



# FINM3407 – Behavioral Finance

## Topic 3:

Chapter 4: Challenges to Market Efficiency

*Reference: Ackert and Deaves, Chapters 4*

Dr. Shirina Lin August 2024

# What we do this week

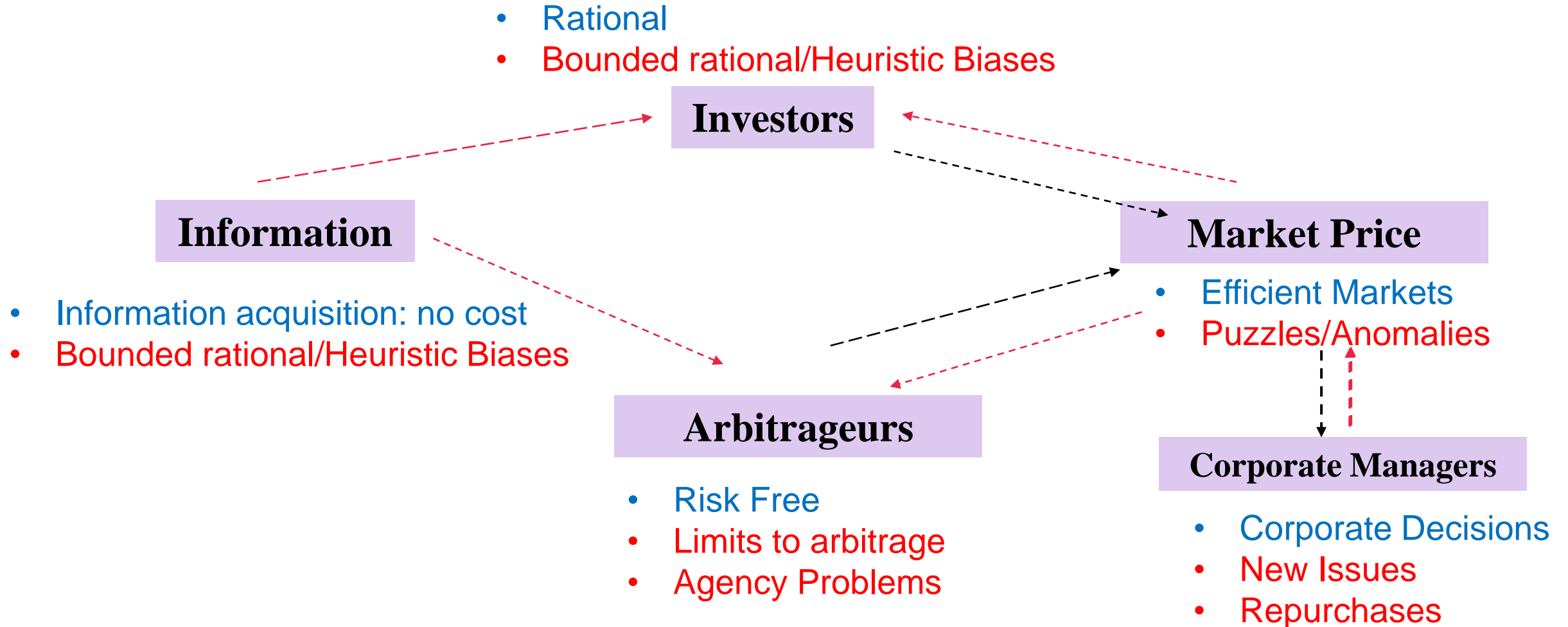
## [Part One – Efficient Market Hypothesis]

- Overview about Efficient Market Hypothesis
- Theoretical foundations and assumptions

## [Part Two – Challenges to Market Efficiency]

- Rationales supporting efficient market hypothesis
- Theoretical challenges and Empirical challenges

# Traditional Finance vs. Behavioral Finance



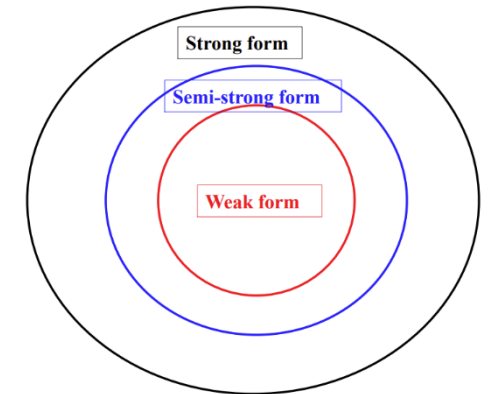
# Efficient Market Hypothesis - Overview

Only **new information** will *move* stock prices and this information is equally likely to be good news or bad news

The **competition for information** makes the capital market informationally efficient.

- The market processes information quickly and efficiently  
→ Prices reflect the information in the market.
- Market efficiency can be categorised:
  - The weak form asserts that all information to be derived from *past stock prices* and *trading volume* is already reflected in stock prices.
  - The semi strong form claims that all *publicly* available information is already reflected.
  - The strong form, which generally is acknowledged to be extreme, asserts *that all information*, including *insider information*, is reflected in prices.

Information content and three forms of EMH



# Efficient Markets

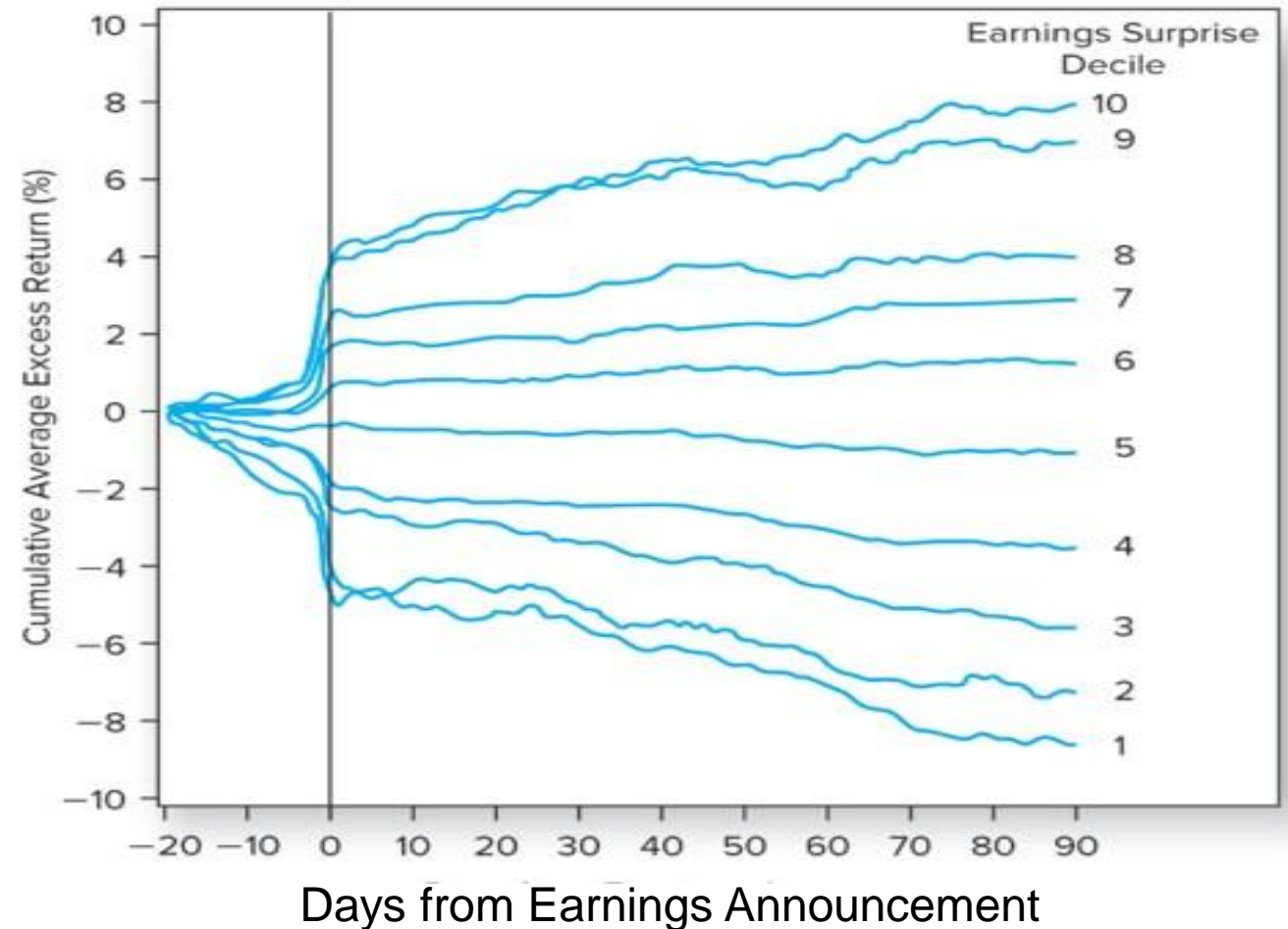
It makes sense to think that the current price of a traded security incorporates all information

→ prices or returns are unpredictable.



## Are Markets Efficient? Semi-strong Form

- But investors underreact to news, e.g., post earnings announcement drift (PEAD).
- The evidence is against **semi-strong form efficiency**
- i.e., Prices do not incorporate all public information quickly enough.

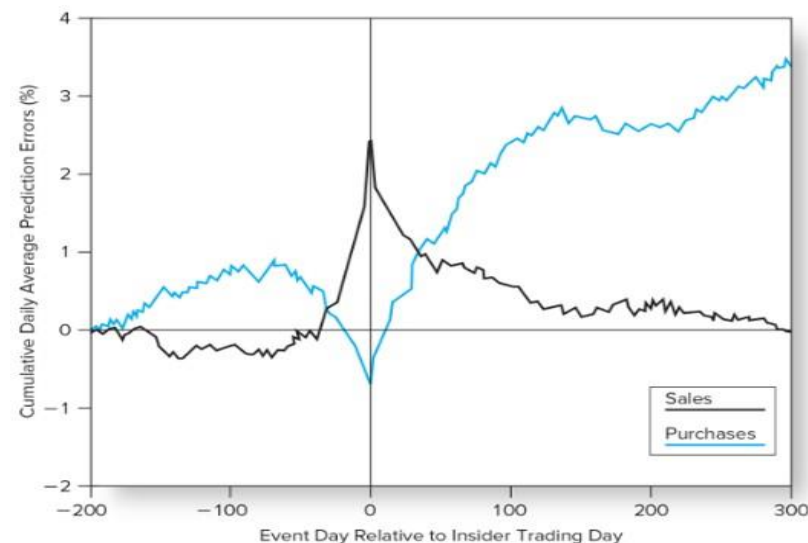


# Are Markets Efficient? Strong Form

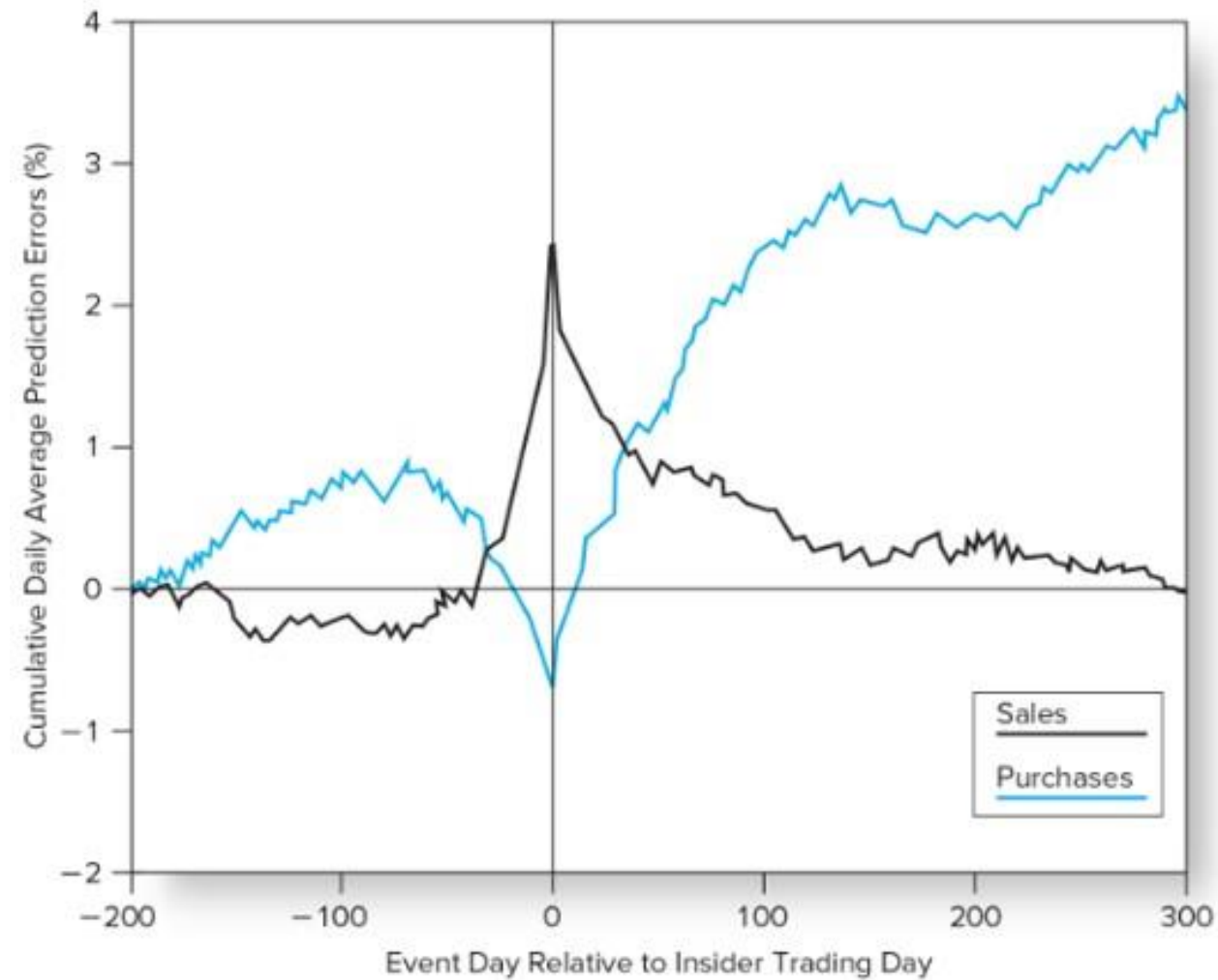
## Strong-form tests

- Do stock prices fully reflect all information including information known only to insiders (directors, management)?
- If insiders can freely trade on their inside information then we might expect their trading to move price to where it reflects that information

Some studies have found insiders time their purchases and sales very profitably on average.



## Are Markets Efficient? Strong Form





## Efficient Market Hypothesis - Implications

- **Technical analysis**: focuses on *stock price patterns* and on proxies for buy or sell pressure in the market.
- **Fundamental analysis**: focuses on the determinants of the underlying value of the firm, such as *current profitability and growth prospects*.
- Because both types of analysis are based on **public information**, neither should generate excess profits if markets are operating efficiently. That is, either ***technical analysis or fundamental analysis is not useful in predicting security price movements***.

Proponents of the **efficient market hypothesis** often advocate **passive** as opposed to **active** investment strategies.

- The policy of passive **investors** is to buy and hold a broad-based market index.

They expend resources neither on market research nor on frequent purchase and sale of stocks.

That is, investors would be **better off buying and holding an index fund or exchange traded funds (ETFs)** than attempting to buy and sell individual securities or actively managed mutual funds. Examples: Track fund (2800) and H-share fund (2828)

## Random Walk ➡ Efficient Market Hypothesis

- **Burton Malkiel:** Yes, Random walk ➡ Efficient market hypothesis
- **Richard Thaler says:** No, Random walk > Efficient market hypothesis
  - (1) Prices generated by noise traders could be random but could be deviated from the fundamental value.
  - (2) A drunk person walks on the street ➡ random walk, but not efficient.
- ***Alternative interpretation (Richard Thaler)***
  - (1) Prices are right (EMH) ➡ No free lunch (no arbitrage opportunity)
  - (2) No free lunch > Prices are right (EMH)

# Efficient Market Hypothesis: Theoretical Foundations

## • Three arguments

1. *Investors are rational* and *they value securities rationally*. ( $\Rightarrow$  rational trades)

- Rationality implies efficient market hypothesis.

2. *However, EMH does not absolutely require rationality.*

$\Rightarrow$  Although some investors are *irrational*, if their trades are *random*, their irrational trades cancel out each other without affecting prices. ( $\Rightarrow$  irrational random trades)

One possible model: With random noise traders whose actions are random and hence *uncorrelated*, their trades are likely to cancel out each other.

Implication: volume may be substantially high, but prices are always close to the fundamental value.

## Efficient Market Hypothesis: Theoretical Foundations ... cont'd

**3. EMH does not even require noise traders' uncorrelated actions. EMH depends on arbitrage (Fama, 1965 and Friedman, 1953).**

- Even if there are investors with *systematic irrationality*, *rational arbitrageurs* can correct the errors of noise traders. This is by far the most important. (=> no risk for arbitrage)
- The simultaneous buy and sale of the same or essentially similar security in two different markets to take the advantage of different prices.

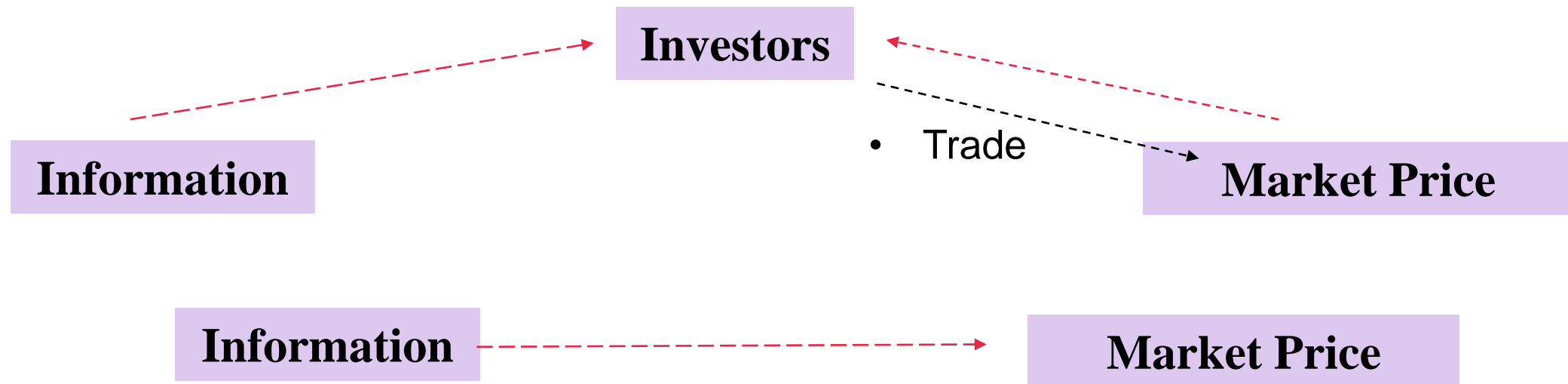
- *For example,*
  - *Royal Dutch (traded in the US) vs. Shell (traded in the UK)*
  - *Price of gold in NY vs. Price of gold in London*
- *Smart arbitrageurs notice the mispricing induced by “dumb” noise traders and trade against them to bring the price towards the fundamental value.*

# Efficient Market Hypothesis: Assumptions

- The argument underlying the EMH is that investors *are smart*:
  - ☐ They buy any security that is a “good deal”
  - ☐ They sell any security that is “overpriced”
- *Competition* between investors ensures securities are properly priced.
- Key assumptions:
  - ☐ Investors can *access to* and have the ability to process information
  - ☐ Investors *are rational* (rational expectations and expected utility maximization)
  - ☐ There is *no limit of arbitrage*

## Efficient Market Hypothesis: Assumptions

- The assumption that investors are able to “*see through*” all available information and *process* it *perfectly* suggests that



- We can directly link information and prices

That is, we can ignore actual investor behavior.

# Are Markets Efficient? Event Studies

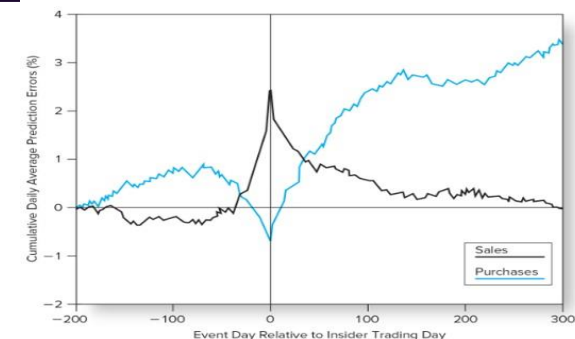
An event study is an empirical technique used to examine the impact of an event on the value of a group of securities (academic research, litigation).

If markets are trading on information then we should be able to observe how quickly the markets react to important events. We can measure the importance of an event by examining price changes around the time of the event.

## Event Studies

### *Steps in conducting an event study:*

1. Identify an event of interest.
2. Identify a large group of companies impacted by that event.
3. Measure the actual return around the event day for each company (often 3 days around event day).
4. Calculate the expected return over that same period. For example, expected return = market return or CAPM, or FF4 model.
5. Calculate the abnormal return: **Actual return** minus expected return i.e.,  $\alpha$ .
6. Sum the abnormal returns across all companies then test whether the abnormal return is significantly different from zero.



# Rationales Supporting Efficiency

Fama (1998): Two reasons

## 1. Anomalies are chance results

- Apparent overreaction to information is about as common as underreaction.
- Post-event continuation of pre-event abnormal returns is about as frequent as post-event reversal.

## 2. Apparent anomalies can be due to methodology (more serious)

- **A joint test:** Fama (1970) emphasizes that market efficiency must be tested jointly with a model for expected (normal) returns. (we covered in Lecture One).
- Bad-model problems
  - Any asset pricing model is just a model and so does not describe expected returns (wrong model)
  - Even if there were a true model, any sample period can produce systematic deviations from model's predictions. (I.e., there are chances for sample-specific patterns). Example: CAPM does not seem to describe expected returns on small stocks (sample specific)
  - To limit bad-model problems, one can use the market model or the comparison model approach (how to remedy)
  - The bad-model problem is *less serious in event studies* on short return windows. Bad-model errors in expected returns grow faster with the return horizon than the volatility of returns (short term: less a problem)



## Rationales Supporting Efficiency

### 2. Apparent anomalies can be due to methodology (more serious) – continued...

- The return metric issues
  - **Theoretical issue:** *Average “monthly” abnormal returns* (AARs or CARs) vs. *buy-and-hold abnormal returns*
  - **Statistical issues:** each method has its own drawback
  - *Equal-weight returns vs. value-weight returns*
  - *Adjusted vs. unadjusted cross-sectional correlation*
  - Most long-term anomalies tend to disappear with reasonable changes in technique

# Rationales Supporting Efficiency

## Other reasons:

- **Behavioral models are specific:** Barberis, Shleifer, and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1997), and Hong and Stein (1998):
  - Work well on the anomalies they are designed to explain (short-term underreaction and long-term overreaction)
  - Other anomalies are embarrassing.
- **Data mining** (Lo and MacKinlay (1990))
  - If a sufficient number of variables are correlated, some correlations will be statistically significantly different from zero. I.e., if we search enough, we can always find some anomaly in historical data.
  - Repeated visits to the same data set
  - Long term data are not more persuasive
- **Misinterpretation of size effect** (Berk (1995))
  - Operational size (such as total assets or sales) is unrelated to expected returns, but size is related to average return
  - Size is likely to proxy for omitted or misestimated risk
- **Econometric estimation limitations**
  - Sensitive to index inefficiency
  - Anomalies depend on econometric power
- **Attribute sorting problem** (Ferson, 1996, 1998) - May create the illusion of false risk factors

## i. Key trading rules that have shown to be effective

### Small cap portfolios vs. large cap portfolios?

- Small cap wins out!

### Portfolios formed based on P/Es:

- Low P/Es do better!

### Earnings announcements momentum:

- Reaction to extreme announcements is slow!

## ii. Key trading rules that have shown to be effective

### Value vs. growth portfolios (usually value firm has a high book/market and a growth firm here is one with an absence of value):

- Go for value!

### Predictable serial correlation:

- Medium-term momentum!

### Long-term winners vs. losers:

- Reversals: losers become winners!

## Value vs. growth portfolios: International evidence

Table 4.3: Portfolio Performance (%) for Value vs. Glamour Stocks in Various Countries (Source: Fama & French 1998)

Country	Market	B/P		E/P		CF/P	
		Value	Glamour	Value	Glamour	Value	Glamour
U.S.	9.57	14.55	7.55	14.09	7.38	13.74	7.08
Japan	11.88	16.91	7.06	14.14	6.67	14.95	5.66
U.K.	15.33	17.87	13.25	17.46	14.81	18.41	14.51
France	11.26	17.10	9.46	15.68	8.70	16.17	9.30
Germany	9.88	12.77	10.01	11.13	10.58	13.28	5.14

Source: Fama, E. F., and K. R. French, 1998, "Value vs. growth: The international evidence," *Journal of Finance* 53, 1975-99

In Table 4.3, the returns from various value investing (value stocks vs. glamour/growth stock) approaches (that is, using different price ratios as screens) are shown for the United States, Japan, the United Kingdom, France, and Germany during 1975–1995.<sup>1</sup>

We see that in all 15 cases value stocks outperformed glamour stocks, where value/glamour portfolios were formed within each country by forming portfolios from the top/bottom 30% of stocks for each year on the basis of beginning-of-year B/P, E/P, and CF/P.

## Reversal evidence

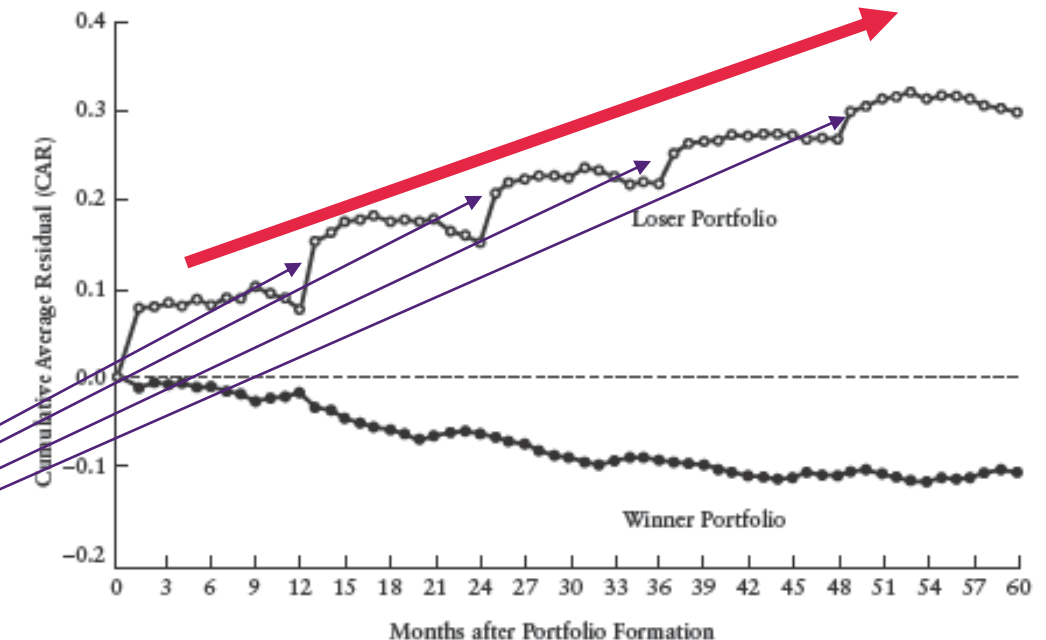
Figure 4.2, based on five-year formation periods and future returns being tracked five years out, indicates that there are substantial differences.

The difference between winners and losers is stark, with past losers substantially **outperforming past winners**.

Also salient from the figure are two other points:

1. much of the difference is generated by the strong performance of losers rather than the weak performance of winners;
2. much of the return boost/drop occurs in the month of January

FIGURE 4.2 Cumulative Average Residuals for Winner and Loser Portfolios of 35 Stocks (1–60 months into the test period)



Source: Figure 3 from De Bondt, W. F. M., and R. Thaler, 1985, "Does the stock market overreact?" *Journal of Finance* 40, 793–807. © 1985 Wiley Publishing, Inc. this material is used by permission of John Wiley & Sons, Inc.

## Momentum evidence

Several years later, intermediate-term (3–12 month) momentum was documented by Narasimhan Jegadeesh and Sheridan Titman. Their approach was similar to that of De Bondt and Thaler except that their return intervals were shorter. Table 4.4 reproduces some key results from their paper.

They found, for example, that a long-short zero-cost portfolio formed on the basis of returns over the previous six months earned an average excess return of 0.95% per month over the next six months.

Also, there is a **relationship between post-earnings announcement drift and momentum—though whether momentum disappears** after accounting for post-earnings announcement drift is a point of debate.

Table 4.4: Returns (%)/month and t-stats (in parentheses) for various momentum strategies

		Test period (months)			
		3	6	9	12
Formation period (months)	3	0.0032 (1.10)	0.0058 (2.29)	0.0061 (2.69)	0.0069 (3.53)
	6	0.0084 (2.44)	0.0095 (3.07)	0.0102 (3.76)	0.0086 (3.36)
	9	0.0109 (3.03)	0.0121 (3.78)	0.0105 (3.47)	0.0082 (2.89)
	12	0.0131 (3.74)	0.0114 (3.40)	0.0093 (2.95)	0.0068 (2.25)

Source: Jegadeesh, N., and S. Titman, 1993, "Returns to buying winners and selling losers: Implications for stock market efficiency," *Journal of Finance* 48, 65–91.

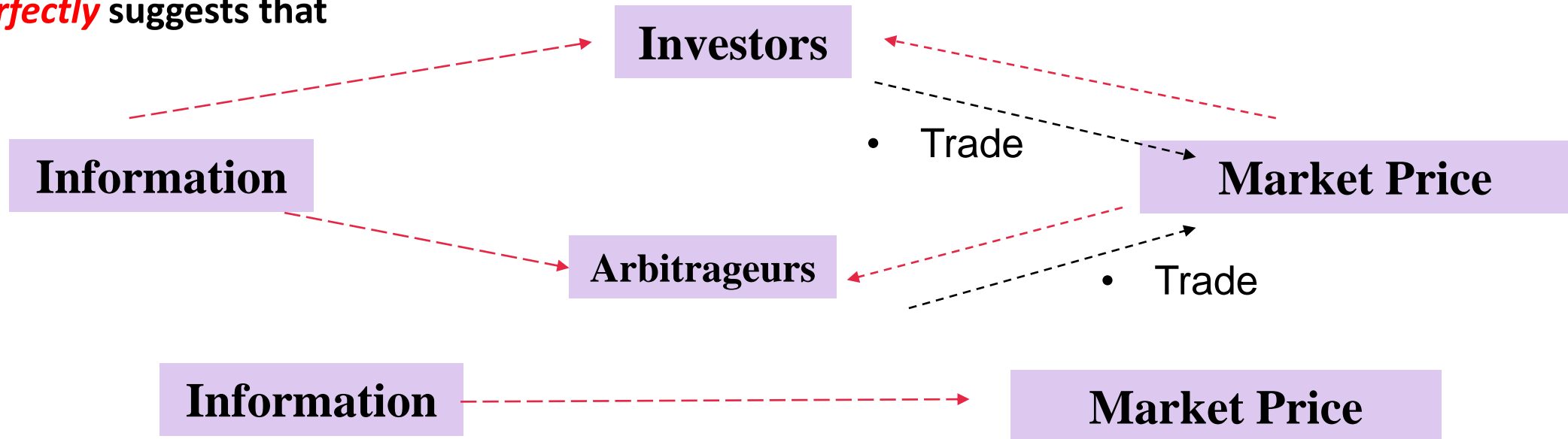
## Recall: Theoretical foundations of efficient markets

**Market efficiency requires that only one of the following three conditions need hold:**

1. Universal rationality
2. Uncorrelated errors
3. Unlimited arbitrage

## Recall: Efficient Market Hypothesis: Assumptions

- The assumption that investors are able to “*see through*” all available information and *process* it *perfectly* suggests that



- Arbitrageurs** would force the prices back into line:
  - To re-establish the link between information and prices
  - And again to allow us to ignore actual investor (and arbitrageur) behavior.



## Recall: Market efficiency and arbitrage

- One of main foundations of EMH is **no-arbitrage condition**.
- If there are **pricing errors** (e.g., caused by irrational investors) smart-money traders arbitrage them away.
- **No free lunches are left on the table!**

## “Prices are right” vs. “No free lunch”

Ross (2001) and Rubinstein (2001) point to the inability of professional money managers to beat the market as strong evidence of market efficiency. (Do you agree?)

- Barberis and Thaler (2003) argue that this statement is equivalent to the assumption that “no free lunch” implies “prices are right.”
- However, the performance of fund managers tells little about whether prices reflect fundamental value



- Which is more important: “prices are right” or “no free lunch” ?
- From *efficient capital allocation* point of view: “prices are right” is more important.

## Triangular Arbitrage

- ❖ Cross rates can be used to check on opportunities for intermarket arbitrage. Suppose the following exchange rates are available:

Barclays Bank: Australian dollars per pound sterling: A\$1.8410/£

Westpac Bank: Australian dollars per Euro: A\$1.2223/€

Deutsche Bank: Euro per pound sterling: €1.5100/£

- ❖ The synthetic cross rate between Euro and Pound and is:

$$\frac{\text{A\$1.8410/£}}{\text{A\$1.2223/€}} = \text{€ 1.5062/ £}$$

- ❖ Strategy: Buy Low Sell High = Buy € and Sell £

£ Overvalued

You get more  
Euro from and  
sell Pound to  
Deutsche Bank

## Triangular Arbitrage - An Example

Barclays Bank: Australian dollars per pound sterling:

Westpac Bank: Australian dollars per Euro:

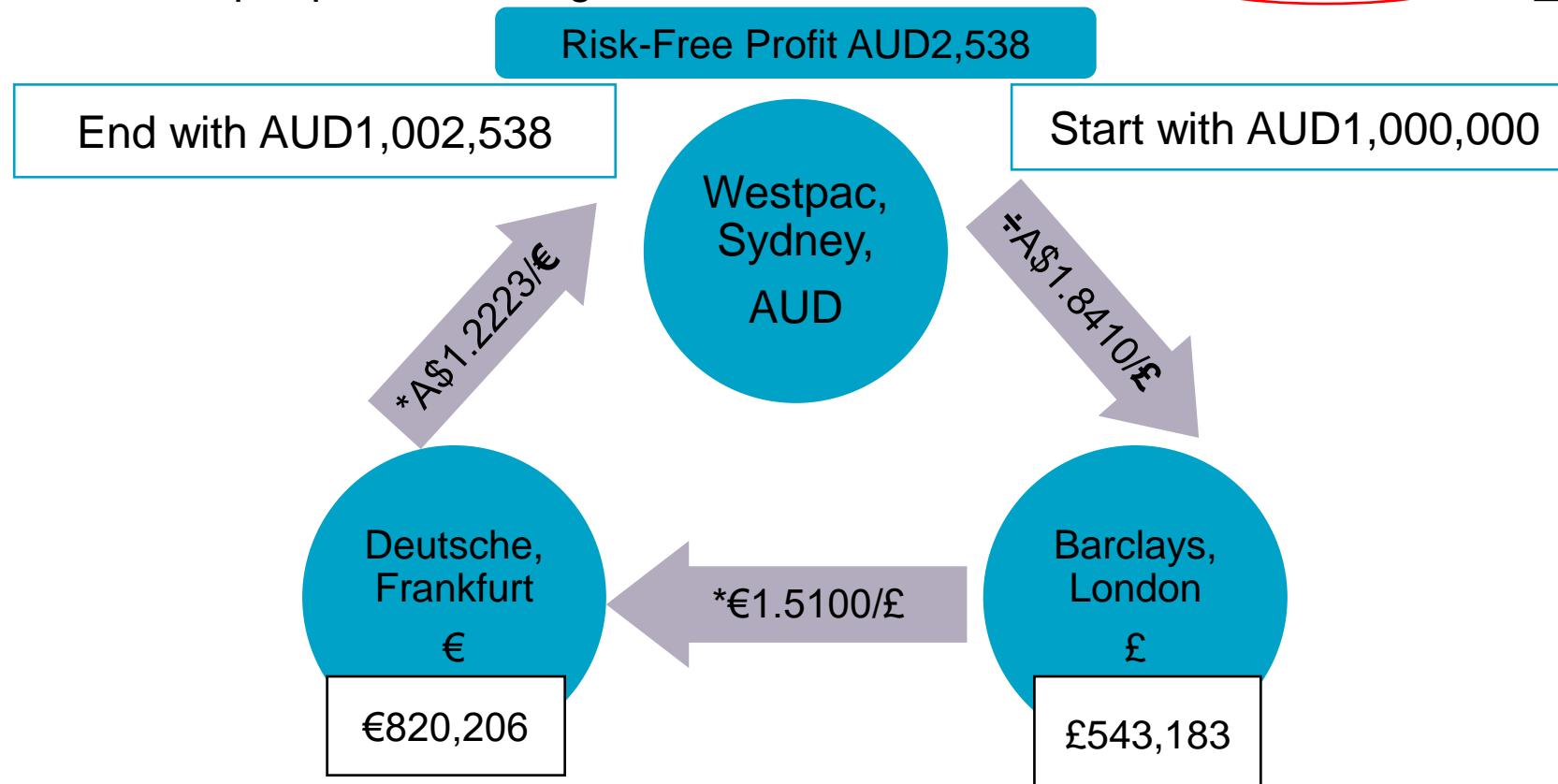
Deutsche Bank: Euro per pound sterling:

A\$1.8410/£

A\$1.2223/€

€1.5100/£

Strategy:  
Buy € and  
Sell £



## Multiple Choice Quiz

Barclays Bank: Australian dollars per pound: A\$1.8410/£

Westpac Bank: Australian dollars per Euro: A\$1.2223/€

Deutsche Bank: Euro per pound sterling: €1.5100/£

If I can change the quoted rate of €1.5100/£ to another number, so that there would be no more risk-free profit, what would that number be?

- a) €1.4700/£
- b) €1.5100/£
- c) €1.5300/£
- d) €1.5062/£
- e) I don't know the answer

## Is Arbitrage Risk-free?

However, when a mispricing occurs, strategies designed to correct can be **risky and costly**, thereby allowing the mispricing to survive for a long time.

- Example: A shares vs. H shares

## What hampers arbitrage exploitation?

1. Fundamental risk
2. Noise-trader risk
3. Implementation costs

# 1) Fundamental risk

- If you think a stock is underpriced you can buy it, but:
  - ❑ *You might be sideswiped by the market.*
  - ❑ *Or maybe by the industry.*
  - ❑ *Plus, there is idiosyncratic risk.*
- Pure arbitrage seeks to eliminate all of these.
- **Problem:** **you need to find perfect substitutes**. Or we can say it is the risk when *a perfect substitute is not available.*
- Ex 1: Ford is overpriced. Sell Ford and buy GM? But is GM a perfect substitute for Ford? (next slide)
- Ex 2: Huaneng power (902) vs. Datang power (991)

## But where are these substitutes?

- Say Ford is too cheap.
- You buy Ford.
  - ☐ But market may drop.
  - ☐ Or auto industry may drop.
- So you buy Ford and short GM.
  - ☐ But Ford itself may falter without industry or market dropping (idiosyncratic risk) .
- Even you totally manage fundamental risk, there is still noise-trader risk: spread may widen as investors get it even more wrong.



## Sentiment and noise

- Noise is opinion on value unrelated to fundamental information (i.e., based on misinformation)
  - Sentiment is correlated noise, and has the potential power to move markets.
  - This implies that price movements can be driven by misinformation rather than information.
- 
1. *Noise traders can influence the prices.*
  2. *Noise traders can earn more profits than arbitrageurs, when they are are bullish and are willing to take more risk, they create.*
  3. *Noise traders may not be driven out of the market.*
  4. *However, arbitragers have higher expected utility, while noise traders have lower expected utility*

## 2) Noise-trader risk

The idea is introduced by De Long et al. (1991) and Shleifer and Vishny (1997).

(Noise trader risk is the risk that mispricing being exploited by the arbitrageurs **worsen** in the short run)

- It has been shown that noise-trader risk is systematic, which means that it cannot be diversified away.
- Real world arbitrageurs cannot wait it out because as professional money managers they do not have long horizons – they are usually evaluated at least at once per year.

**== > Three issues:**

- (1) Principal – Agent Problems (Horizon Mismatch Risk)
- (2) Creditor Risk (Margin Risk)
- (3) Short Squeeze Risk

### 3) Implementation costs

- In some cases, horizon is short but short-selling is:
  - ❑ Expensive (commissions, spreads, price impact & fees for shorting stock)
  - ❑ Difficult or even impossible (lack of availability regardless of fees; legal factors: many institutions cannot short)

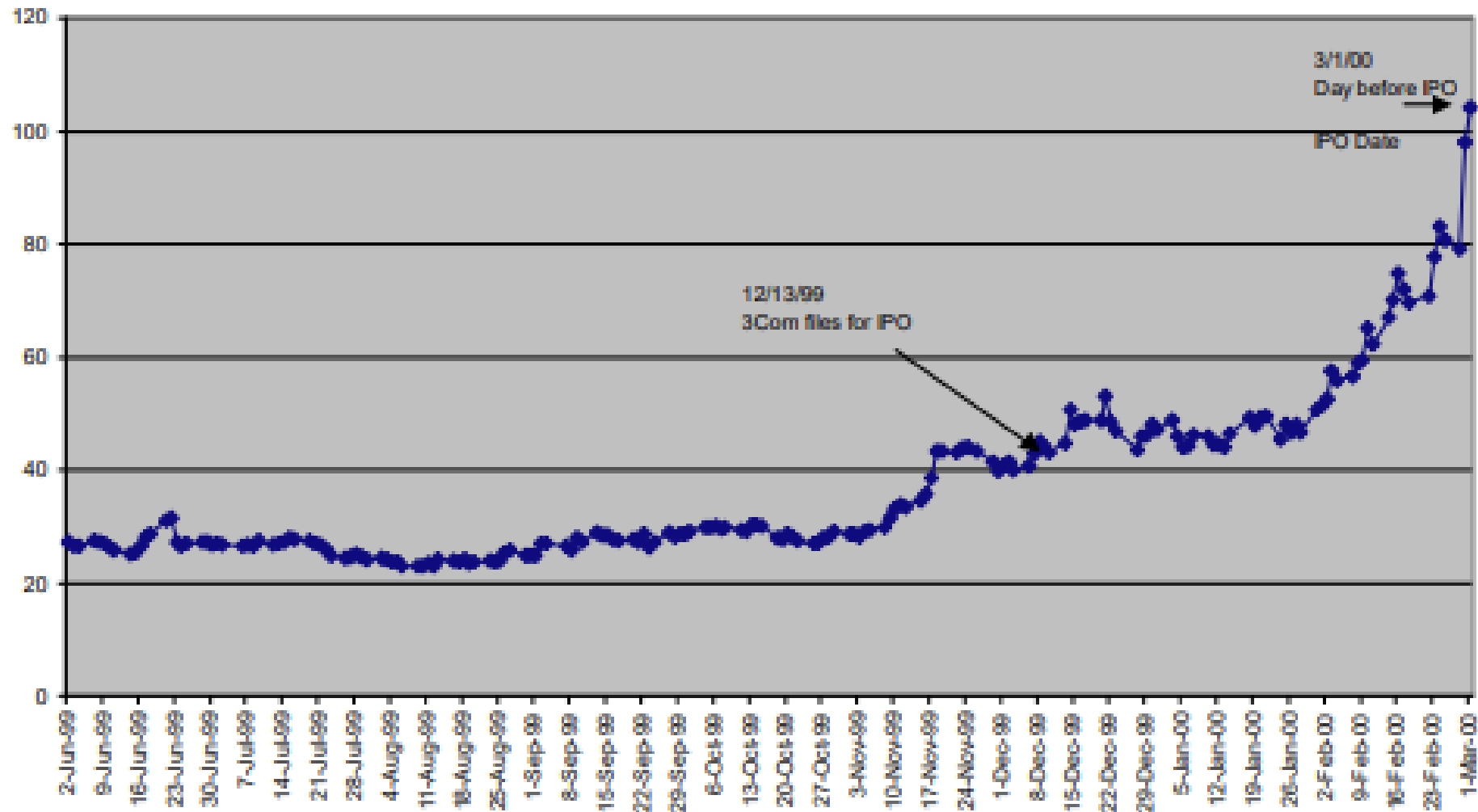
Plus there is cost of finding these arbitrage opportunities.

- Transaction costs: commissions, bid-ask spreads and price impact can make it less attractive to exploit a mispricing.
- Legal constraints: many pension and mutual fund managers are not allowed for short sales.
- Other costs: the cost of finding and learning about a mispricing and the cost of the resource needed to exploit it.

## 3Com and Palm

- Background: Before 2000, **3Com** owned **Palm** (via an acquisition of U.S. Robotics), a maker of handheld computers. 3Com was being ignored by the stock market during the Internet bubble period, especially compared to those sexy Internet companies.
- To gain the market recognition, on 12/13/1999, 3Com announced that it would sell a fraction of its stake in Palm to the general public via an IPO.
- In this transaction (called equity carve-out), 3Com retained ownership of 95% of Palm shares.
- **March 2, 2000: 3Com carves out in an IPO 5% of its subsidiary Palm.**
- At same time, 3Com announced that in the near future the remaining 95% of the shares would be distributed to current shareholders **(roughly 1.5 of Palm/share of 3Com).**
- **Two ways of buying Palm:**
  - ☐ Buy Palm directly.
  - ☐ Buy 3Com getting Palm and rest of 3Com business.

## 3Com Share Prices before the IPO of Palm



## 3Com and Palm cont.

Clearly if investors are rational:

$$P(3Com) = 1.5 * P(Palm) + \text{Residual value}$$

*What happened?*

• After 1<sup>st</sup> day of Palm trading:

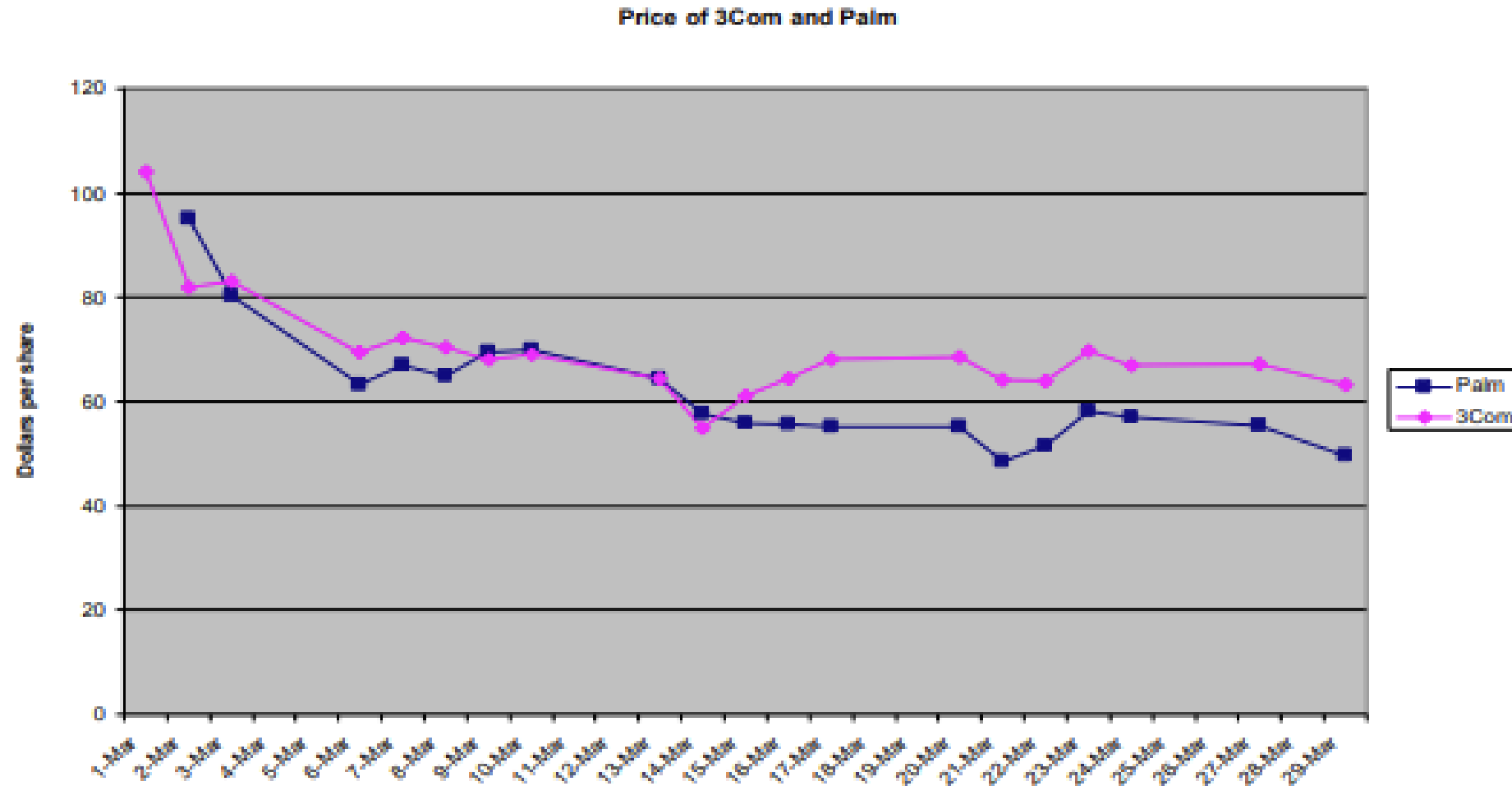
- $P(Palm) = \$95.06$
- $P(3Com) = \$81.81$
- *Implied residual value: less than zero.*

Implication: Value of residual 3Com was negative \$22 billion.

## 3Com and Palm cont.

- In addition, 3Com held cash and other marketable securities with more than **\$10** per share and operated a profitable network business.
- One analyst estimated that, all in all, 3Com's non-Palm component was worth **\$35** per share, which suggests that 3Com should be worth **at least \$142.5**, and possibly as much as **\$177.5**.
- 3Com shares closed the day before the IPO at just over **\$100 per share**.
- What happened *on the day* of the IPO?
  - Despite this high implied value, 3Com shares ended the day at **\$81.80**.  
*(In fact, 3Com share price actually fell 21% during the day.)*

## 3Com Share Prices AFTER the IPO of Palm





## 3Com and Palm cont. ii.

Everyone seemed to understand the situation:

- **“The nature of the mispricing was so simple that even the dimmest market participants and financial journalists were able to grasp it.”**

*Incredibly the **mispricing** persisted for months!*

*And other such examples can be cited!*

# What can explain this?

- “Smart” investors were limited in their ability to short-sell Palm (as documented in Lamont and Thaler), so it wasn’t their fault.
- But this cannot explain why anybody would buy Palm instead of 3Com – for this one needs irrationality.
- In facts 2 things are needed for mispricing to exist:
  - ❑ Irrational investors
  - ❑ Limits to arbitrage (here due to implementation costs)
- 3Com & Palm case illustrates that mispricing does not imply a free lunch!



## How Can the Mispricing Happen?

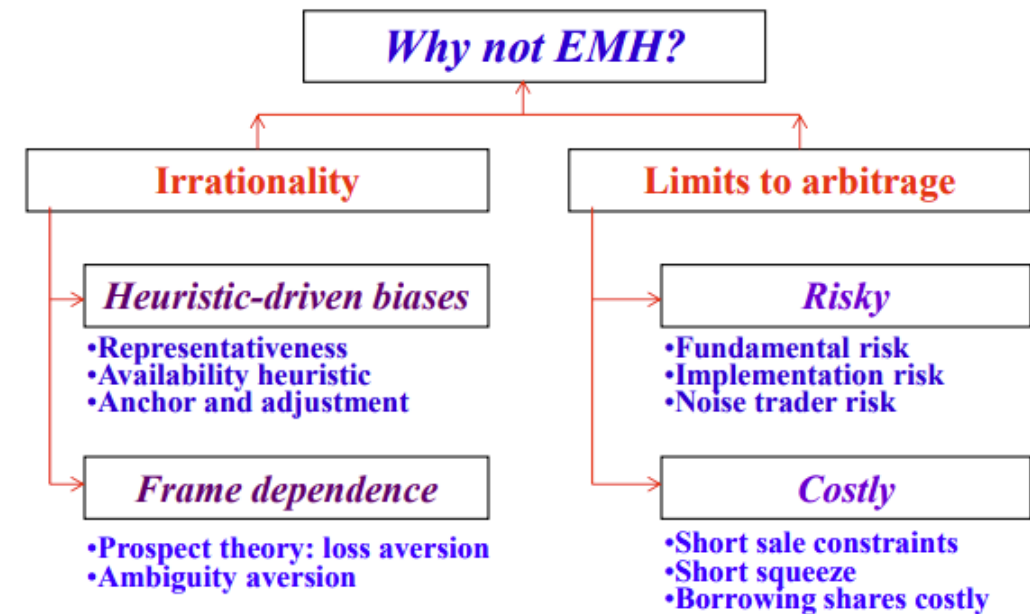
- Arbitrage costs and risks that arise in exploiting mispricing:

Example	Fundamental risk	Noise trader risk	Implementation risk
Royal Dutch/Shell	×	√	×
Index inclusions	√	√	×
3Com/Palm	×	×	√

- When the stock market cannot multiply by 1.5 in the cases of Royal Dutch/Shell and Palm/3Com, why doesn't arbitrage work?
- In the case of Royal Dutch/Shell, as mentioned before LTCM and other hedge funds did try to bet on the convergence. But, in December of 1998, the difference in prices was at the record highs and widened rather than narrowed!!
- Other examples:
  - Hong Kong H- vs. Shanghai A-shares;
  - A- vs. B-shares.

# Conclusion

- There are investors who are *not fully rational*. Furthermore, investors are deviated from rationality in a *systematic and consistent way*.
- The systematic and consistent irrationality cause *security prices deviated from their fundamental values*.
  - However, arbitrage is risky and therefore is limited and *mispricing may be worsened before getting better*.
- *Do not jump* in the conclusion too early to assume that *noise traders are the losers*.
- Noise traders *take on more risk and* they *need not die* out and may make more profits.





# FINM3407 – Behavioral Finance

## Lecture 3:

Thank you very much