2604-697
Financial Markets, Institutions and Instruments

Topics 8-9:
EMH and Behavioral Finance

capital market → mkt for trading financial assets

efficient mkt hypothesis

3 degrees of capital mkt efficiency

① weak form efficiency
② semi-strong " ——— "
③ Strong " ——— "

Ruttachai Seelajaroen, Ph.D.
Dept of Banking & Finance
Chulalongkorn University

MS Finance

Overview

1. Introduction
2. Background
3. Weak Form Tests
4. Semi-Strong Form Tests
5. Strong Form Tests
6. Behavioral Finance

* Asset pricing models
* Efficient market hypothesis

CAPM assumes efficient mkt

IFRS

Fair value

financial assets must be recorded as "fair value"

intrinsic value

- stock is actively traded → use price in secondary mkt
- stock is not actively traded / not in secondary mkt
  - need to use valuation model

whether mkt price reflects intrinsic value or not?

- efficient mkt ✓
- not " —— " ✗ biased

* Behavioral finance
  - due to biasedness ⇒ can do trading strategy to make profit

1. Introduction

- Security price seems to move randomly around the positive trend line, while in the rate of return form, they seem to move up and down randomly as well.
- Does this price/return behavior imply that the capital market is irrational?
- As it turns out, this behavior of security price/return is what we expect to see in a well functioning market.
- Note: 1) on average, risky assets should generate positive returns in the long run, and 2) as the arrival of new information (good vs. bad news) is random, so as to movements in security prices.

information efficiency : stock price is informative

Efficient market :

must ignores noises

Instantly & fully reflect all available and relevant information

price movement is quite random

- positive trend

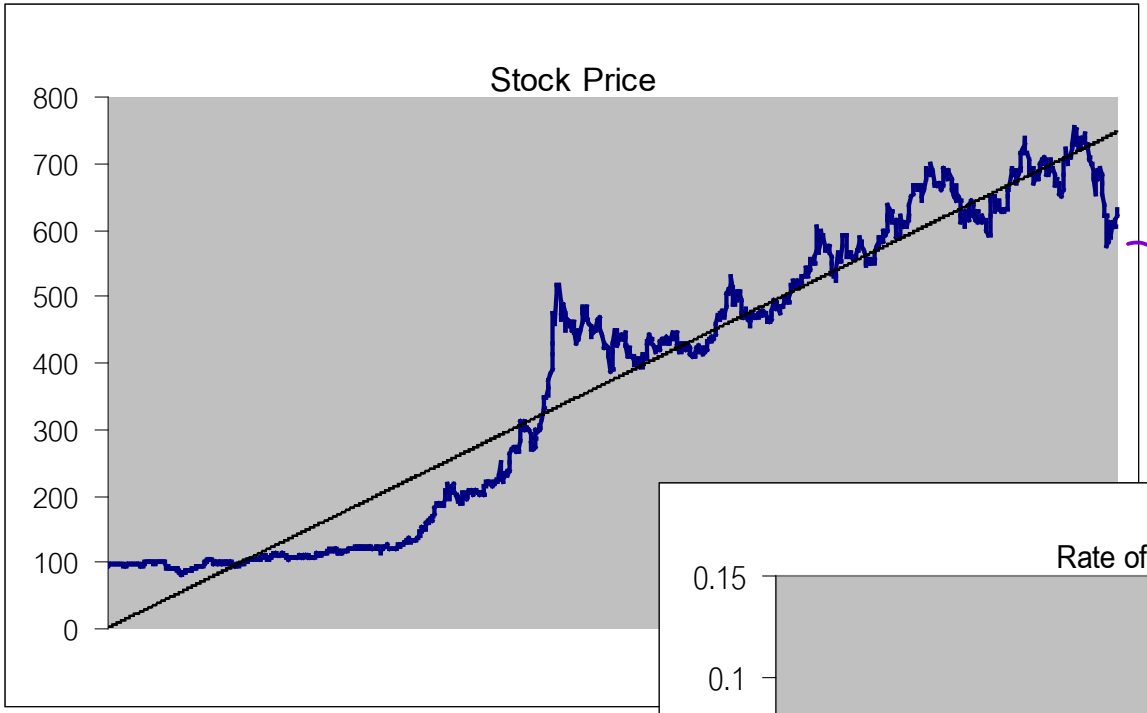
  risk averse wants ⊕ RP

  expect to get positive return ⇒ risky investment, investors expect ⊕ RP → positive trend

  in SR → you may get ⊖ return

  in LR → hold long enough → ⊕ return

Typical Stock Price and Return Movements

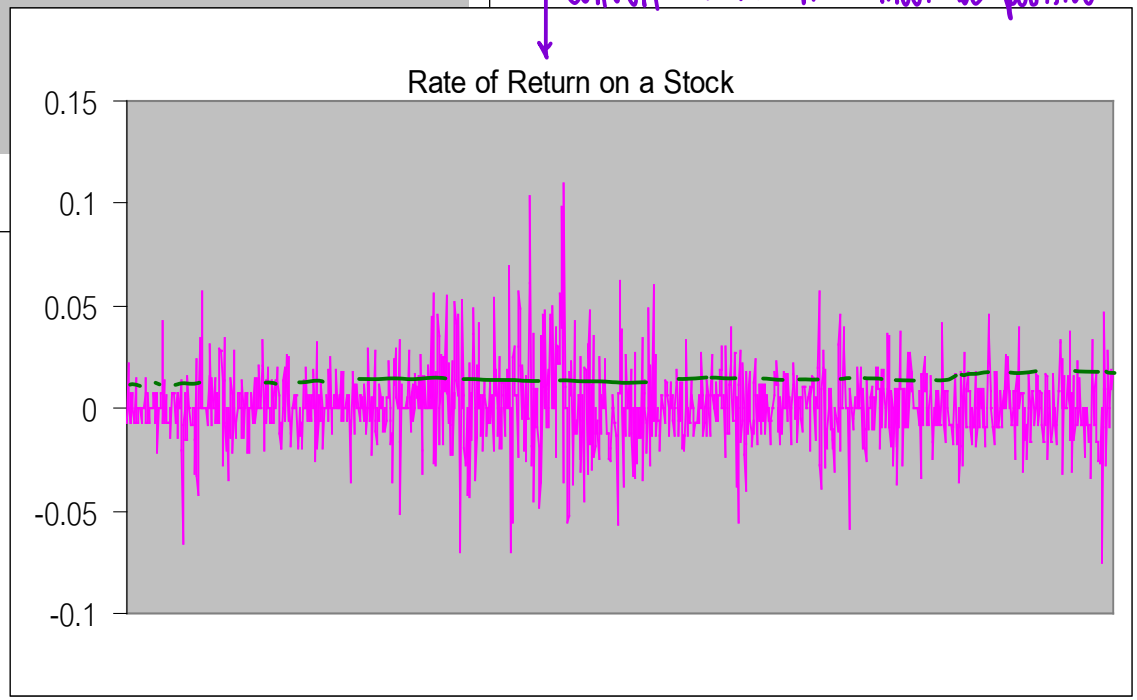


movement of a stock price <positive trend>

return

>0

convert → ln LR ✓ must be positive



Different investors have different set of information / access to information
▸ Informed vs. uninformed investors
still need mkt to be efficient, but lower degree of efficiency, want price to reflect info lacking
want efficient mkt
don't want informed investors to take advantage
price always reflect true value

1. Introduction

corporation : manager can observe stock price as feedback to his decision / strategy
↳ mkt react positively : strategy is added value to shareholders

* Regulator : prefers mkt to be efficient
more fair
forecast error can occur
stock price is not always correct even with efficient mkt
but mkt should not systematically misforecast stock price

- This leads to the concept of Efficient Capital Market Hypothesis (EMH).
- In an (informational) efficient capital market, security prices **fully** and **instantaneously** reflect **all available and relevant** information.
- EMH has many implications to security investors, professional investment managers, corporate financial managers and market regulators.
- For example, in efficient markets, it is impossible to **consistently** identify mispriced securities. Thus, active security selection will only earn normal profits (i.e., returns that compensate for risk).

to which degree mkt is efficient

1. Introduction

- Research questions in this area focus on; 1) are capital markets efficient 2) what are the degrees of market efficiency.

could happen/achievable

- Note that **efficient capital market** is a much less restrictive condition than the notion of **perfect capital market**.

ideal condition

  - Perfect capital markets imply efficient capital markets, but the reverse is not true.

2. Background

1) Security Prices and Information
2) Costly information
3) Implications of the EMH
4) Security Price Behavior under EMH
5) Forms of the EMH
6) Issues Regarding EMH Tests

1) Security Prices and Information

- The current **market price** of a security (P_0) is the price investors have to pay for the ownership of the security.
- The maximum price that a rational investor is willing to pay (or **intrinsic value**, IV_0) is the PV of all benefits from holding the security.

expected dividend
" — " cash flows } have to use info available now

discount CF model

$$\textbf{Intrinsic Value } (\mathbf{IV_0}) = \sum_{t=1}^{T} \frac{E[\mathbf{NCF_t}]}{(1+\mathbf{rrr})^t}$$

intrinsic value

conditional on reflect from current info

$IV_0 \mid \Phi_0$

Prec

set of info available at time 0

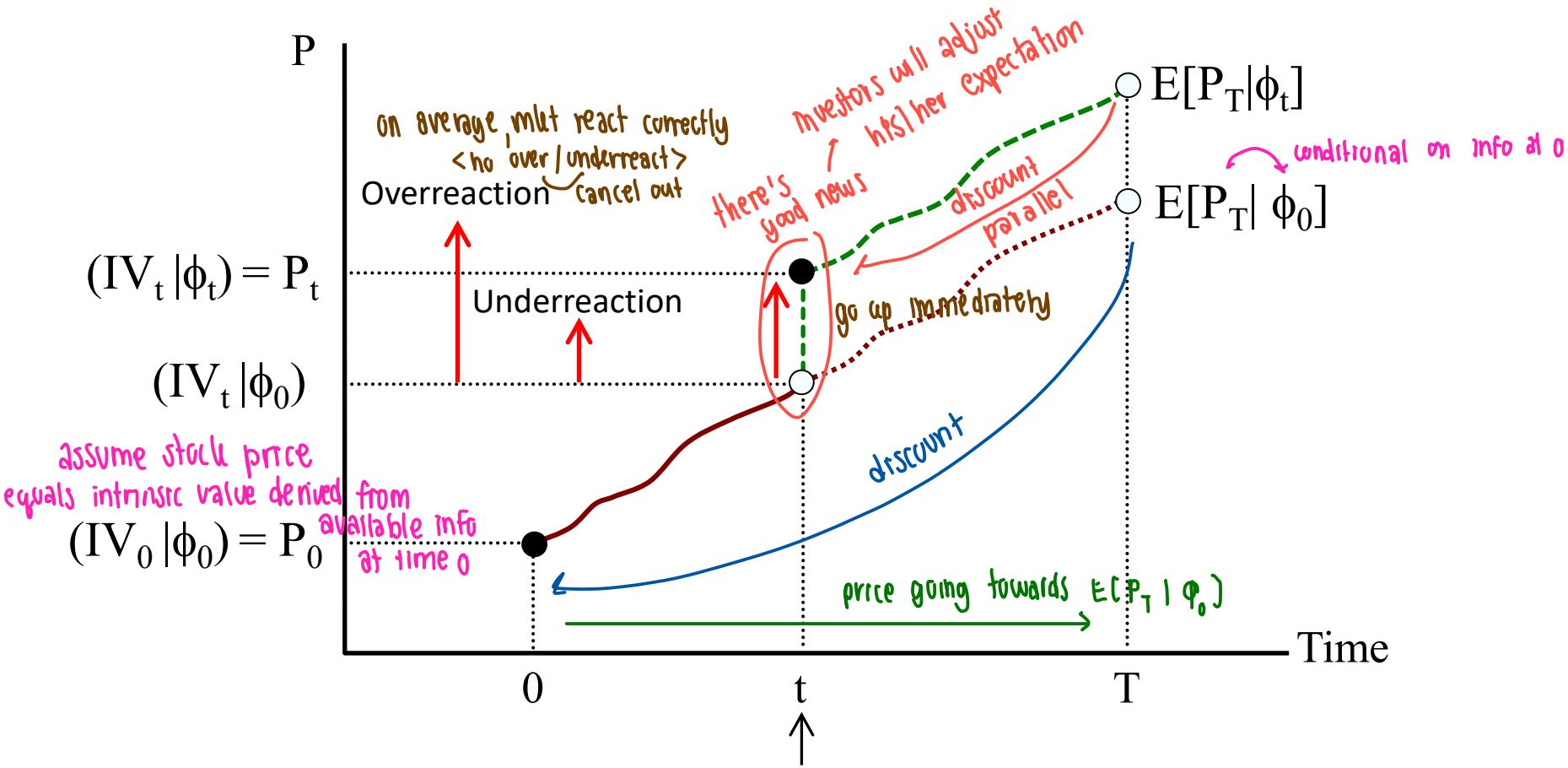
required rate of return

- Both E[NCF] and rrr depend on expectations about future prospect of the firm and its risk.

1) Security Prices and Information

- The expectation is based on the information currently available (ϕ_0). As new information emerges, the expectation/perception could change.
- Security price is said to have fully reflected all available relevant information when $P_0 = IV_0$.
  - change only there's new set of info arrived to mkt
  - ↳ price change is random
- In an efficient capital market, new information is immediately and fully reflected in prices. Therefore,
  - P_0 always equals IV_0.
  - Only new information (i.e., unanticipated information) could cause a shift in security price.

Information, Expectations and Security Prices



Without new information, security price movement should be smooth and the return is predictable.

1) Security Prices and Information

because of human nature

know that stock is underprice → quickly utilize your information before other front-run you → competition

- Why should price always ***instantly and fully*** reflect new information (in a well-functional market)?

For mkt to be efficient, need enough investors to think that mkt is inefficient → dig for more information

- **Competition in the market:** Large number of well-financed and well-equipped market participants looking for profit-making opportunities.

many analysts follow

Degree of efficiency ⟷ size of mkt / price of big stock may be more efficient than small stock

  - If investors have new and reliable information implying that $P_0 < IV_0$, they will try to ***quickly utilize*** this information before someone else does. Their actions will cause $P_0 = IV_0$ immediately.
  - In the end, the market price of the security reflects aggregate information of all market participants.

1) Security Prices and Information

- Note: EMH predicts that all available and relevant information is reflected into prices instantaneously.
  - EMH does not imply that the market has perfect foresight.
  - Random mispricing could occur.

    prediction error must be random → on average, error should be 0.
    ||
    unbiased forecast of price

    (the market unbiasedly give prices to securities)
  - However, the market will not systematically misprice securities.

In efficient mkt, does it make sense that informed investors should get higher return than uninformed investors?
↳ Info is costly, informed investors should get higher return compensate for digging info
↳ net of info cost, they should have the same return

2) Costly information

Active vs. passive ⇒ gross return can be different but net return from info cost should be the same
↳ need compensation for digging info
↳ If not, mkt is not efficient

- Grossman and Stiglitz (1980) argue that information is costly to uncover.
- There must be additional profit from informed trades to at least offset the cost of uncovering new information, in order to motivate information gathering activities.
- Under this setting, total risk-adjusted return (i.e., before deducting trading costs and management fees) of actively managed fund should outperform their passive benchmarks.
- However, net of all-in costs, returns on actively managed portfolios should be at par with their passive benchmarks.

2) Costly information

- The degree of market efficiency could differ across various markets or various groups of stocks traded in the same market, depending on how intensively these stocks are analyzed.
  - Stocks of small firms receive less attention and coverage from professional security analysts. Their prices may be less efficient than stocks of large corporations.

3) Implications of the EMH

- EMH has many implications to various groups of market participants.

  passively manage port ⇒ trade not often

- **Uninformed investors** could view market prices of securities as their fair prices.

- **A passively managed portfolio** (i.e., index funds) is as good as an **actively managed portfolio**. Their risk-adjusted return, net of all-in costs, should be similar.

  trade more often, higher transaction cost

  - However, active management may result in a poorly diversified portfolio, too much trading activities and too much rent extraction by portfolio managers. Hence, active strategies may be harmful to unit holders.

3) Implications of the EMH

- **Accountants** could use market prices of securities traded in liquid markets to reflect the securities' fair value.
- **Corporate financial managers**
  - Market price reactions provide correct signals for making corporate decisions. Value added from a corporate decisions can be measured from changes in market prices of securities issued by the firm.
  - Firms should expect to receive the fair value for securities that they sell. Thus, valuable financing opportunities that arise from fooling investors are unavailable.

3) Implications of the EMH

- The price of a company's stock cannot be affected by a change in accounting.
- Financial managers cannot "time" issues of stocks and bonds using publicly available information.
- A change of financing policy that does not create additional free cash flows (such as tax savings) will not increase stock value.

- For **regulators**, informational efficient capital markets lead to efficient allocation of funds and real resources.
  - Security prices serve as reliable guides to the allocation of real assets.

come up with hypothesis on how stock price should behave if mkt is efficient

4) Security Price Behavior under EMH

- One way to test for the EMH is to describe or hypothesize how security price should behave if the market is efficient. Then, test against that description or hypothesis.

- **Fair games (fair price) hypothesis:** For a current price to instantaneously and fully reflect all relevant information, on average, $E[P_{i,t+1}|\phi_t]$ must correctly reflect (i.e., be an unbiased estimator of) $P_{i,t+1}$.

using information now

unbiase predriction

true value on average

future price

use info from previous period

$$P_{i,t+1} = E[P_{i,t+1} | \phi_t] + \varepsilon_{i,t+1}$$

average = 0

adjustment when under or over predict price

cancel

Not run regression on stock price : $P_{i,t} = a + bY_{i,t} + e_{i,t}$

$r_{i,t} = a + b y_{i,t} + u_{i,t}$

!! ① When convert stock price → return, we cut out the trend ⇒ lossing some info (trend)

② can compare stock with different par

4) Security Price Behavior under EMH

- In other words, the estimation error of the market forecast is zero on average.

on average, $P_{i,t+1} =$ check whether

but cannot observe expectation

from time t → price at time t as constant

mean value of price is not constant → not stationary → not meaningful result → so, convert to return! :)

e.g. CPI → inflation

fair game:

- In price form: $P_{i,t+1} = E[P_{i,t+1}|\phi_t] + u_{i,t+1}$
- In return form: $r_{i,t+1} = E[r_{i,t+1}|\phi_t] + \varepsilon_{i,t+1}$

divided by $P_{i,t}$

where $E[P_{i,t+1}|\phi_t]$ is expected price in the future based on information available at the current time.

$u_{i,t+1}$ and $\varepsilon_{i,t+1}$ are forecast errors

$E[u_{i,t+1}] = 0$

$E[\varepsilon_{i,t+1}] = 0$

4) Security Price Behavior under EMH

- To test the fair game hypothesis, we need to observe $E[P_{i,t+1}|\phi_t]$ and $E[r_{i,t+1}|\phi_t]$, which is impossible.
- More testable hypotheses need to be developed.
- There are 3 hypotheses usually proposed in the literature.
  - statistical model
    Martingale model
  - Sub-martingale model
  - Random walk model

How expectation price is formed → stimulate this number

4) Security Price Behavior under EMH

price always reflect info when mkt is efficient → up/down depend on new info → today price (unbiased) reflects expectation about future price

The martingale model of security price and return:

$$E[P_{i,t+1}|\phi_t] = P_{i,t} \quad \text{and} \quad E[r_{i,t+1}|\phi_t] = 0$$

- The martingale is a fair game where tomorrow price is expected to be equal to today price.
- Given that the current price fully reflects all information (ϕ_t), the best predictor of tomorrow's price is today price.
- As such, the expected return on security is zero when conditional on the set of information available (ϕ_t).
- This model is unrealistic (Why?). It is generally rejected in empirical studies.

	T	P_T	actual price P_{T+1}	forecast error
1st Jan	0	4	3	3 - 4 = -1
2nd Jan	1	3	5	5 - 3 = +2
3rd Jan	2	5		

average should be 0 if martingale correct

* price at time 0 is unbiased estimator of price at time 1

If change price to return → it should reflect zero return

risk neutral but normally people are risk adverse

not make sense

should be ⊕ in average bcs it is return from risky assets

4) Security Price Behavior under EMH

given current information

we always expect that future price will be higher or equal to price today

The sub-martingale model of security price and return:

To test this model, should assume on how expected price or return is formed in equilibrium

$$E[P_{i,t+1}|\phi_t] \geq P_{i,t} \quad \textbf{\textit{and}} \quad E[r_{i,t+1}|\phi_t] \geq 0$$

to assume it follows CAPM

we expect average return must be ⊕ anyway

- The sub-martingale is a fair game where tomorrow price is expected to be greater than today price (i.e., prices are expected to rise overtime).
- Implication: The abnormal return on a portfolio is the difference between portfolio return ($r_{i,t+1}$) and its expected return ($E[r_{i,t+1}|\phi_t]$).

0 ——— T

1 stock ⇒ don't need CAPM

e.g PTT

on average, should earn positive return

e.g. use graph

① Active trade $\bar{r} = 10\%$ ⇒ cannot claim that this beat the mkt. ⇒ need to compare with passive return (same risk) buy / hold

not beat mkt

② Passive trade (buy / hold) $\bar{r} = 12\%$

<buy & hold>

don't need info

Or compare with CAPM

given $\beta_p = 1.2$

$r_F = 3\%$

$r_M - r_F = 10\%$

CAPM: $E[r_p] = 3\% + 1.2(10\%) = 15\%$

Joint test hypothesis problem

rejecting mkt efficient or model ??

compare to CAPM, mkt may be efficient but model cannot capture all risk

Fama - french

↳ CAPM cannot capture all risk !!!

4) Security Price Behavior under EMH

- To test the EMH under this interpretation, one needs to know how $E[r_{i,t+1}|\phi_t]$ is formed by the market.
  - The returns on a comparable buy-and-hold (i.e., passive) strategy can be used represent $E[r_{i,t+1}|\phi_t]$. Then test whether an active strategy on stock/portfolio *i* could beat this $E[r_i]$.
  - Alternatively, we could use the CAPM or APT to generate $E[r_{i,t+1}|\phi_t]$. Then test against return on an actively managed portfolio.

4) Security Price Behavior under EMH

expected error is zero

- **A random walk model** of security price

stock price changes are random & unpredictable

$$P_{i,t+1} = \mu_i + P_{i,t} + \varepsilon_{i,t+1}$$

where μ is a drift term (= expected price change)

$\varepsilon_{i,t+1}$ is the change in price due to new information

$\varepsilon_{i,t+1} \sim$ iid with $E[\varepsilon_{i,t+1}] = 0$ and constant $\sigma_{\varepsilon i}^2$

- Write the RW model for 2 periods:

reflect new info arriving to mkt

constant term | price over last period | error term

$$P_{i,t+1} = \mu_i + P_{i,t} + \varepsilon_{i,t+1}$$

$$P_{i,t+2} = \mu_i + P_{i,t+1} + \varepsilon_{i,t+2}$$

If new info emerge randomly
↳ error terms have zero correlation

when convert price → return overtime
asset return over time should have
0 correlation as well

- As new information emerges randomly, the RW model implies that $Cov[\varepsilon_{i,t+1}, \varepsilon_{i,t+2}] = 0$.

cannot predict direction

Random walk without drift : $P_{i,t+1} = P_{i,t} + \varepsilon_{i,t+1}$

doesn't make sense

↳ return = 0

4) Security Price Behavior under EMH

- Write the RW model in the form of price change (return):

price change over time or return should be zero

zero correlation

$$\Delta P_{i,t+1} = \mu_i + \varepsilon_{i,t+1}$$

$$\Delta P_{i,t+2} = \mu_i + \varepsilon_{i,t+2}$$

- If $Cov[\varepsilon_{i,t+1}, \varepsilon_{i,t+2}] = 0$, then $Cov[\Delta P_{i,t+1}, \Delta P_{i,t+2}] = 0$
- The RW implies that consecutive price change must be uncorrelated. That is, security returns should have zero serial correlation (or auto-correlation).
- The RW is a more restrictive model than sub-martingale as significant serial correlation is not inconsistent with the sub-martingale.

cross-sectional correlation (btw diff stock at same period)

AIS	PTT
$r_{AIS,t}$	$r_{PTT,t}$
⋮	

- Auto-correlation (same stock, diff period)
- Serial-correlation

	$r_{AIS,t}$	$r_{AIS,t+1}$
1	$r_{AIS,1}$	
2	$r_{AIS,2}$	
3	$r_{AIS,3}$	

if $=0$; mkt efficient

if $\neq 0$; mkt inefficient

test efficient based on degree

5) Forms of EMH

- Apart from testing time series properties of security returns, EMH can also be tested by detecting whether some specific news (or information) is not yet impounded in the asset price and whether that information could be used to make abnormal profit.

test against information set

- The EMH is divided into three sub-hypotheses based on different sets of information.

cannot beat mkt = bad

technical analyst

mkt should be easy to be efficient with ①

easy to access

Types of information

fundamental analyst use public information

hard to get

mkt is hard to be efficient with insider info

5) Forms of EMH

1) Weak Form Hypothesis:

- Stock prices already reflect all information in ***market trading data*** such as past price movements and trading volumes.
- Implication: Trading strategies based on technical analysis will not create abnormal returns on average.

use graph

5) Forms of EMH

2) Semi-Strong Form Hypothesis:

- Stock prices already reflect ***all publicly available information*** regarding the prospects of the firms including past prices, fundamental data on the firm's product line, quality of management, balance sheet compositions, patents held, earning forecasts, accounting practices and etc.

- Implication: Trading strategies based on fundamental analysis (i.e., forecasting future operating performance of the firms) will not create abnormal returns on average.

will not beat mkt

5) Forms of EMH

3) Strong Form Hypothesis:

- Stock prices already reflect ***all information relevant to the firm*** including information only available to company insiders.
- Implication: Even trades on inside information will not create abnormal returns on average.

not public

not allow you to consistently beat mkt.

6) Issues Regarding EMH Tests

interprete result differently → not clear cut because there're issues that all EMH tests will encounter at least 1 problem

- The following 4 issues surrounding tests of EMH imply that the debate of whether the market is efficient never will be settled.

relied on even more assumption

not efficient <perfect mkt>

  - The joint test issue e.g. Fama-French rejects CAPM model not mkt

    asset-pricing model is also an assumption
  - The magnitude issue
  - The selection bias issue
  - The lucky event issue

The Joint Test Issue

- Tests of EMH are mostly tests of joint hypotheses.
- The statement "prices fully reflect all available information" reflects two aspects of prices.
  - Information content
  - The price formation mechanism
- Any test of this proposition must concern
  - The kind of information reflected in prices
  - How the information come to be reflected in prices.

The Joint Test Issue

- For example, most tests of EMH assume an equilibrium model, such as the CAPM or the APT, that defines normal security returns.
- However, the CAPM and the APT rely on an even more restrictive set of assumption than the EMH.
- **The joint hypotheses problem:** If efficiency is rejected, this could be because the market is truly inefficient or because an incorrect equilibrium model has been assumed.

The Magnitude Issue

- A small increase in performance, even though it is economically significant, is quite hard to detect especially when returns fluctuated overtime.
- For example, an improvement of 0.1% pa in return on a $5 billion portfolio will increase portfolio earnings by $5 million annually. However, the 0.1% return improvement will likely be statistically insignificance against standard deviation of portfolio return, says 15% pa.

Statistically significant
Economically significant

not economically significant

$r_t = 0.02 + 1.2\, r_m + \underline{0.0000001}\ SMB$
(2.12)

t-statistic
statistically significant

Asset return is noise
↳ standard error high → t-stat very small → not statistically significant

If $\alpha_p = 0.5\%$ pa → significant in term of economic especially for big fund
(0.9)
↳ not significant in term of statistics → cannot claim

select

we want to test using sample to inference to population

The Selection Bias Issue

self-select : people who can beat mkt will not disclose their strategy
only who cannot beat mkt disclose it

only select fund that survive today <survivalship bias>

- Only investors who find that an investment scheme cannot generate abnormal returns will be willing to report their finding to the public. Hence, we cannot used evidence that various techniques do not provide investment reward as proof of market efficiency. This problem is called **"selection bias"**.

- If we use a sample of existing portfolio managers to test whether on average professional portfolio managers can outperform their passive benchmarks, we may introduce **"survivorship bias"** into the sample. Since only good-performing managers survive through time, our sample tend to only represent good managers, not the average.

The Lucky Event and Data Mining Issue

beat mkt consistently

outlier from luck

- **The lucky event issue:** The evidence that some well-known investors can outperform the market in the long-run cannot be used as a prove that the market is inefficient. Statistically speaking, this could be due to luck rather than pure skills.

same stategy not useful anymore

strategy beat mkt previously may not beat mkt again if mkt is efficient

- **The data mining issue:** The evidence that certain trading rules/strategies can beat the market cannot be used as a prove that the market is inefficient. As this type of test is normally performed against historical data, searching hard enough, stock price patterns could be identified. However, the same pattern may not work again in the future.

3. Weak Form Tests

1) Random walk hypothesis — historical info

$$\mathrm{cov}[r_{i,t}, r_{i,t+1}] = 0$$

announce bad news during mkt closed <weekend> ⇒ return on Monday always bad ⇒ short sell on Friday, then buy back on Monday

2) Day of the week effect

return in Jan > Dec

3) January Effect / Halloween Effect

4)

1) Trading Rules

2) Returns over Short Horizon

3) Returns over Long Horizon

4) Time Patterns in Security Returns

5) Conclusion

Weak form test:

1) Random walk hypothesis — historical info

$$cov[r_{i,t}, r_{i,t+1}] = 0$$

2) Day of the week effect

→ announce bad news during mkt closed <weekend> ⇒ return on Monday always bad ⇒ Short sell on Friday, then buy back on Monday

3) January Effect / Halloween Effect — return in Jan > Dec

4) Test technical rules vs. Buy & hold

1) Trading Rules

If rule can beat buy & hold ⇒ mkt is not efficient

- These tests involve back testing trading rules proposed by technical analysts to see whether return from the trading strategy could beat return from a buy-and-hold strategy on the same stocks.
- Various strategies have been tested with mixed results.

most trading rules cannot beat market on consistent periods

- After properly adjusting for trading costs, most technical rules do not seem to beat the buy-and-hold strategy.
- Many successful trading rules are either sample or period specific.

bad news for technical investors

↓

but we cannot use this to imply bcs who can beat mkt will not tell it to public

2) Returns over Short Horizon

- each port has 100 stocks
10 portfolios
past return
3 months 0
1st - 1st port
1000th

- Conrad and Kaul (1988) and Lo and MacKinlay (1988) examine weekly returns of NYSE stocks and find weak positive serial correlation.

short-term return tends to exhibit

++ --
positive return followed by positive
(run test)

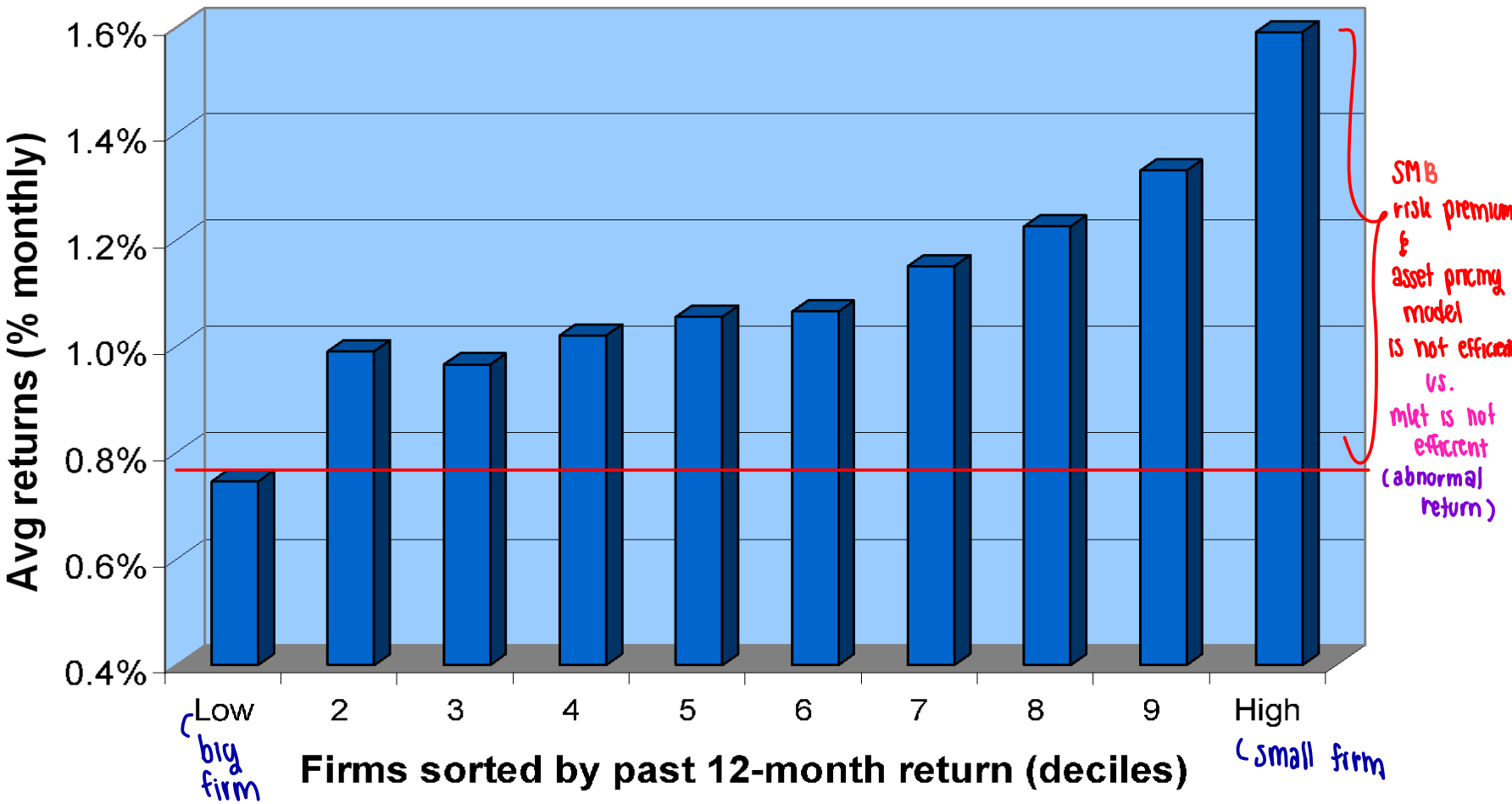
- **Momentum Effects:** Jegadeesh and Titman (1993) find momentum effects, in which good or bad recent performance of stocks continues over the short to medium terms.

  - Portfolios of stocks with high returns over the past 3- to 12- months typically continue to outperform stocks with low past returns.

ranking based on historical return
<group of stocks not single stocks>

top rank stocks tend to perform good again in the next period
(momentum effect)
* if longer than 12-months, you will not see this effect

Momentum portfolios, monthly returns



past winner tend to be next winner

3) Returns over Long Horizon

- **Reversal Effect:** DeBondt and Thaler (1985) find a reversal effect of returns on the market portfolio over a long run. 1-5 years past winner become future loser <reversal effect>
- **Contrarian Strategy:** Chopra, Lakonishok and Ritter (1992) find that stocks with high returns over the past 5 year under-perform stocks with poor past return.
  - This implies that contrarian strategies may earn positive abnormal returns.

- 5yrs 0

past winner ⇒ should short sell past winner
past losers then use cash to long past losers] gap of return represent abnormal return but is not efficient

reverse their fortune

ST momentum
LT reversal
] - Fad hypothesis

- The mkt tends to overreact in short term → good news ⇝ price go up & up in ST
  In long run, mispricing / overpricing → price drops to correct value

- bad news: mkt overreact in ST & price ↓↓↓
  then in long run, price ↑ to real price

4) Time Patterns in Security Returns

- **Day-of-the-week Effect**

  firms on average announce bad news in weekend

  - Many researchers find that average returns on Monday are lower than returns on other days of the week.
  - Some argue that firms tend to announce bad news over the weekends.

- **January Effect**

  - Average returns in January are higher than in other months of the year.

    In Dec, if you're institutional investor → you need to close book, you sell bad stocks → make their price ↓ → then investors buy it back in Jan.

  - However, the January effect seems to disappear in recent years.

    window dressing

• big vs. small firms ⇒ if we see it as abnormal return → short big & long small
↳ but people see diff between big & small as risk premium < Fama-french >

Hard to reject weak form

5) Conclusion

less likely to get advantage from tms
- reversal in LT
- momentum in ST
- positive serial correlation of stock effect

obtain small return but high risk

because

- In general, the random walk hypothesis is rejected.

↳ hard to believe that we can get abnormal return from mfo

- However, it is hard to reject the weak form hypothesis.

↓ cannot beat buy & hold

  - Trading costs
  - Risk may not be properly adjusted.

4. Semi-Strong Form Tests

from firm announcement
Fundamental factors
- Fin ratios → $\frac{D}{E}$, $\frac{P}{E}$
  - mkt cap, BTM, etc.
- Analyst's recommendation
- Quality of auditor

Fama · French
firm return correlates with

1) Returns and Firm Characteristics

2) Event Study and Announcement Effects

How quickly & fully the market (stock price) reacts to new information (firm's announcement)

1) Return and Firm Characteristics

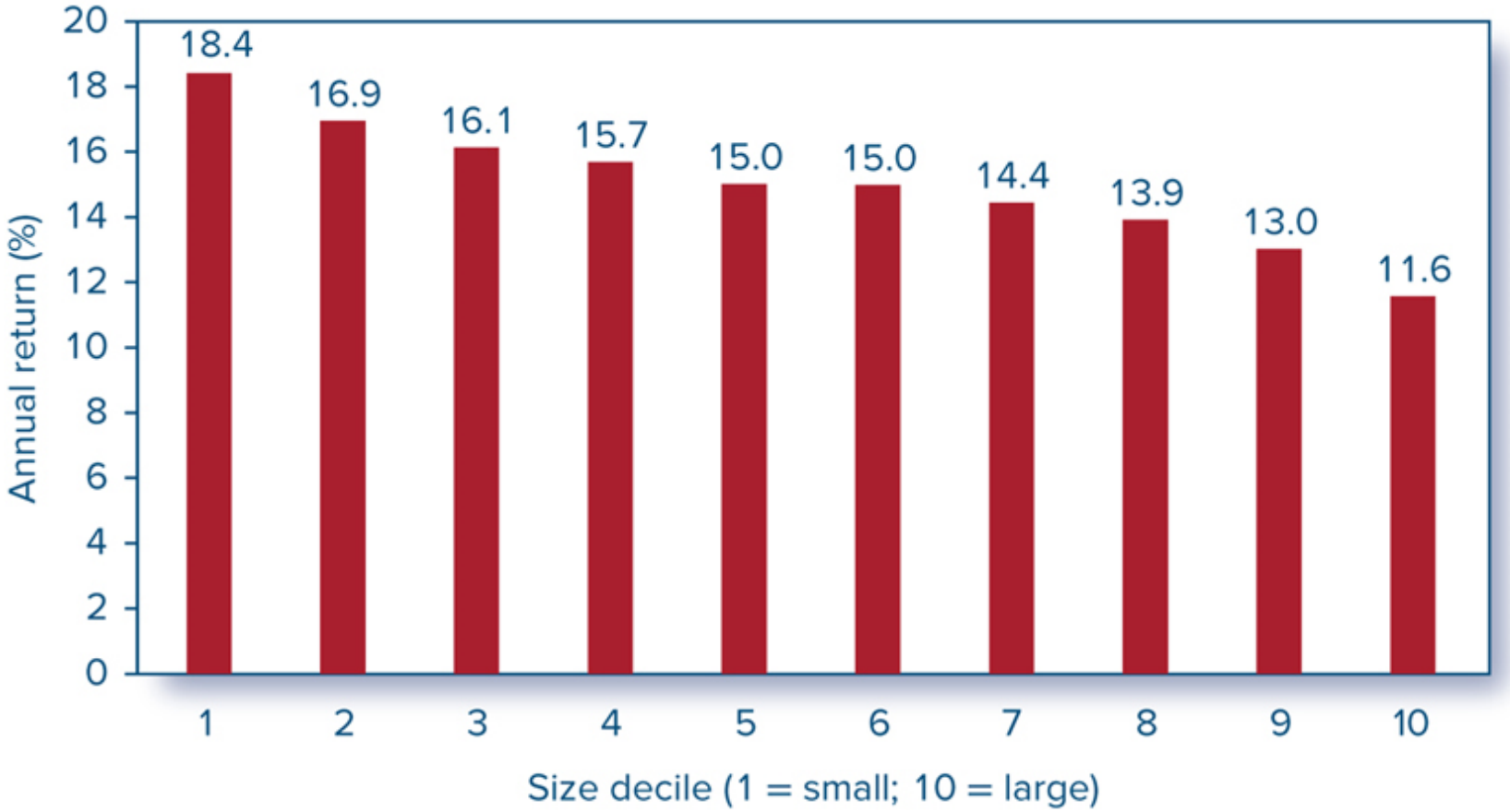
- **P/E Effect:**
  - Basu (1977): Portfolios of low P/E ratio stocks outperform high P/E portfolios, even when the difference in market betas is controlled.
- **Size Effect:**
  - Banz (1981): Portfolios of small firms have higher returns than large-firm portfolios.
  - Kiem (1983), Reinganum (1983) and Blume & Stambaugh (1983): Small firm effect occur virtually in January.

→ short high P/E, long P/E
growth stock
value stock
price per share
earning per share (EPS)
→ but value stock tend to be firm with financial difficulty → make their price to go down
Thus gap represents risk premium
Fama · French
outperform big firm → gap is "SMB"
↳ risk premium
return from small has higher SD
(riskier
High BTM outperform low BTM
* HML → risk premium
firm characteristic affect its return

1) Return and Firm Characteristics

- **Book-to-Market Ratio (BTM):**
  - Fama & French (1992): Portfolios of firms with high BTM (value firms) outperform portfolios consisting of low BTM firms even after adjust for market betas.
- **Interpretations of market anomalies:**
  - Support the notion that markets are inefficient.
  - Markets are efficient, but firms characteristics are proxies of systematic risks not captured by the CAPM beta.

Average Annual Return for Size-based Portfolios, 1926-2018



Source : BKM (2023) p.350

Average Annual Return for BTM-based Portfolios, 1926-2018

Source : BKM (2023) p.362

2) Event Study and Announcement

- Event Study is a method for testing market reaction to certain announcements.

- Steps involved in conducting an event study are

1st step

  - Identify types of announcement to study, i.e., earnings announcement, takeover announcement and etc.

bidder will lose bcs they pay more than mkt price → the synergy will be realized in the future <has risk>

2nd step

  - Collect a sample of firms making the same announcements

period outside event window

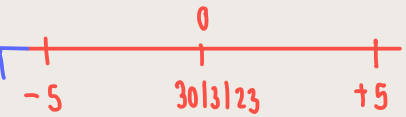
estimation period

Event window

announcement has effect

use to estimate model

to get normal return



    - Announcement date
    - Prices surrounding the announcement date

ยกนี้เยอะมาก → เข้าใจสมการ ก่ำสที่สมทั่วไปยังไง

2) Event Study and Announcement

transforming calendar date to event date

- For each stock, rearrange return data from calendar to event date.

Earning announcement
announcement date
day 0

A	2/5/02	3/5/02	4/5/02	**5/5/02**	6/5/02	7/5/02
B	8/7/05	9/7/05	10/7/05	**11/7/05**	12/7/05	13/7/05
C	5/2/06	6/2/06	7/2/06	**8/2/06**	9/2/06	10/2/06

Calendar Date

–3	–2	–1	0	1	2
$R_{A,-3}$	$R_{A,-2}$	$R_{A,-1}$	$R_{A,0}$	$R_{A,1}$	$R_{A,2}$
$R_{B,-3}$	$R_{B,-2}$	$R_{B,-1}$	$R_{B,0}$	$R_{B,1}$	$R_{B,2}$
$R_{C,-3}$	$R_{C,-2}$	$R_{C,-1}$	$R_{C,0}$	$R_{C,1}$	$R_{C,2}$

Event Date

3-day before announcement

is this from return bcs of reaction of earning announcement not other factor

firm's specific event

earning announcement

others

* First, we believe mkt model

$r_{A,t} = \alpha_A + \beta_A \cdot r_{M,t} + \varepsilon_{A,t}$ from event

estimate this outside event window

capture normal return

X must remove this effect

eliminate this 1st

<e.g. macro event>

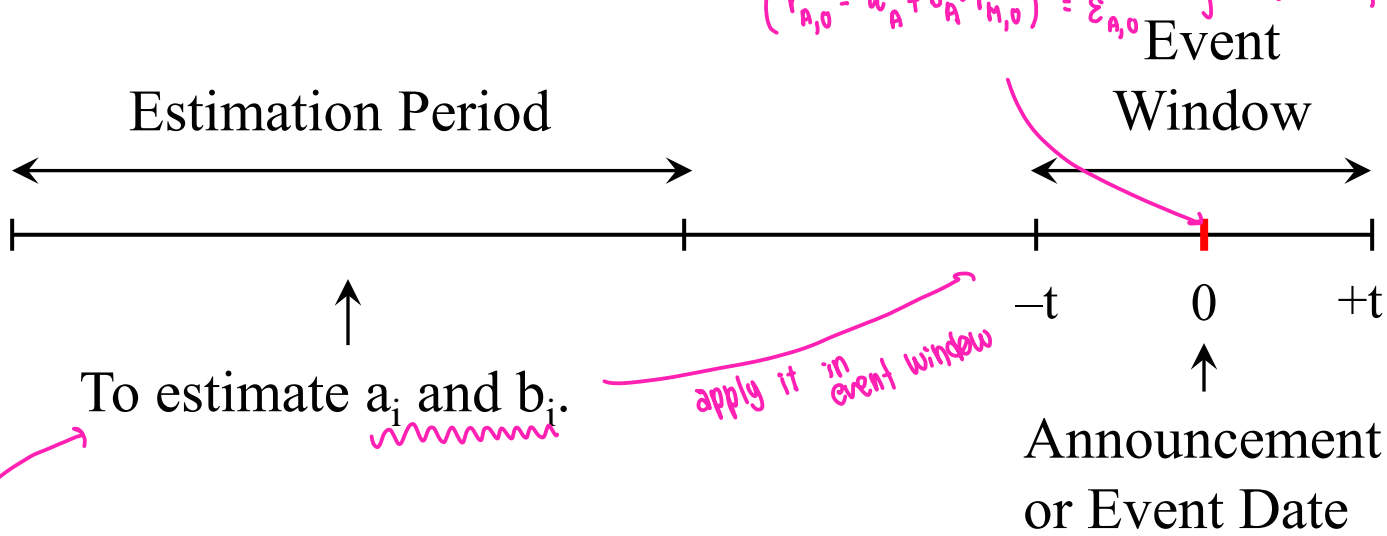
tent to affect all firms

500 stocks → run 500 times → they all announce at same time earning

Calculate abnormal return in each day

from estimation period

$(r_{A,0} - a_A + b_A \cdot r_{M,0}) = \varepsilon_{A,0}$ $\varepsilon_{A,-t}, \varepsilon_{A,-t+1}, \ldots, \varepsilon_{A,+t}$



apply it in event window

From the market model: $r_{i,t} = a_i + b_i \cdot r_{M,t} + e_{i,t}$

Use a_i and b_i estimated from the estimation period, ~~and~~ Then, use the estimated a_i and b_i together with $r_{i,t}$ and $r_{M,t}$ during the event window to calculate ~~$e_{i,t}$~~ $AR_{i,t}$ ~~during the event window.~~ Where $AR_{i,t} = r_{i,t} - (a_i + b_i \cdot r_{M,t})$

~~$e_{i,t}$~~ $AR_{i,t}$ represents abnormal return ($AR_{i,t}$) resulting from the specific event.

2) Event Study and Announcement

- For each stock, determine market reaction, i.e., calculate abnormal return during the event period

หาไม่ต้องลบอันนี้

$$AR_{i,t} = r_{i,t} - (a_i + b_i \cdot r_{M,t})$$

where β_i is estimates from the market model using data during the period outside the event window.

- Take average abnormal return across stocks in the sample

affect of others eliminated

bad & good offset each other

cancel

$$\overline{AR}_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t}$$

good news → return beats mkt expectation

do the test separately btw firms those can beat expectation & cannot beat expectation

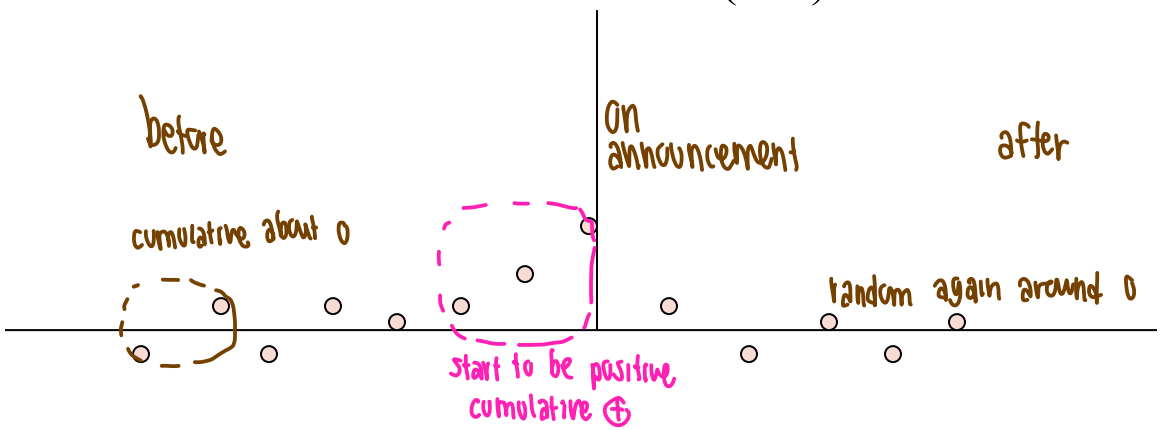
accumulation during event window

$$CAR_T = \sum_{t=1}^{T} \overline{AR}_t$$

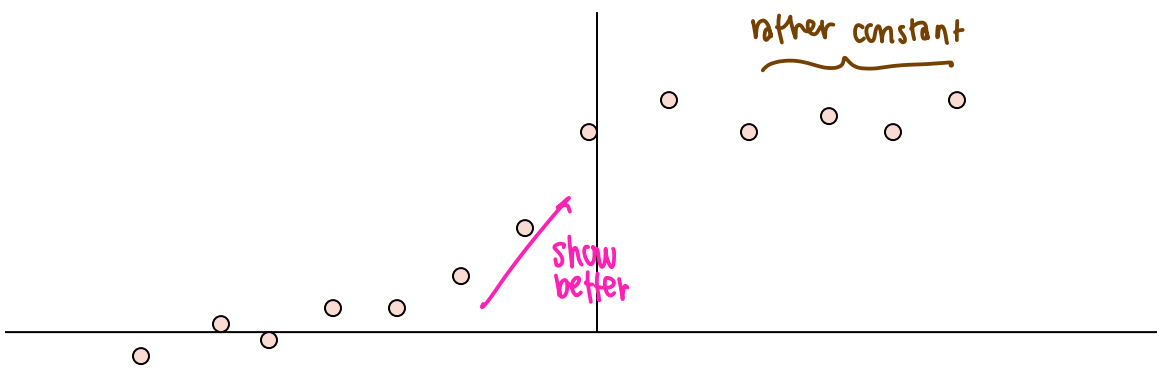
A Typical Event Study Result

Abnormal return $AR_{i,-T}$ … $AR_{i,-1}$ $AR_{i,0}$ $AR_{i,+1}$ … $AR_{i,+T}$

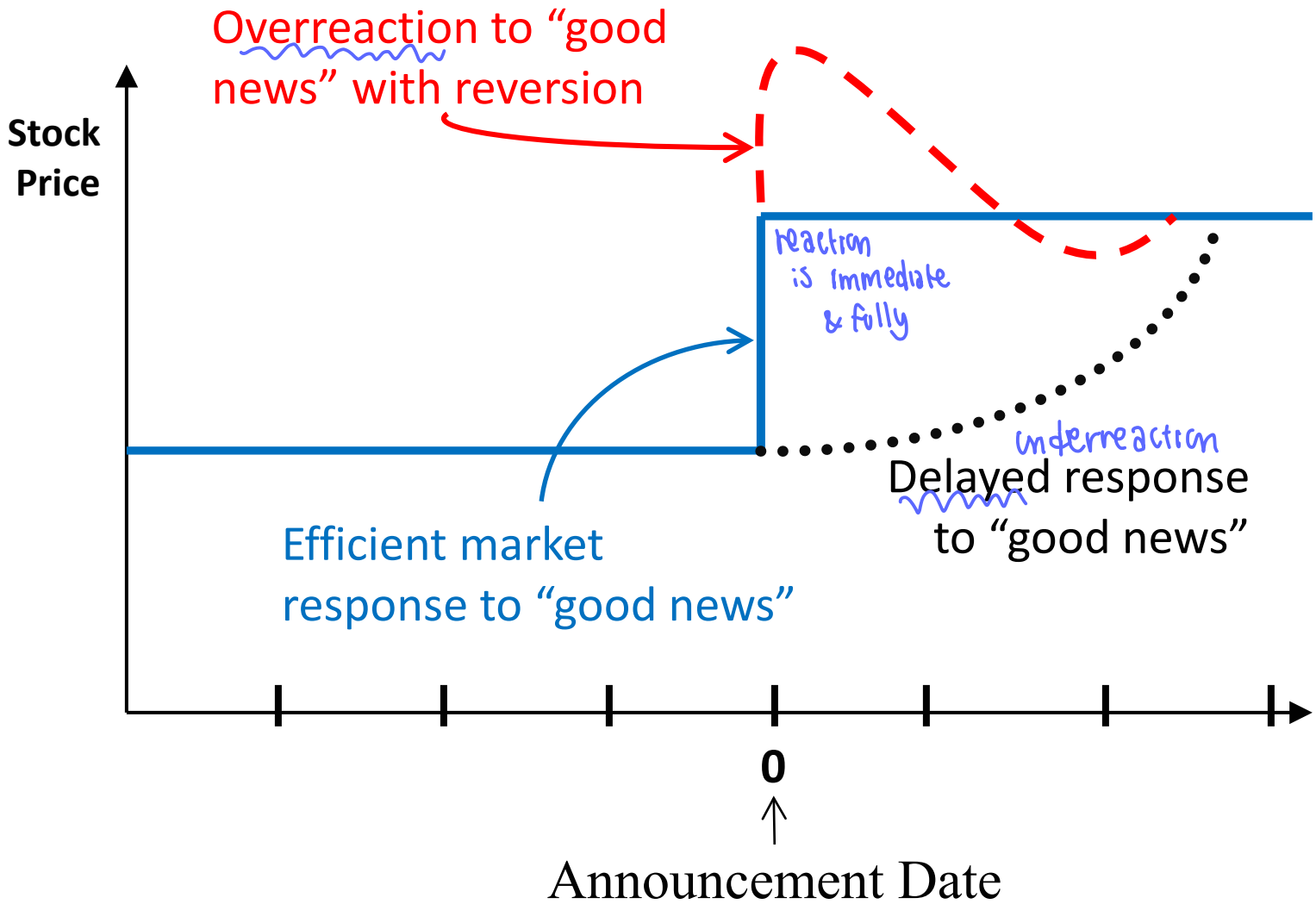
abnormal return (AR)



cumulative abnormal return (CAR)



Price Reaction: Speed of Adjustment



Take-Over Announcement (Target Firms)

Tend to use 2-3 month gap before event window

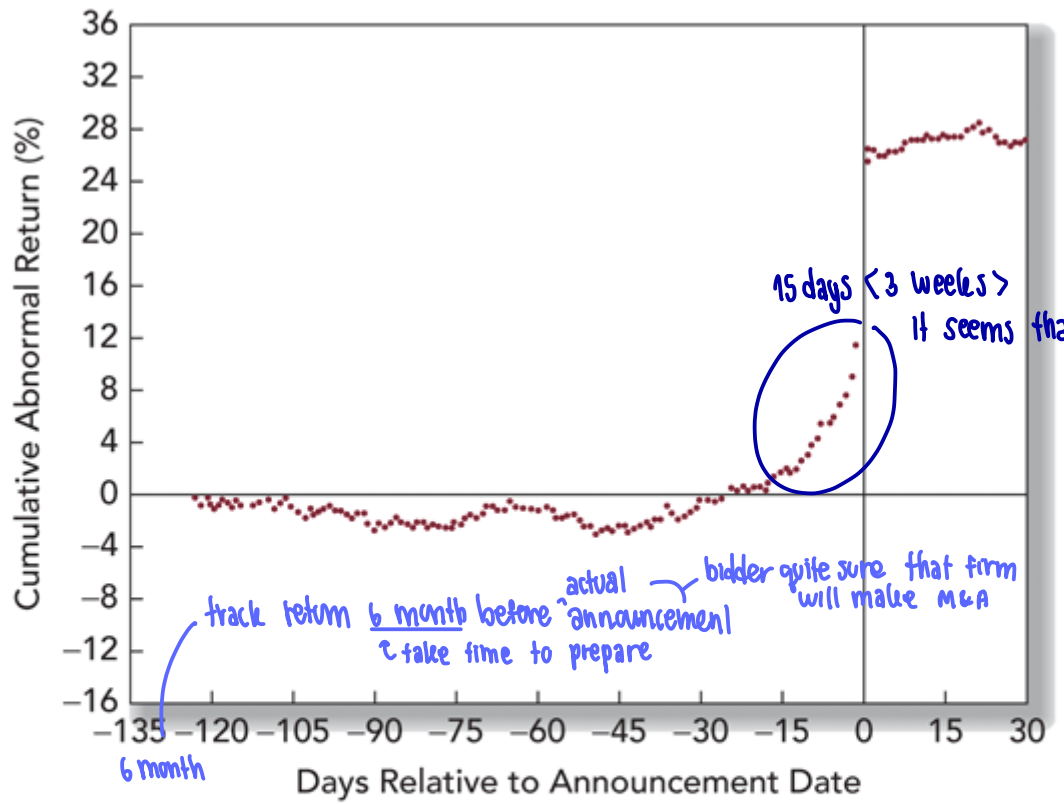
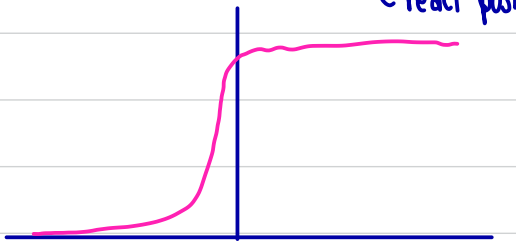


FIGURE 11.1 Cumulative abnormal returns before take-over attempts: Target companies

Source: Arthur Keown and John Pinkerton, "Merger Announcements and Insider Trading Activity," *Journal of Finance* 36 (September 1981). Reprinted by permission of the publisher, Blackwell Publishing, Inc.

Stock split (1-to-4) 1 old stock become 4 new stocks

↳ react positively



M&A

Additional value → comes from synergy

↳ bidder tend to lose bcs they pay too much

Stock-split add additional value ? par value ↓ demand ↑ → push value of stock

- difficult to explain

↳ from people's mindset

B/S

Asset = 100	Lia = 40
	Eq = 60

} no change in asset & capital structure

Post-Earnings-Announcement Drift (PEAD)

US

ทั้งของ semi-strong

Actual EPS − E[EPS] > 0

good news

analysts consensus (outside SET 50)

limit to large firms (cause selection bias)

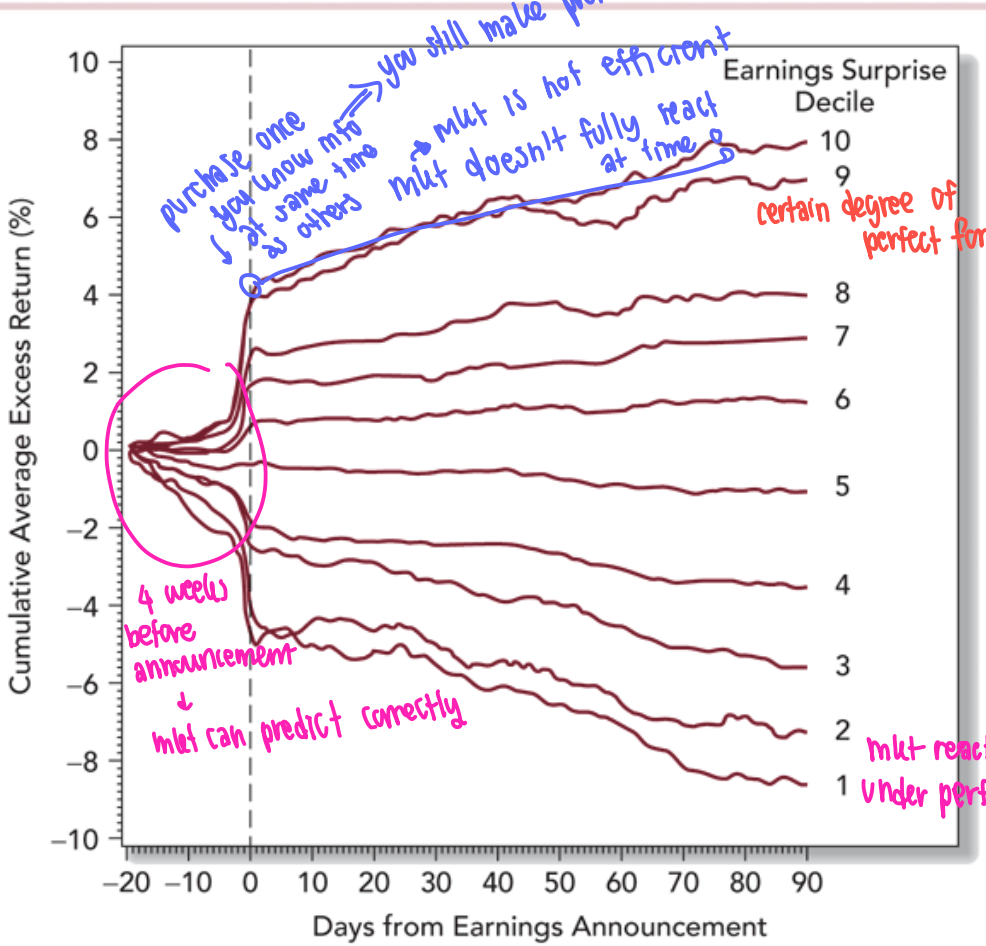


FIGURE 11.5 Cumulative abnormal returns in response to earnings announcements

Source: Reprinted from R.J. Rendleman Jr., C. P. Jones, and H. A. Latané, "Empirical Anomalies Based on Unexpected Earnings and the Importance of Risk Adjustments," *Journal of Financial Economics* 10 (1982), pp. 269–287. Copyright 1982 with permission from Elsevier Science.

5. Strong Form Tests

→ SEC announce after a day
→ corporate insider
→ test whether they can beat mkt
→ fund manager
→ security analyst

know info more than average investors

On average, analyst & fund manager cannot beat mkt.

1) Analyst Forecast and Fund Performance

2) Inside Trading

1) Analyst Forecast and Fund Perf

- Womack (1996) focuses on changes in analysts' recommendation and found that
  - A positive change in recommendation is associated with 5% price increase. A negative change in recommendation is associated with 11% in price decrease.
    - Do price changes come from buy/sell pressure of the recommendation or the revelation of true IV?
  - As price impact seems to be permanent, this implies that analysts' recommendation reveals real information not reflected in prices.

1) Analyst Forecast and Fund Perf

- Barber et al. (2001) find that analysts have tended to be overwhelmingly positive in their assessment of the prospects of firms. Note that sell-side analysts work for brokerage firms.
- They find that portfolios formed according to analyst recommendations earn abnormal returns. However, such portfolios have heavy trading activities that would probably wipe out the potential profits.

1) Analyst Forecast and Fund Perf

- In sum, the literature suggests some value added by stock analysts, but ambiguity remains.
  - Revelation of new information or price pressure in response to the recommendation?
  - Can one actually make abnormal profit net of trading costs?

1) Analyst Forecast and Fund Perf

- **Average performance**

return of fund manager

CAPM: $RP_{P,t} = \alpha_P + \beta_P RP_{M,t}$

3-Factor Model: $RP_{P,t} = \alpha_P + \beta_{M,P} RP_{M,t} + \beta_{S,P} SMB_t + \beta_{D,P} HML_t + \varepsilon_{P,t}$

4-Factor Model: $RP_{P,t} = \alpha_P + \beta_{M,P} RP_{M,t} + \beta_{S,P} SMB_t + \beta_{D,P} HML_t + \beta_{RPT,P} \underbrace{RPT_t}_{\text{return of momentum port} \Rightarrow \bar{r}_{\text{past winners}} - \bar{r}_{\text{past losers}}} + \varepsilon_{P,t}$

- Some individual managers are able to earn positive abnormal return. However, on average they earn negative abnormal returns.

Performance of Mutual Funds

Type of Fund	No. of Funds	Alpha (%)	T-statistics for alpha
Equity Funds			
Maximum Capital Gain	12	–4.59	–1.87
Growth	33	–1.55	–1.23
Growth and Income	40	–0.68	–1.65
Balance Funds	31	–1.27	–2.73

expenses have been included already → doesn't imply that fund manager doesn't have skill

& should be compared to index fund

include expenses

incur too much expenses to investors

On average, α is negative

$r = \frac{NAV_1 + NAV_0}{NAV_0}$

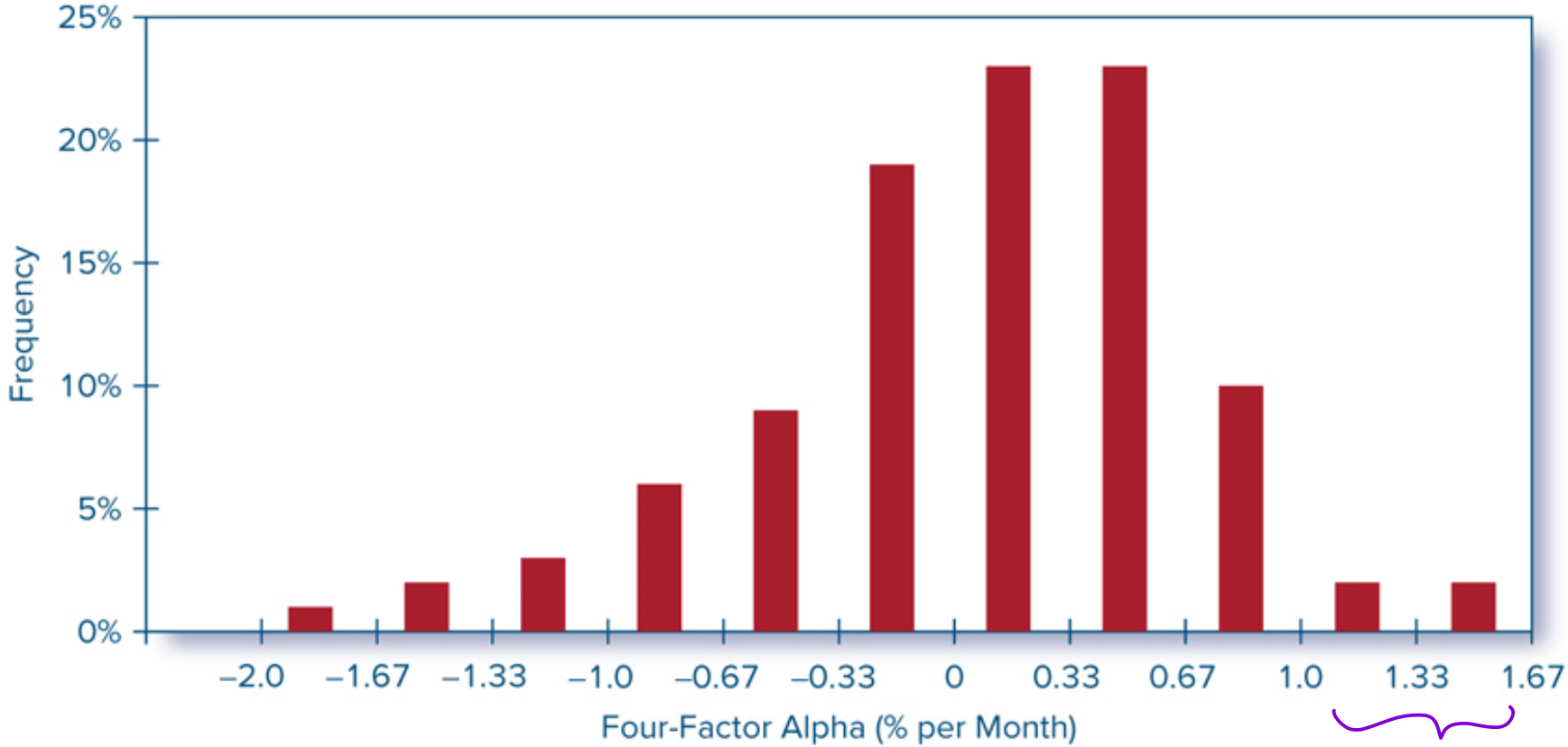
Alpha for each fund is calculated from the three-index model

$$R_{P,t} - R_{F,t} = \alpha_P + \beta_{M,P}(R_{M,t} - R_{F,t}) + \beta_{S,P}SMB_t + \beta_{D,P}HML_t + \varepsilon_{P,t}$$

Source: Elton, Gruber, Das and Hlavka (1993)

Mutual Alphas Based on a 4-factor model, 1993-2007

↳ can be used only if there's performance persistence



some managers can earn ⊕ α

Source : BKM (2023)

performance may not be persistence

Table 11.1

Consistency of Investment Results. Percentage of top-half funds that remain in the top half in the following two years.

	Number of top-half performers in year ending June 2019	Percentage of 2019 outperformers that perform in top half of sample in year ending June 2020	Percentage of 2019 outperformers that perform in top half of sample in both year ending June 2020 and year ending June 2021
All domestic equity funds	1,041	71.8	19.0
Large-cap equity funds	373	61.1	25.5
Small-cap equity funds	261	69.4	16.5

less than 20% still in top ranking

Source: Berlinda Liu and Gaurav Sinha, "U.S. Persistence Scorecard, Mid-Year 2021," *S&P Dow Jones Indices*, October 2021.

Source : BKM (2023)

1) Analyst Forecast and Fund Perf

- Performance persistence
  - Most managers do not have persistent relative performance.
  - Very small number of managers are able to maintain superior performance over time.

2) Inside Trade

Track trading activity of insider

Not useful bcs investors can do insider trading in some firm

- The SEC publishes an official summary of security transactions and holding of firms' insiders. This data allow researchers to test the strong form EMH.
- Givoly and Palman (1985) document the tendency for stock prices to rise after insider intensively bought shares and to fall after intensive insider sale.
- Seyhun (1986) studies whether following insider transactions after the information is known to public would provide abnormal return. The author uses information on insider trading activities published by the SEC. He find no evidence of abnormal return.

6. Behavioral Finance

believe that investors aren't rational
↳ price cannot fully reflect info
↳ mkt is not efficient

EMH : believe that all investors're rational
↓ rational price

1) The Behavioral Critique

1) The Behavioral Critique

- EMH assumes that individuals make rational decisions.
- Several anomalies evidence, however, has led some economists to believe that individuals do not always make rational decisions.
- This has led to the development of a relatively new school of thought called ***behavioral finance***.

Rational

① Rational behavior → axioms of choice

② Rational expectation : on average, we make correct expectation regarding stock price

$$P_{i,t+1} = E[P_{i,t+1} \mid \Phi_t] + \varepsilon_{i,t+1}$$

not systematically mispricing

$E[\varepsilon_{i,t+1}] = 0$

if > 0 expectation always under actual → increase expectation

* adjust expectation as there's new information

1) The Behavioral Critique

current price not always reflect intrinsic value

- Behavioral finance argues that market prices are not always rational, that is, on average prices could deviate from their intrinsic values. not rational
- As it is difficult to exploit mispricing in the market, the failure to uncover obviously successful trading rules or successful traders cannot be taken as proof of market efficiency.

1) The Behavioral Critique

- Irrationalities fall into 2 broad categories

rational expectation (cognitive bias) → cause investors cannot adjust their expectation

  - **Information Processing** (rational expectation): Individuals do not always process information correctly. They could infer incorrect probability distributions about future rates of return.

Emotional bias

  - **Behavioral bias** (rational behavior): Individuals often make inconsistent or systematically suboptimal decisions.

Game

Ⓐ $0
- H = $0 → 0
- T = $50 → 50

Ⓑ + $50
- H = -$50 → 0
- T = $0 → 50

Ⓐ ~ Ⓑ

If you behave in accordance with axioms of choice, you will be indifference btw A & B

⇓

even payoff is exactly the same you will not feel indifference btw A & B

↳ called framing problem

1) The Behavioral Critique

arbitrage will not be risk-free
lack of evidence that there's oppo
cannot conclude that mkt is efficient

- The existence of irrational investors would not by itself lead to inefficient capital markets, as sharp-eyed arbitrageurs will take advantage of profit opportunities and push prices back to intrinsic values.
- Therefore, the behavioral finance also argues that in actual markets there are constrains that limit arbitrage activities to take place. These limits to arbitrage cause mispricing to remain in the market.

Information Processing

- **Limited Attention:** Investors have limited time and attention and may rely on rules of thumb or intuitive decision-making.

port will not be fully diversified

- **Overconfidence:** investors overestimate their forecasting abilities.
- **Conservatism:** investors are too slow in adjusting their beliefs to new information.

use small samples to represent population

- **Representativeness Bias:** investors draw conclusions from too little data

div + $1 stock - $1

div $1
cap gain $1 } the same

Behavioral Bias

- **Mental accounting:** People segregate certain decisions. Investors may treat 2 parts of their investment portfolios, the initial investment (principal) and accumulated profits, differently.
  - Momentum in Stock Price: After a stock market run-up, investors may view investments as largely funded out of a "capital gains" account, become more tolerant of risk and thus push up prices.

make same prospect

Situation (A) — Now → $-\$1000$ — $+\$1,100$

Situation (B) — $-\$1,660$ — $+\$1,100$

gain ⇒ sell (A)

↳ people tend to sell stock that gain quickly to avoid lose in the future

lose

↳ lose aversion < bias >

prospect theory

hold on losing stock too long

ผล lose aversion → ถ้าแก้ risky assets return decrease wealth

ศึกลงทุนที่เป็น loss aversion จะทำไงกับ port?

↓

สรุปจะ take on more risk to avoid a loss

Behavioral Bias

- **Regret avoidance:** People feel more regret on a bad decision if the decision was more unconventional. A loss on a blue-chip stock is less painful that the same size of loss on an unknown start-up firm.
  - Size and BTM effects: High BTM firms tend to have depressed stock prices. They are out of favor stocks. Small firms are less well known and less conventional investment. Investors could become more risk averse and require more returns on these stocks.
  - Investors may not buy a stock whose prospects are not good even though $P_0 < IV_0$.

Behavioral Bias

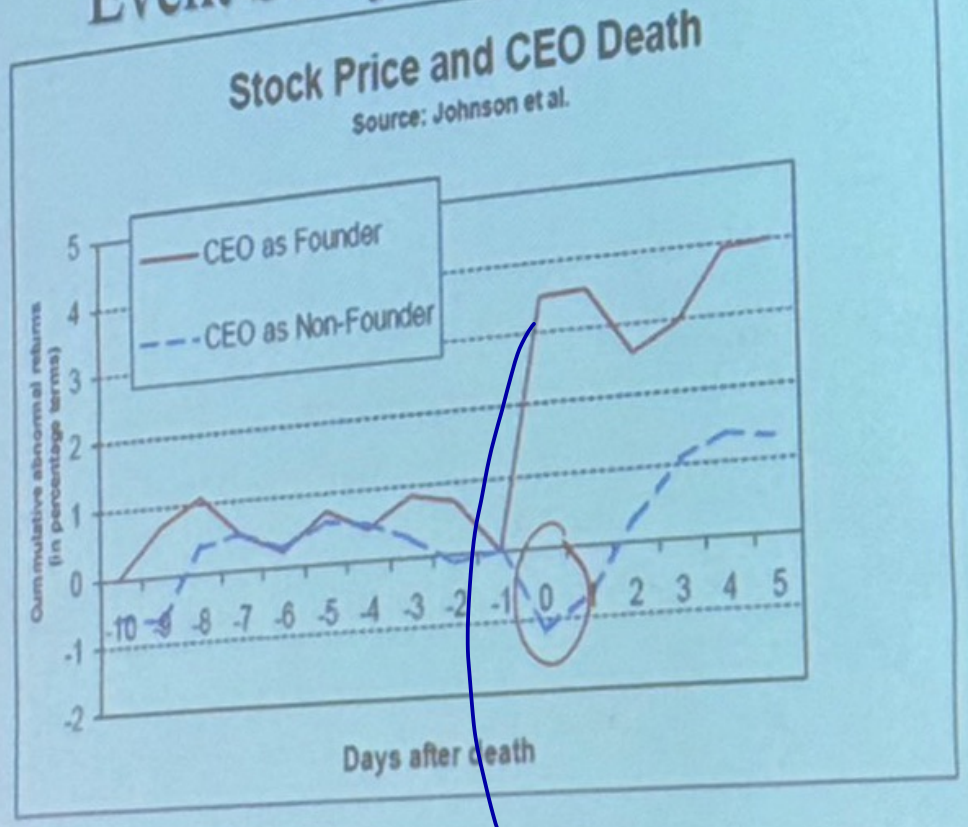
- **Prospect theory:** In standard utility theory, we assume investors are “risk aversion”. A competing description of preferences is “loss aversion”.
  - Loss aversion behavior results in investors being risk seeking when it comes to losses. They will take more risk when their current investment positions are at a loss.

Limits to Arbitrage

- **Fundamental risk:** Price might eventually move to IV, but the time it takes could be too long.
- **Implementation costs:** Profit taking transactions will not take place, if the trade profit does not exceed transaction costs.
- **Model risk:** There is a chance that the model used to estimate intrinsic value of stock could be wrong.

good news for firm ??

Event Study: Death of CEO



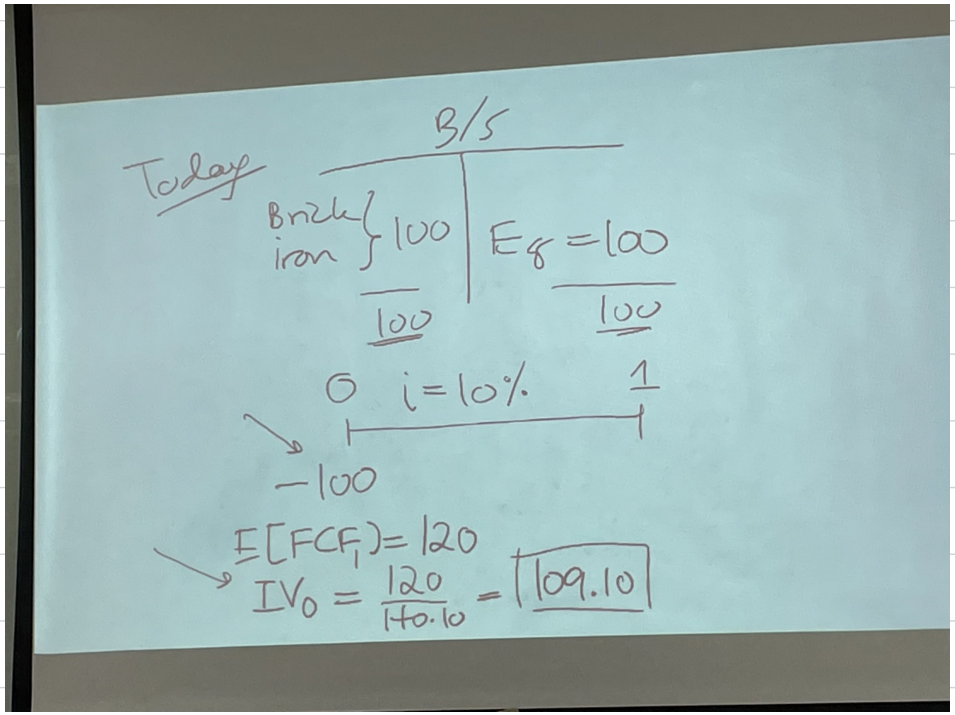
founder still maintain power ⇒ may affect wealth of other shdr

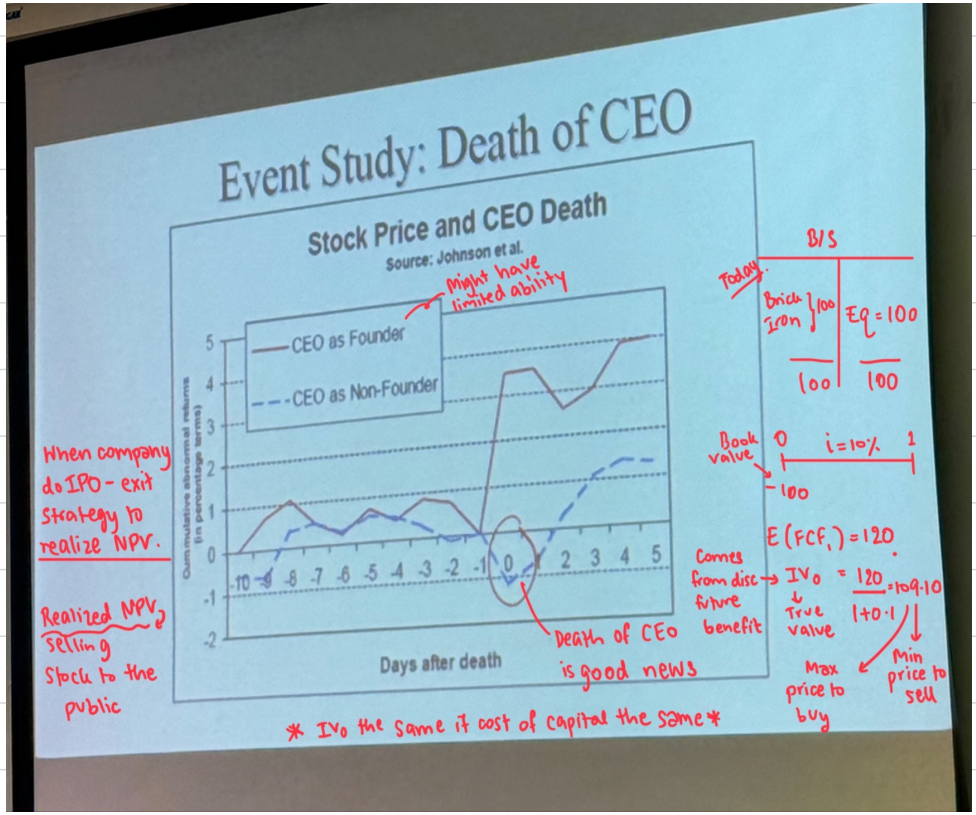
Another example:

Today

B/S

Brick iron	100	Eq :	100
	100		100





Conclusion

▷ Three arguments

① Investors themselve have limit ability to process information → may not develop unbiased estimation <cognitive bias>

② Emotional biases : not axioms of choice

③ In practice, there're a lot of cost to do arbitage <not risk-free & could be costly> → irrational price may remain

Conclusion

- Three arguments why market price could be irrational and price may not be quickly adjusted.
  - Limitation in information processing (cognitive bias)
  - Behavioral biases (emotional bias)
  - Limits to arbitrage

Game of chance: If you behave according to axioms of choice → decide on the final payoff

↳ investors should feel indifferent btw Ⓐ & Ⓑ → but not → emotional bias

Ⓐ

$0 → H : +$50 → +$50

$0 → T : $0 → $0

Ⓑ

+$50 → H : $0 → +$50

+$50 → T : −$50 → $0

Conclusion

- The EMH is based on the promise that investors are rational. On average, investors in the market react correctly to new information.
- EMH implies that security prices serve as reliable guides to the allocation of real assets. An efficient capital market leads to efficient allocation of resources.
- The debate on whether the capital markets are efficient is far from over.
- An alternative school of thought, called “behavioral finance”, arguing that human behavior is not always rational.

Conclusion

- However, many economists believe that this relatively new school of thought is still too unstructured (i.e., not a unified theory).
  - Basically, virtually any anomaly can be explained by some combination of irrationalities chosen from a list of behavioral biases.

Homework

- “In efficient markets, prices are always at their fair levels. This implies that buy-and-hold of a fully diversified portfolio (passive) is an efficient investment strategy. Thus, in such market fund managers add no value to the investment community.” Comment whether you agree with the statement.
- Recently, a chartist has successfully used historical data to show that his trading strategies earn higher net returns (i.e., after trading costs are deducted) than a buy-and-hold strategy on the same stocks. He argues that his result is an evidence to reject the EMH. Comment whether you agree with his conclusion (Your comments should be based on existing empirical evidence).
- A small number of investors, such as Peter Lynch, Warren Buffet and John Templeton, have shown that they can persistently beat the market. Does this mean the market is not efficient?

Homework

- Problems 7, 15-16, and 27 and CFA Questions 1-6 and 9-10 in Bodie, Kane and Marcus (BMK), Chapter 10 (p.347-351)