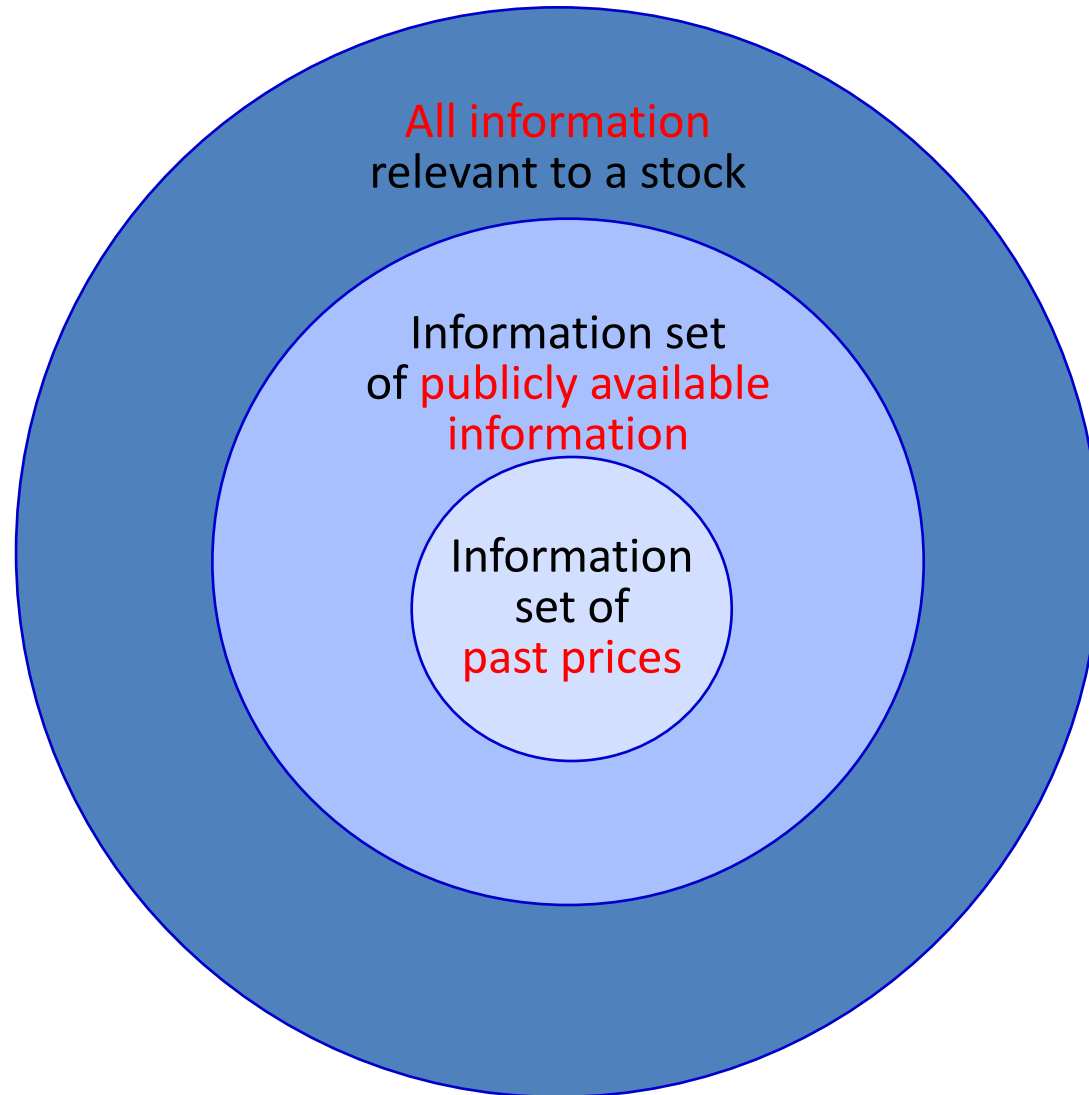


# Versions of EMH/Info-Efficiency

- **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

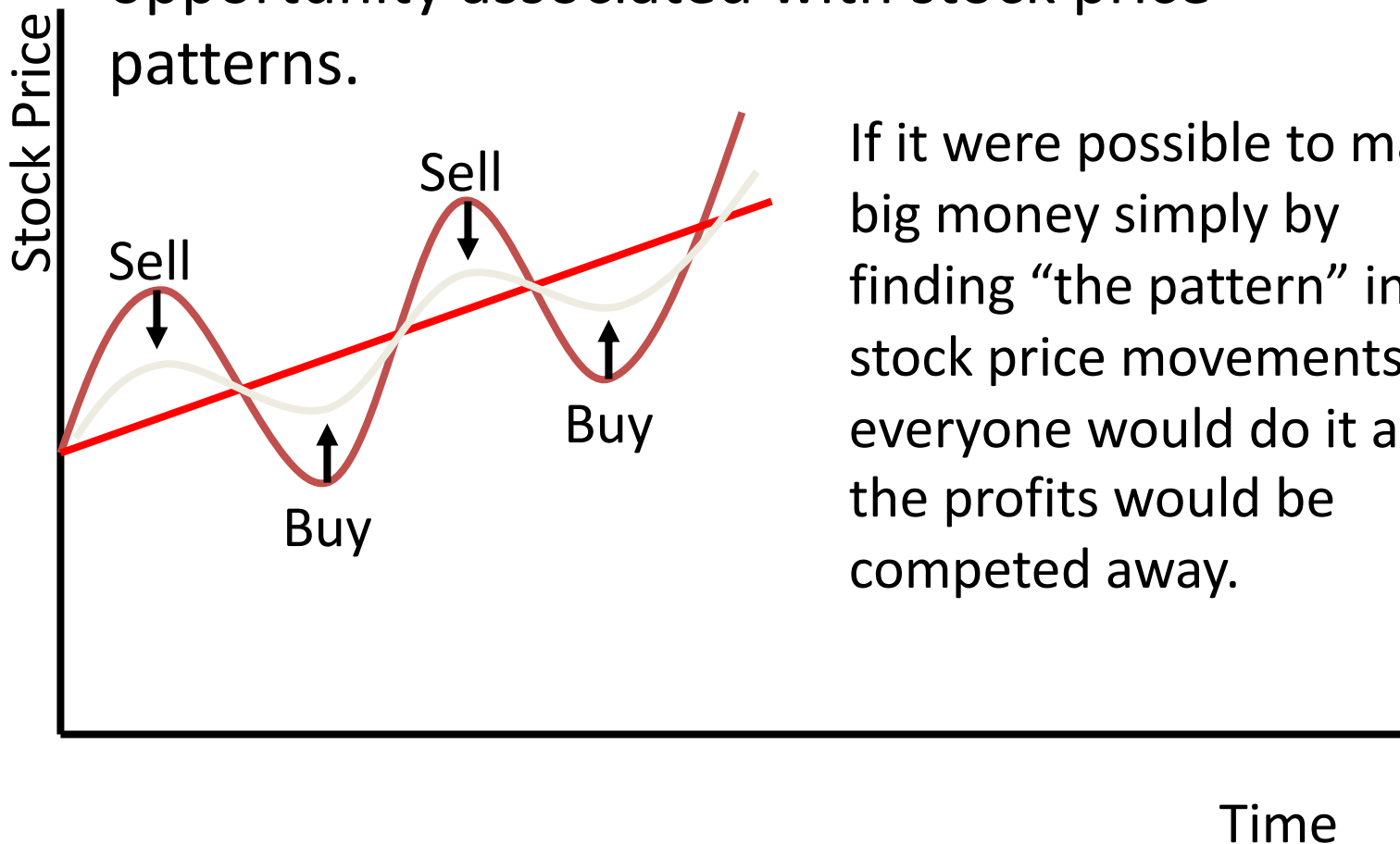


# Efficient Market

- 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.



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

1. Define as day “zero” the day the information is released
2. Calculate the daily returns  $R_{it}$  the 30 days around day “zero”:  
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3. Calculate the daily returns  $R_{mt}$  for the same days on the market  
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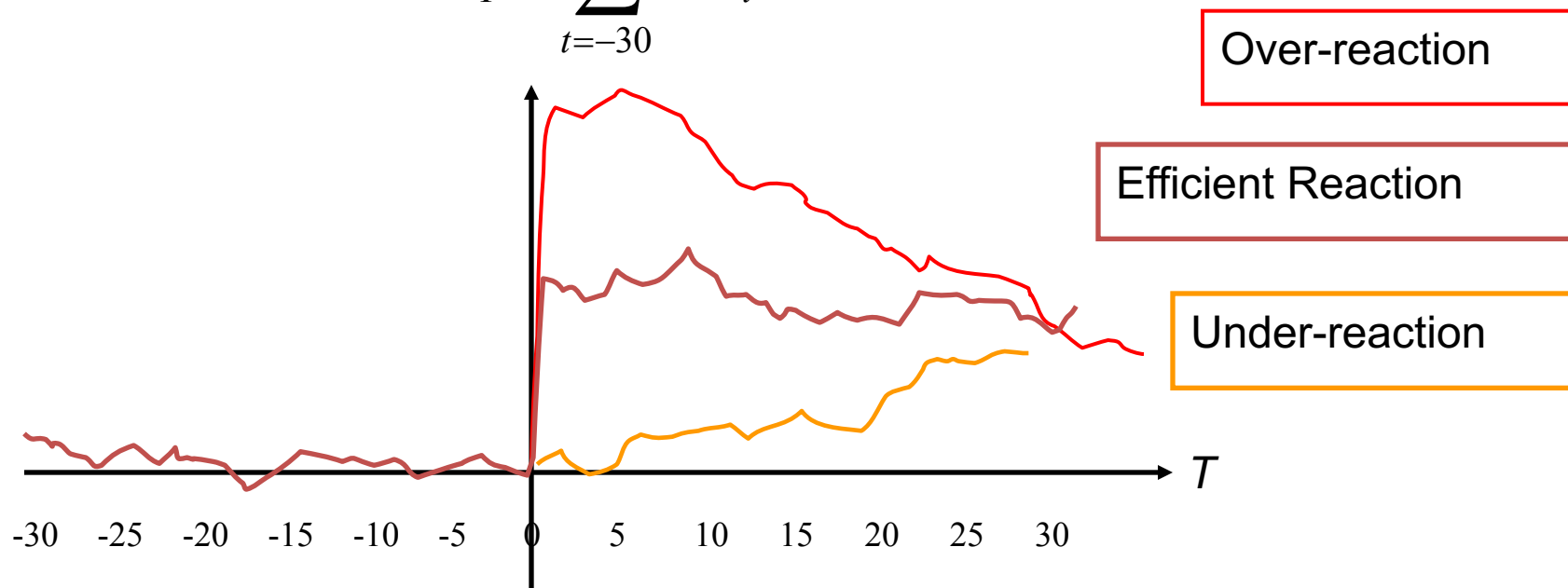
$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it}$$

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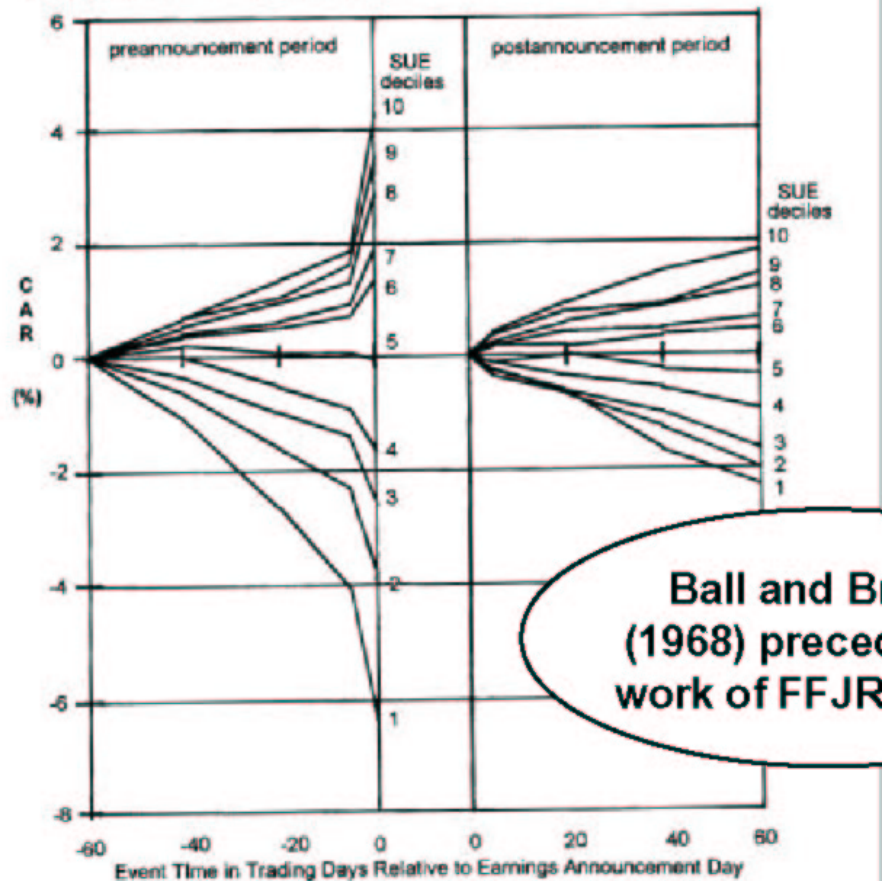
# Market Efficiency in Event Studies

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



# 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

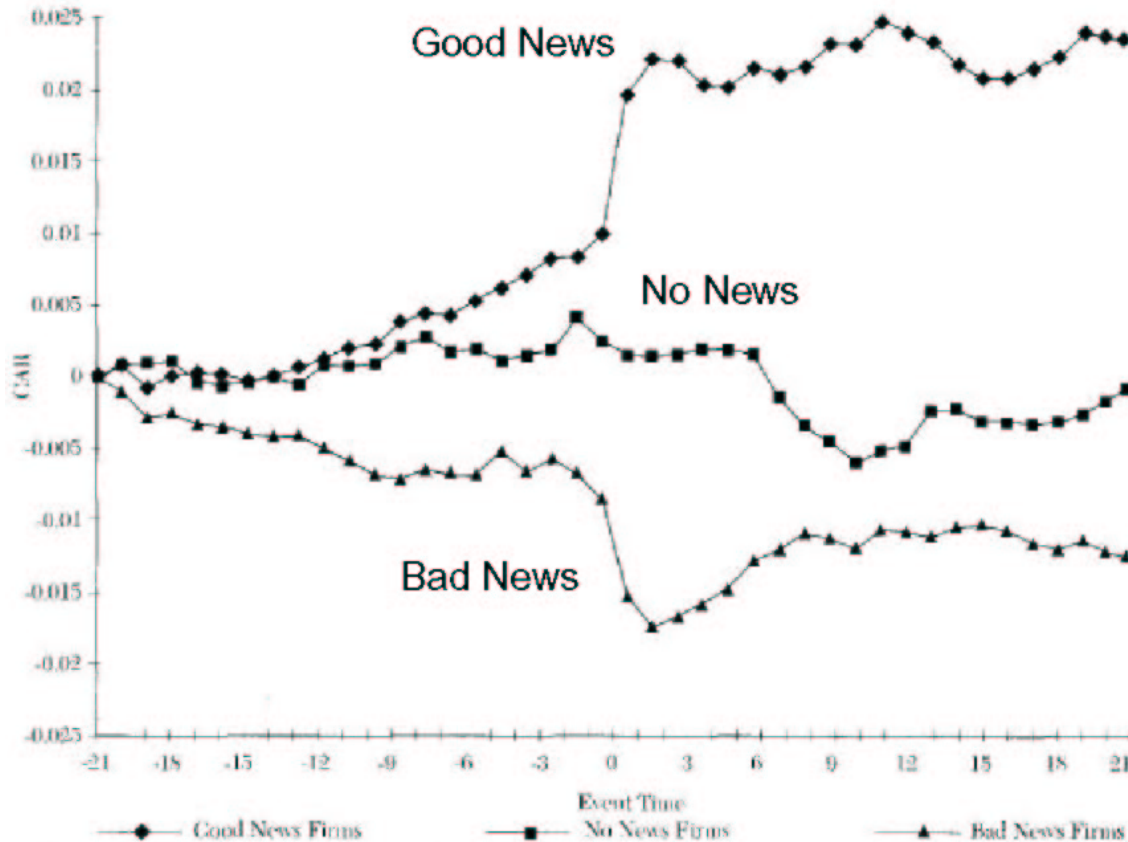
! against strong-form

Post-announcement drift

! against semi-strong form



# Event Study: Earning Announcement



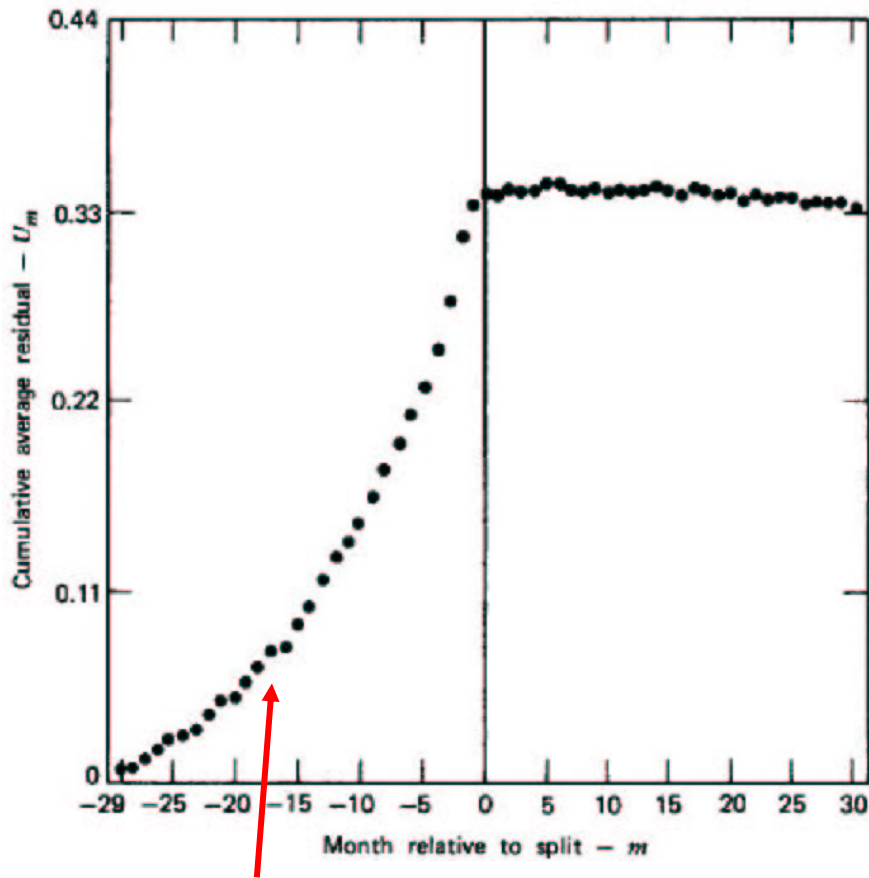
Cumulative abnormal returns around earning announcements

(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.

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.

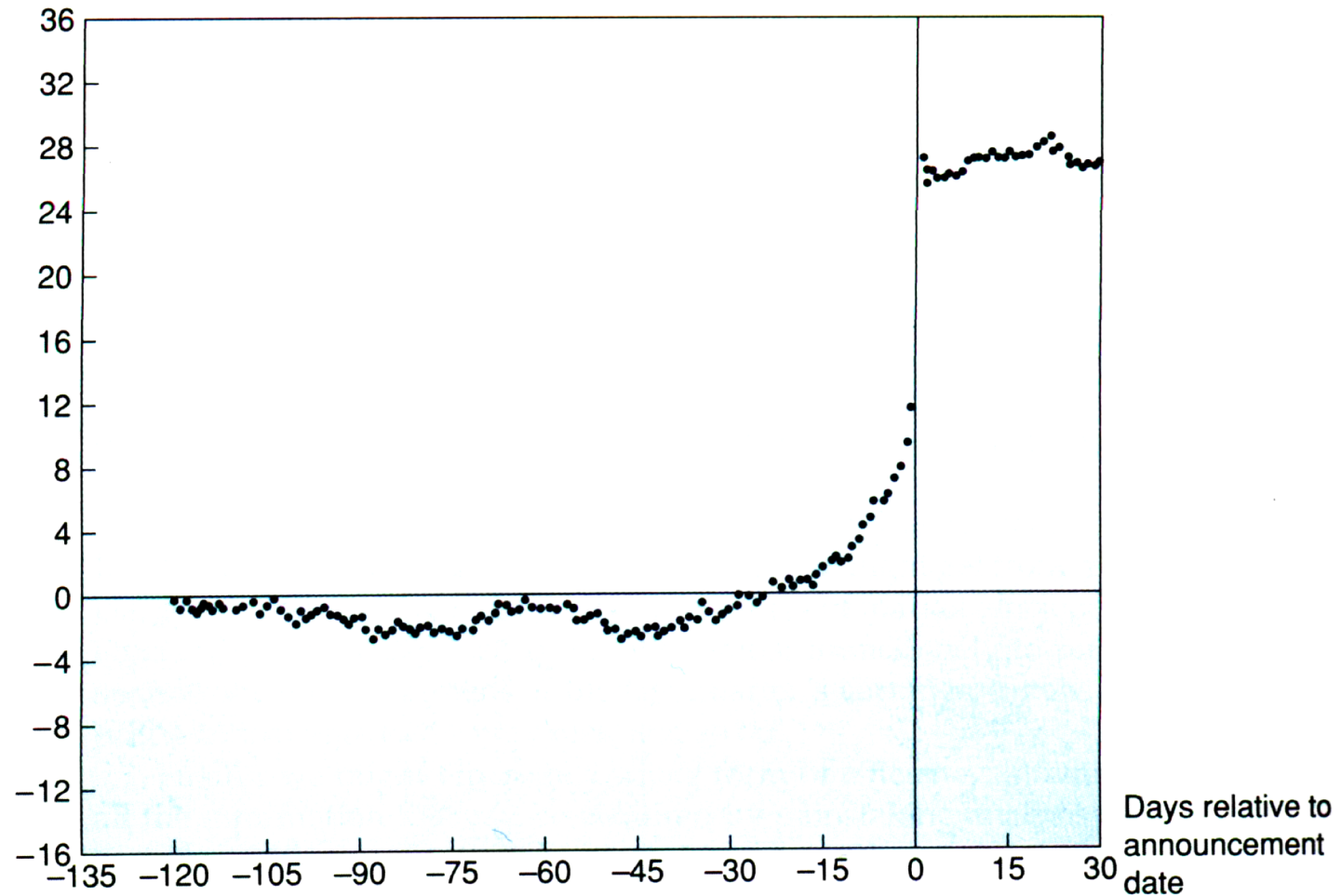
! inconclusive

No post-announcement drift

! for weak form

# Event Study: Take-over

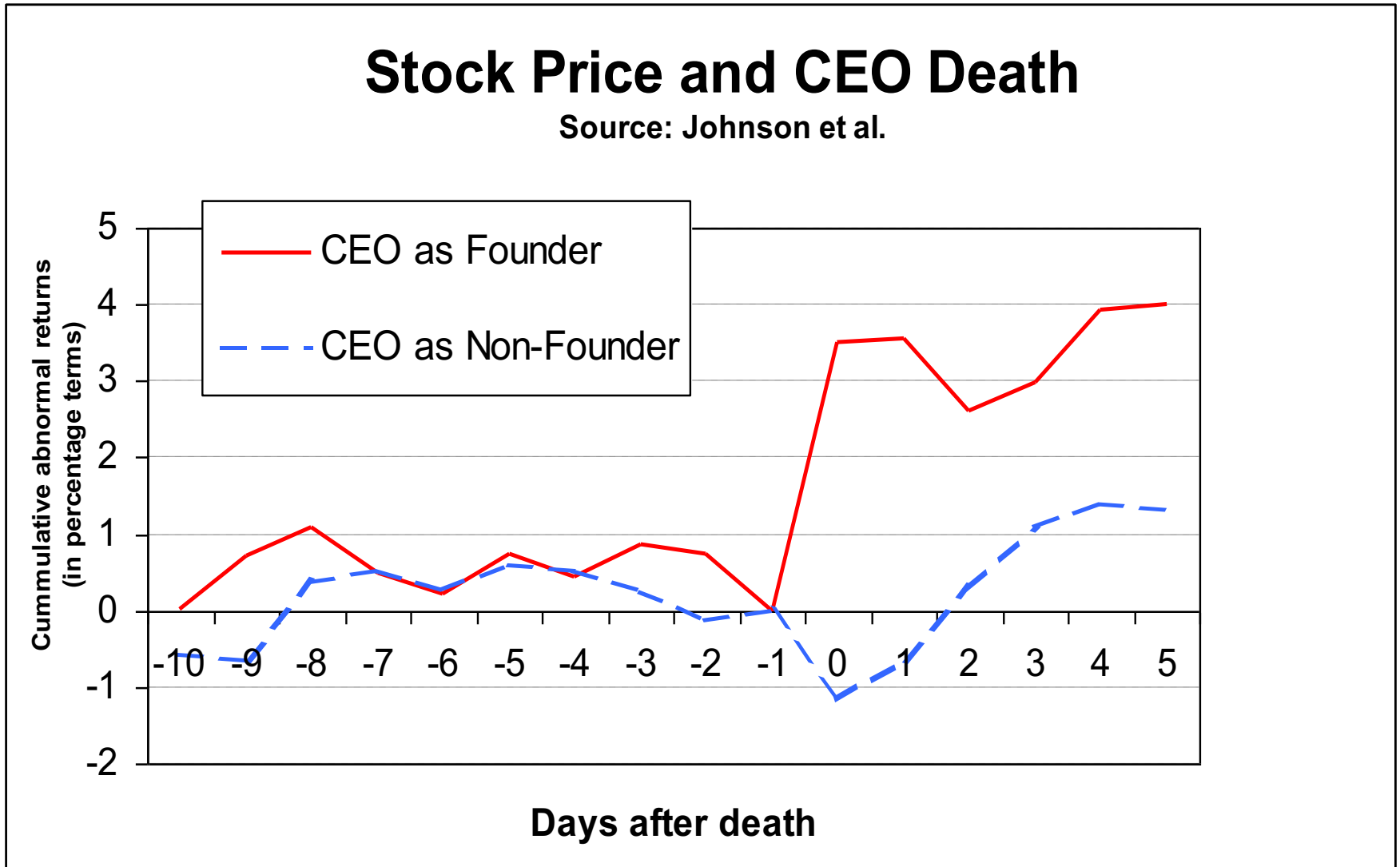
Cumulative  
abnormal  
return,  
percent



# Event Study: Death of CEO

## Stock Price and CEO Death

Source: Johnson et al.

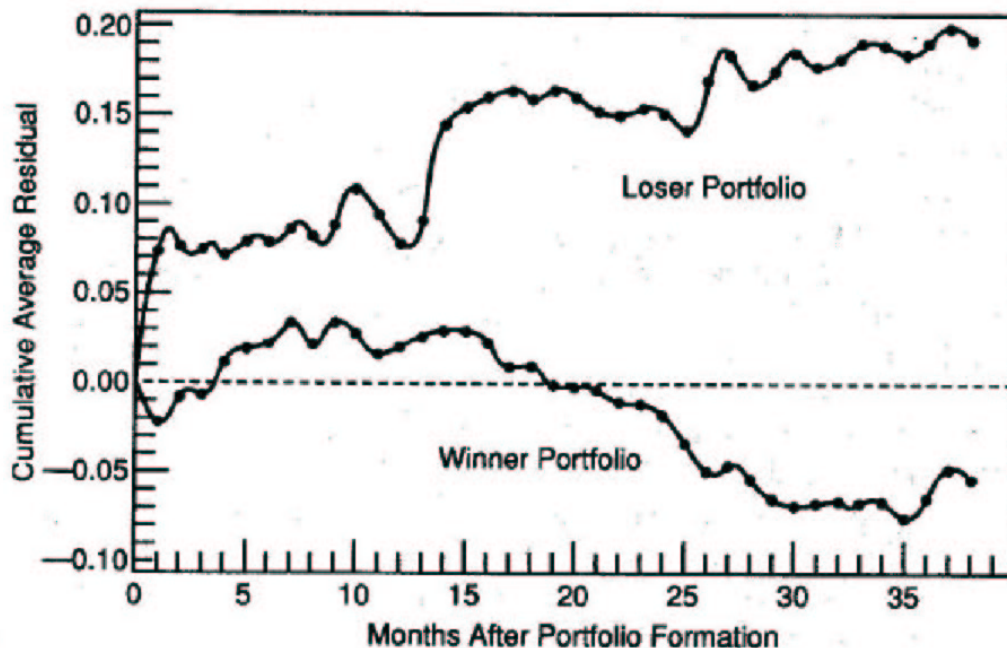


# Evidence I: Predictabilities Studies

- 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

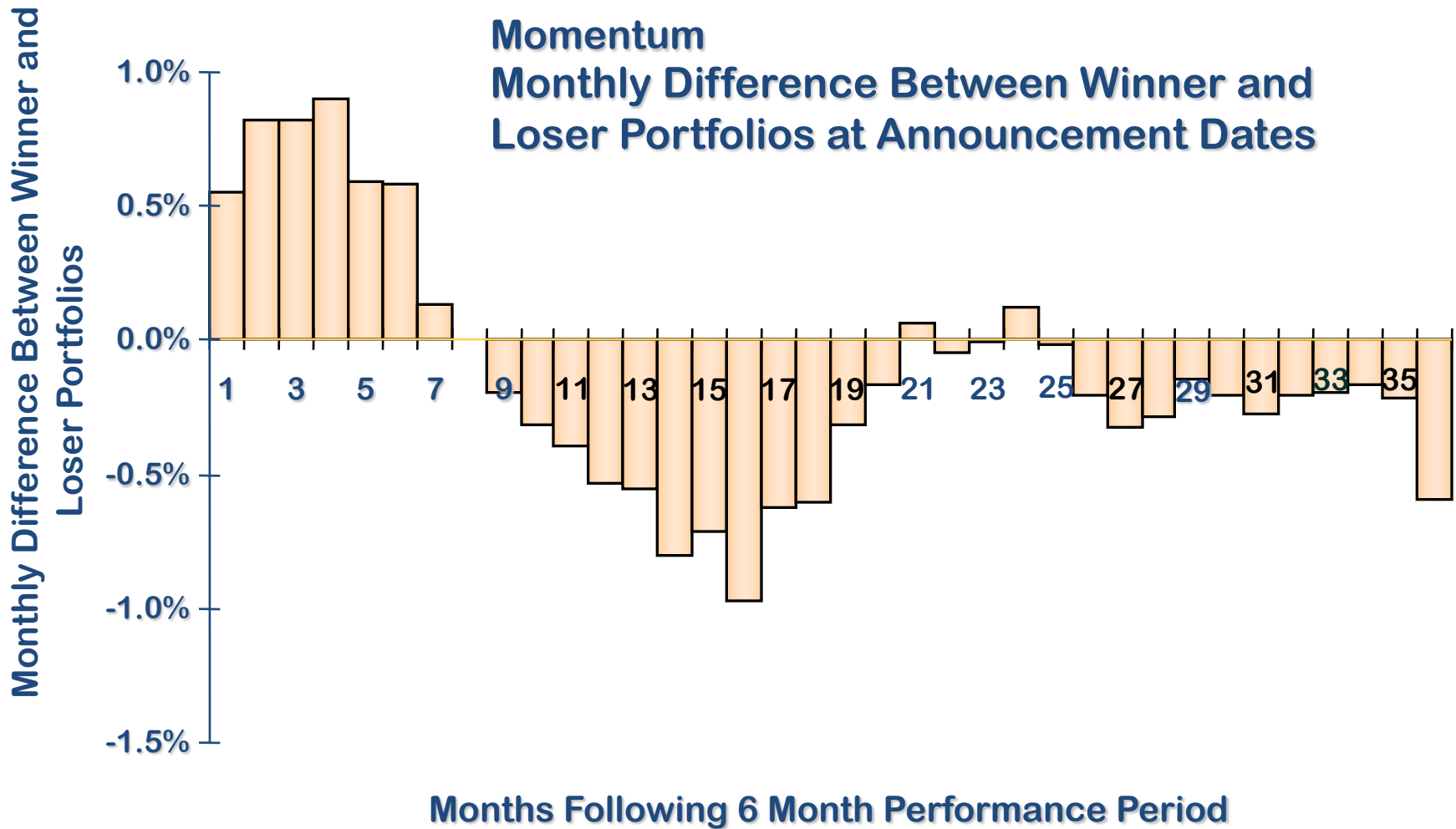
Figure 1 Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1–36 months into the test period)



Long-run  
Reversals

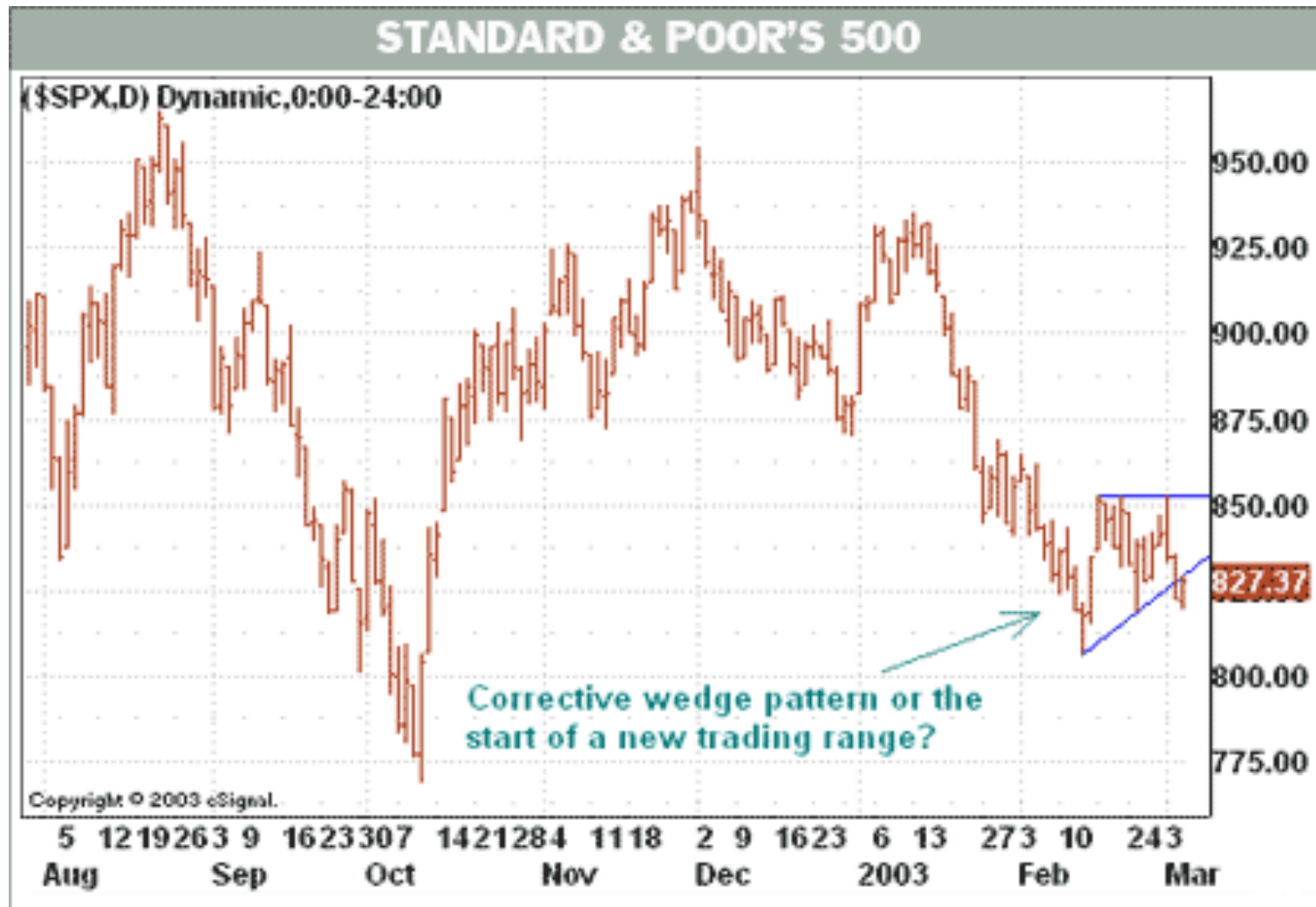
Returns to  
previous 5 year's  
winner-loser  
stocks  
(market adjusted  
returns)

# Short-run Momentum



# Getting Technical

## Barron's March 5, 2003





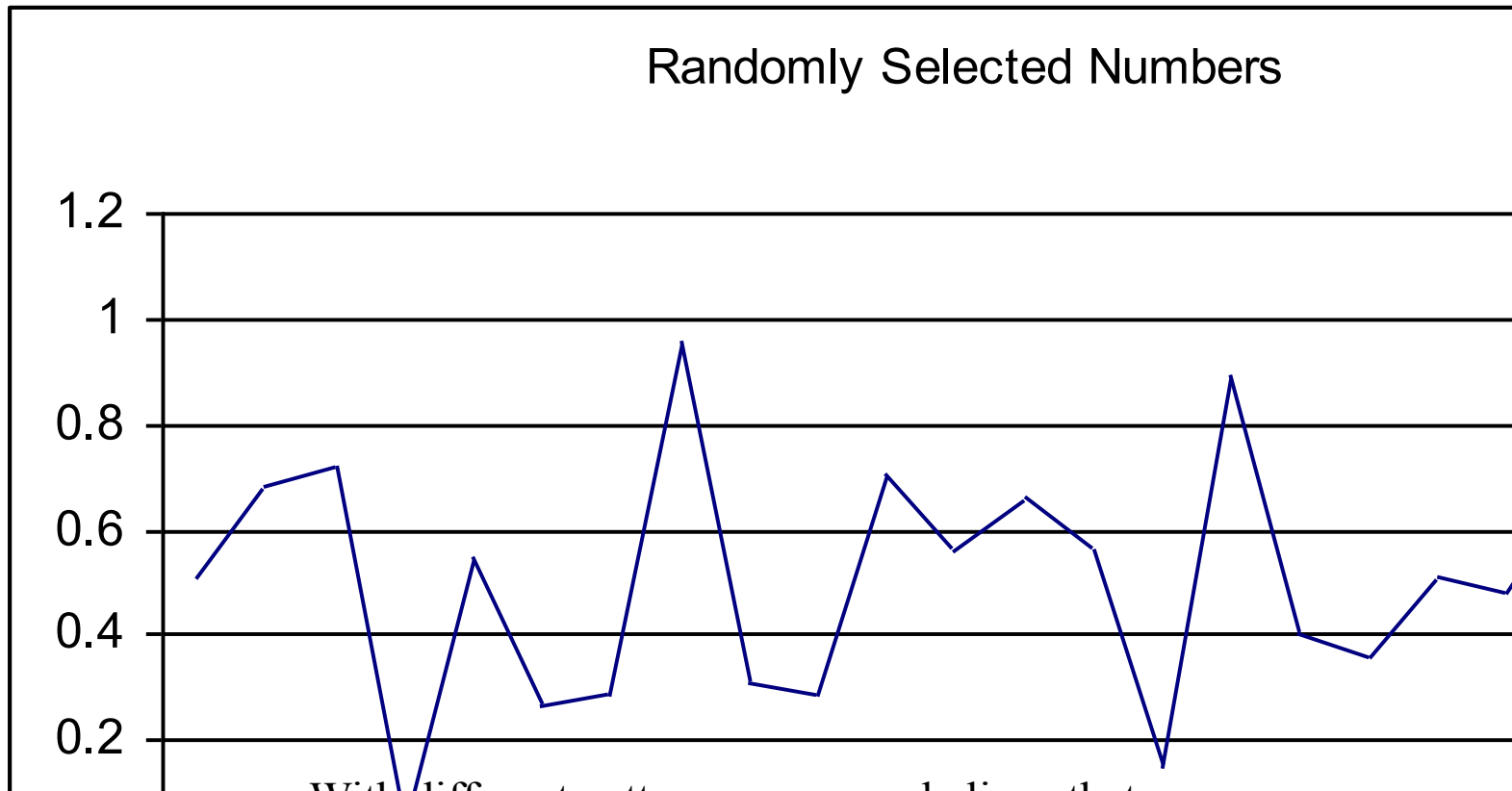
# Getting Technical

Back to Buy Low, Sell High

*Barron's March 12, 2003*

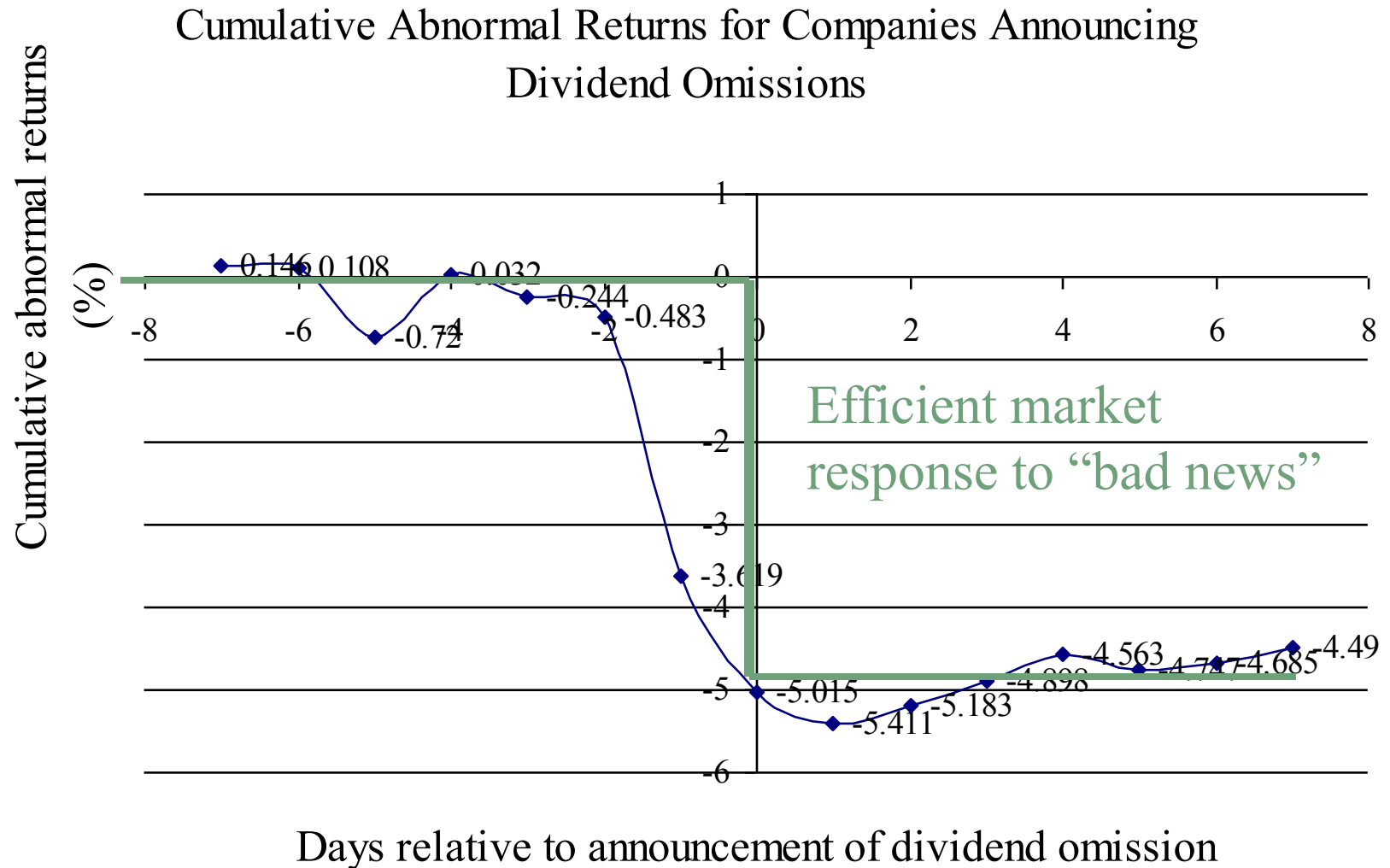


# What Pattern Do You See?



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

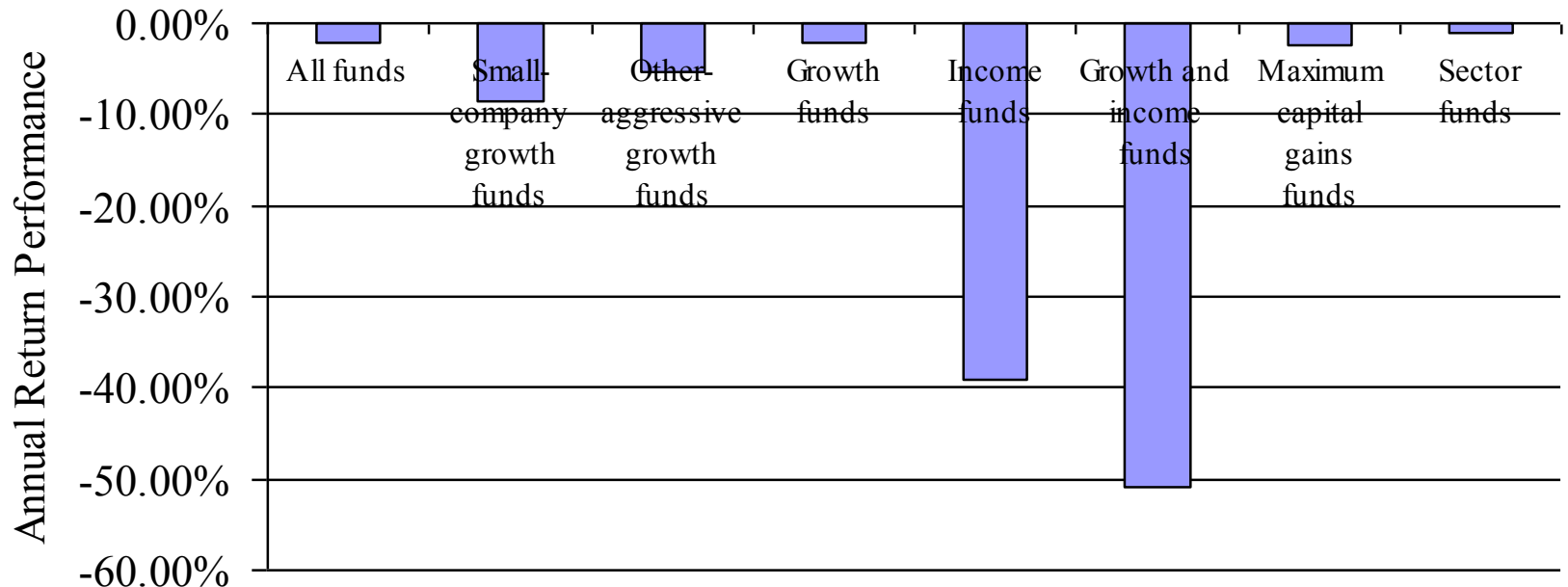


S.H. Szewczyk, G.P. Tsetsekos, and Z. Santout "Do Dividend Omissions Signal Future Earnings or Past Earnings?" *Journal of Investing* (Spring 1997)

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

- Doron Kliger and Gregory Gurevich (2014), Event Studies for Financial Research: A Comprehensive Guide, Palgrave Macmillan
- 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
- Ross et al. (2005), Corporate Finance, 7th Edition, McGraw-Hill
- 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.
- MacKinlay, A. C. (1997), Event studies in economics and finance. *Journal of economic literature*, 35(1), 13-39.