

# Chapter 12 - Behavioral Finance and Technical Analysis

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## Conventional finance assumes that investors are rational, but behavioral finance does not

- The premise of behavioral finance is that conventional finance ignores how real people make decisions
- Conventional finance
  - Assumes that investors are always rational
  - Therefore, prices are correct and equal to intrinsic values
  - Therefore, markets efficiently allocate resources
  - Consistent with the EMH
- Behavioral finance
  - Does not assume that investors are always rational
  - *Requires “limits to arbitrage” so rational arbitrageurs cannot force prices to match intrinsic values*

## There are two broad categories of irrationalities in behavioral finance

- Information processing errors: Investors do not always process information correctly and, therefore, infer incorrect probability distributions of future returns
- Behavioral biases: Even when given the correct probability distribution of returns, investors may make inconsistent or suboptimal decisions

# Information processing errors: People have limited capacity to process information I

- Limited attention, underreaction, and overreaction
  - People have limited time and attention
  - Therefore, they rely on *heuristics* or rules of thumb
  - Limited information processing capacity may also cause them to: overreact to salient information, and underreact to less salient information
- Overconfidence
  - Investors tend to overestimate the precision of their beliefs
  - Investors tend to overestimate their abilities
  - May lead to excessive trading and poor corporate investments
- Conservatism
  - Investors update their beliefs too slowly in response to new evidence
  - May explain underreaction and momentum
- Confirmation bias
  - Tendency to interpret new information so it confirms your prior beliefs and disregard information that challenges prior beliefs
  - May explain momentum and long-term reversal

## Information processing errors: People have limited capacity to process information II

- Extrapolation and pattern recognition
  - People are good at finding patterns, including patterns that are not there
  - Representativeness bias: Act as if a small sample is just as informative as a large sample
  - May explain momentum

## Behavioral biases: Even with perfect information processing, people tend to make irrational decisions I

- Framing
  - The framing of choices affects decisions
  - For example, people may choose differently between uncertainty when framed as potential gains from a low baseline and equivalent potential losses from a high baseline
- Mental accounting
  - A specific form of framing where people segregate certain decisions
  - For example, some investors may prefer stocks that pay high cash dividends because they feel free to spend these dividends without selling stocks that pay low or no cash dividends
- Regret avoidance
  - Individuals whose decisions turn out badly have more regret when that decision was less conventional
  - For example, losses on blue-chip stocks are less painful than losses on startups because the blue-chip loss can be attributed to bad luck instead of a bad decision and cause less regret

## Behavioral biases: Even with perfect information processing, people tend to make irrational decisions II

- Affect and feelings
  - Investors tend to choose stocks with high *affect* (i.e., good feelings), driving up prices and driving down returns
  - For example, affect and feelings may drive the home bias, where people over-invest in geographically nearby stocks relative to efficient diversification
- Prospect theory
  - Defines a new utility function, providing a new model for how utility-maximizing investors should behave
  - The prospect theory utility function is:
    - Concave (i.e., risk-averse) for gains
    - Convex (i.e., risk-seeking) for losses
  - Centered on a reference point that moves as wealth changes, so investors feel *changes* in wealth instead of *levels* of wealth

# Prospect theory I

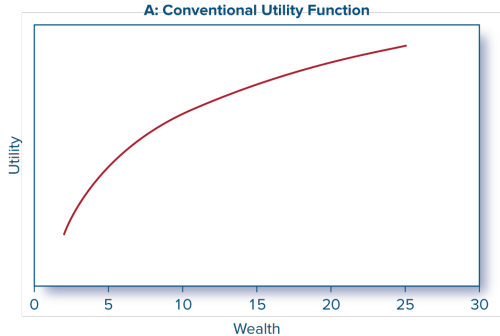


Figure 1: Prospect theory. **Panel A:** A conventional utility function is defined in terms of wealth and is concave, resulting in risk aversion. (BKM 2023, Figure 12.1a)



# Prospect theory II

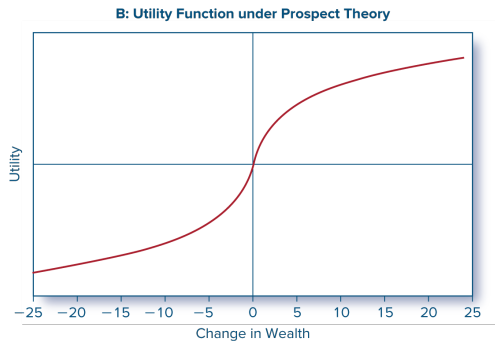


Figure 2: Prospect theory. **Panel B:** Under loss aversion, the utility function is defined in terms of losses relative to current wealth. It is also convex to the left of the origin, giving rise to risk-seeking behavior in terms of losses. (BKM 2023, Figure 12.1b)

Limits to arbitrage are necessary to prevent rational arbitrageurs from fully exploiting the mistakes of behavioral investors and correctly pricing stocks

- Fundamental risk
  - “Markets can remain irrational longer than you can remain solvent” – Keynes
  - Market value may take too long to converge to intrinsic value
  - For example, a mutual fund manager may lose clients and her job if short-term performance is poor
- Implementation costs
  - It can be costly and difficult to exploit overpricing
  - Transactions costs and restrictions on short-selling can limit arbitrage activity
  - For example, there may be no shares to borrow, or lenders may recall shares with short-notice
- Model risk
  - What if you have a bad model and the market value is correct?

## The Law of One Price should always hold, but it does not: Siamese twin companies I

- Royal Dutch should sell for 1.5 times Shell because they are a joint company that splits profits 60/40
- However, these shares have deviated from the 1.5 ratio for extended periods
- These deviations are an example of fundamental risk because the deviations have grown as large as 17%

## The Law of One Price should always hold, but it does not: Siamese twin companies II

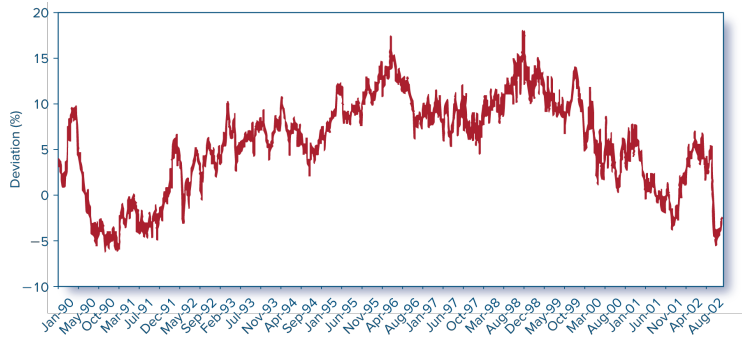


Figure 3: Pricing of Royal Dutch relative to Shell (deviation from parity) (BKM 2023, Figure 12.2)

## The Law of One Price should always hold, but it does not: Equity carve-outs

- In 1999, 3Com spun off its Palm division with an IPO of 5% of Palm
- 3Com committed to spin-off the remaining 95% of Palm by giving each 3Com share 1.5 shares of Palm
- Therefore, after the Palm spin-off, 3Com share prices should have been *at least* 1.5 times Palm share prices
- However, Palm's share price was *higher* than 3Com's share price!
- We can estimate 3Com's *stub value* as 3Com's share price minus Palm's share price
  - 3Com had assets of \$10 per share, so its stub value should have been at least \$10
  - However, 3Com's estimated stub value was *negative* for over two months!
- The limit to arbitrage here was that traders had borrowed and sold short almost all available Palm shares

## The Law of One Price should always hold, but it does not: Closed-end funds (CEFs)

- CEFs often sell at premiums or discounts to NAV
  - Might sell at a discount because NAV does not reflect future fees and expenses that CEF investors will pay
  - Might sell at a premium because NAV does not reflect future investment decisions of the CEF manager
  - Deviations are larger for CEFs that are difficult to arbitrage
- However, there are rational return expectation explanations, too!
  - We can use the constant-growth dividend discount model to express the CEF discount as:

$$\frac{\text{Price} - \text{NAV}}{\text{NAV}} = \frac{\alpha - \varepsilon}{\delta + \varepsilon - \alpha}$$

where  $\alpha$  is the risk-adjusted return,  $\delta$  is the dividend yield, and  $\varepsilon$  is the expense ratio

- If  $\alpha > \varepsilon$ , the CEF will *rationaly* sell at a premium
- Most CEFs trade at discounts to NAV, consistent with most managers not covering their expenses

## Bubbles are easier to spot after they end!

- Dot-com bubble
  - Cooper, Dimitrov, and Rau (2001) show that adding “.com” to a business name generates abnormal returns!
  - 6-year period beginning in 1995, where the tech-heavy NASDAQ Index increased its level by a factor of 6 and the NASDAQ Index eventually fell 75% from its peak
  - Can be explained by overconfidence and representativeness biases
- Housing bubble
  - Set off the worst financial crisis in 75 years
  - Again, can be explained by overconfidence and representativeness biases
- *However*, there are often rational explanations for stock market bubbles using the dividend discount model
  - S&P 500 is worth \$12,883 million if the dividend growth rate is 8% (close to the actual value in 2000)
  - S&P 500 is worth \$8,589 million if the dividend growth rate is 7.4% (close to the actual value in 2002)

## Behavioral finance explanations of efficient market anomalies do not always guide how to exploit them!

- Still, behavioral finance is important because we rely on market prices to allocate capital
- Inefficient prices, whether we can exploit them or not, can result in inefficient investment
- Where do financial economists stand?
  - Many believe behavioral finance is too unstructured and tries to explain too many anomalies from a long list of psychological biases because it is easy to fit an empirical finding to one of these biases
  - Many do not believe it indicts or refutes the EMH because risk-adjusted profits are small and fleeting
- Bottom line: We should not expect risk-adjusted profits from behavioral finance, but it still provides a useful list of common errors we should avoid as investors and managers



a. Which are types of information processing errors?

Check all that apply:

- ☐ Conservatism bias
- ☐ Forecasting errors
- ☐ Overconfidence
- ☐ Regret avoidance
- ☐ Representativeness bias

a. Which of the following asset allocation decisions are typical regret avoidance behavior?

Check all that apply:

- ☐ Avoiding companies with high book-to-market ratios.
- ☐ Buying Company A instead of Company B because Company A's share price has outperformed Company B's share price over the last 2 years.
- ☐ Allocating 50% of one's portfolio to various graphite mining companies in the Mozambique that show high growth potential.
- ☐ Focusing on well-known companies with sound financials.
- ☐ Using diversification to minimize portfolio risk.

# Technical analysis attempts to exploit predictable patterns in stock prices

- Technicians do not deny the usefulness of fundamental analysis
  - However, they believe that prices adjust gradually to intrinsic values
  - As a result, they believe they can profit from slow price adjustments when fundamentals change
- The disposition effect is the tendency of investors to sell winners and hold onto losers
  - Losses are only “paper losses” that investors can ignore until they sell these losers
  - As a result, the demand for shares depends on price history
  - For example, investors holding onto their winners can generate momentum in stock prices
- *Technical analysis and behavioral finance overlap*, and we might think of technical analysis as a playbook for exploiting behavioral biases

# Technical analysis tries to discover trends in market prices I

- In other words, technical analysis is the search for momentum
- Moving averages are a popular tool to search for momentum
  - A moving average is an average price over a given time interval, where the interval updates as time passes
  - Crossing the moving average from below is a *bullish signal*, signifying a shift from a falling trend to a rising trend
  - In contrast, crossing the moving average from above is a *bearish signal*
- Other popular tools are *Elliot wave theory* and *Kondratieff waves*, which decompose price movements into long-term and short-term trends

## Technical analysis tries to discover trends in market prices II

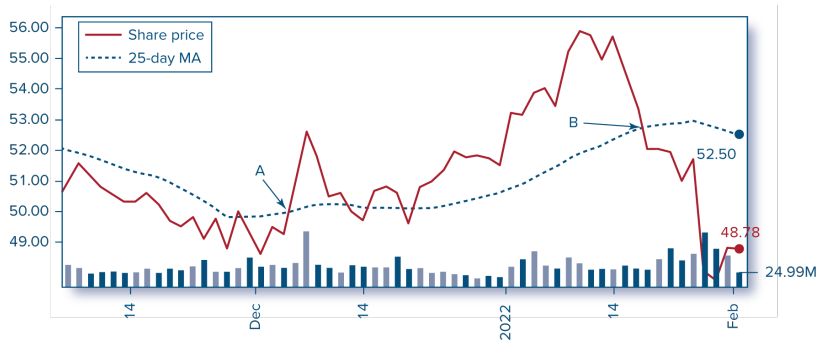


Figure 4: Share price and 25-day moving average for Intel, February 1, 2022 (BKM 2023, Figure 12.3)

Relative strength measures the extent to which a security has outperformed the market or industry

- Calculated as the ratio of the price of the security to a price index for the market or industry
- A rising ratio implies outperformance and a signal to buy if we assume outperformance will persist

Breadth measures the extent to which market movements are reflected widely in the price movements of all the stocks in the market |

Market Dairy		
Issues	NYSE	NASDAQ
Advancing	2,744	3,962
Declining	633	862
Unchanged	129	199
Total	3,506	5,023
Share Volume (millions)		
Advancing	1,127.8	4,664.6
Declining	265.7	442.9
Unchanged	7.6	56.1
Total	1,401.1	5,163.6

Figure 5: Market Diary (BKM 2023, Figure 12.5)

Breadth measures the extent to which market movements are reflected widely in the price movements of all the stocks in the market II

Day	Advances	Declines	Net Advances	Cumulative Breadth
1	1,302	1,248	54	54
2	1,417	1,140	277	331
3	1,203	1,272	-69	262
4	1,012	1,622	-610	-348
5	1,133	1,504	-371	-719

Figure 6: Breadth (BKM 2023, Table 12.1)



# Machine learning, technical analysis, and Renaissance Technologies (RenTech)

- Machine learning based on past prices and trading data is a form of technical analysis
- RenTech has been one of the most successful hedge funds and generated before-fee average annual returns of about 66% between 1988 and 2018
- RenTech's Medallion fund uses machine learning to turn large amounts of data into profitable trades (on average)
  - Is RenTech's success a violation of EMH?
  - Unlikely because they admit that only slightly more than 50% of their trades are profitable
  - RenTech is very good at finding coins with a slight edge and then repeatedly flipping these coins
  - With fast trades and low trading costs, a slight edge grows exponentially!
  - Medallion no longer has outside investors, suggesting that these coins with a slight edge are in limited supply

## *Sentiment* is the general level of optimism I

- Trin statistic
  - Measures the strength of market rise or fall

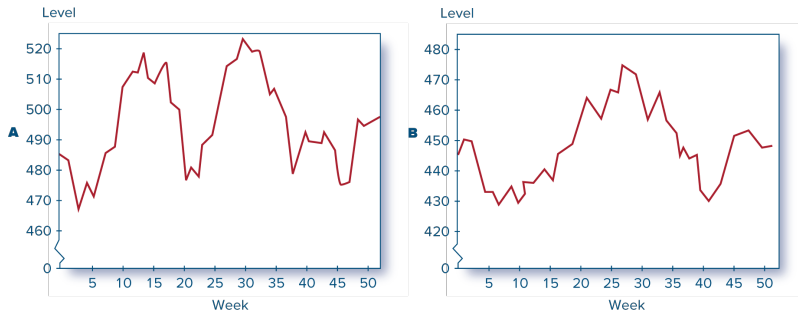
$$\text{Trin} = \frac{\text{Volume declining/Number declining}}{\text{Volume advancing/Number advancing}} = \frac{\text{Average volume declining}}{\text{Average volume advancing}}$$

- Trin ratios greater than 1 are bearish, whereas ratios less than 1 are bullish
  - However, rising volume in a rising market does not necessarily indicate a buyer-seller imbalance because, for every buyer, there is a seller
- Confidence index
  - Measures trends in the *bond* market, which may soon move to the *stock* market
  - The ratio will always be less than one because intermediate-grade yields are always greater than top-rated yields
  - Higher values are bullish signals, and lower values are bearish signals
- Short interest
  - Total number of shares of stock currently sold short
  - Increased short interest reflects negative sentiment and is a warning sign concerning the stock's prospects

## *Sentiment* is the general level of optimism II

- However, the bullish interpretation is that traders must eventually cover their shorts, so short interest indicates latent demand
- Put/call ratio
  - The ratio of outstanding put options to outstanding call options, which is typically about 65%
  - A rising put/call ratio is taken as a sign of broad investor pessimism and a coming market decline

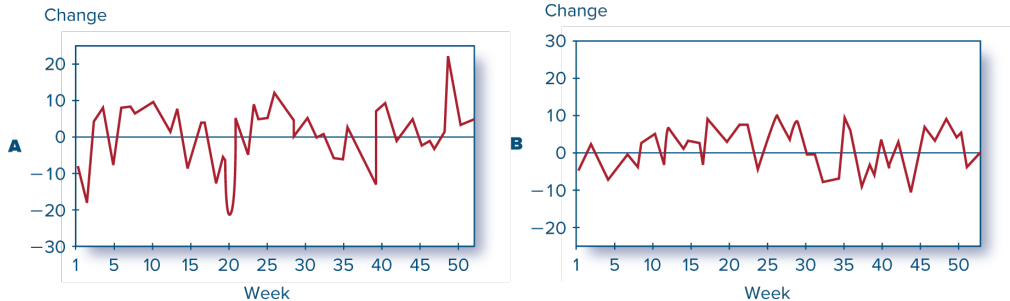
With technical analysis, we can find patterns that do not exist! I



Friday closing levels, December 30, 1955–December 28, 1956, Dow Jones Industrial Average

Figure 7: Actual and simulated levels for stock market prices of 52 weeks (BKM 2023, Figure 12.6)

With technical analysis, we can find patterns that do not exist! II



Changes from Friday to Friday (closing) January 6, 1956–December 28, 1956, Dow Jones Industrial Average

Figure 8: Actual and simulated changes in weekly stock prices for 52 weeks (BKM 2023, Figure 12.7)

. Below is the market diary for a particular day's trading.

Issues	NYSE	Nasdaq
Advancing	2,319	2,169
Declining	654	529
Unchanged	215	115

a. What is the breadth for the **NYSE**?

The table below shows the average 10-year yield of top-rated corporate bonds along with the corresponding yields for intermediate-grade corporate bonds:

Month	Top rated	Intermediate grade
1	0.033	0.08182
2	0.039	0.08738
3	0.025	0.099
4	0.033	0.08182
5	0.03	0.09
6	0.02727	0.108

a. What is the confidence index in **month 5**?

. Below is the market diary for a particular day's trading.

Issues	NYSE	Nasdaq
Number advancing	1,118	941
Volume advancing	974,575,345	953,575,000
Number declining	2,200	2,067
Volume declining	1,504,600,876	1,501,500,000

a. What was the trin statistic for the **Nasdaq** on this day?



. Market data for the index and the stock price of GoldMiners Inc is given below:

Day	S&P	GoldMiners Inc
1	68	38
2	66	37.7
3	65	38.5
4	61.7	39
5	63.7	40.2

a. GoldMiners Inc \_\_\_\_\_.



- ☐ does neither show nor not show relative strength
- ☐ does not provide enough information about relative strength
- ☐ does not show relative strength
- ☐ shows relative strength

# Summary

1. Behavioral finance focuses on systematic irrationalities that characterize investor decision making. These “behavioral shortcomings” may be consistent with several efficient market anomalies.
2. Among the information processing errors uncovered in the psychology literature are heuristic decisions, overconfidence, conservatism, confirmation bias, and representativeness. Behavioral tendencies include framing, mental accounting, regret avoidance, and loss aversion.
3. Limits to arbitrage activity impede the ability of rational investors to exploit pricing errors induced by behavioral investors. For example, fundamental risk means that even if a security is mispriced, it still can be risky to attempt to exploit the mispricing. This limits the actions of arbitrageurs who take positions in mispriced securities. Other limits to arbitrage are implementation costs, model risk, and costs to short-selling. Occasional failures of the Law of One Price suggest that limits to arbitrage are sometimes severe.
4. The various limits to arbitrage mean that even if prices do not equal intrinsic value, it still may be difficult to exploit the mispricing. As a result, the failure of traders to beat the market may not be proof that markets are actually efficient, with prices equal to intrinsic value.
5. Technical analysis is the search for recurring and predictable patterns in stock prices. It is based on the premise that prices only gradually close in on intrinsic value. As fundamentals shift, astute traders can exploit the adjustment to a new equilibrium.
6. Technical analysis also uses volume data and sentiment indicators. These are broadly consistent with several behavioral models of investor activity. Moving averages, relative strength, and breadth are used in other trend-based strategies.
7. Some sentiment indicators are the trin statistic, the confidence index, short interest, and the put/call ratio.

Figure 9: Chapter 12 summary from BKM (2023)

# References I

-  Bodie, Zvi, Alex Kane, and Allan J. Marcus (2023). *Investments*. 13th ed. New York: McGraw Hill.
-  Cooper, Michael J., Orlin Dimitrov, and P. Raghavendra Rau (2001). “A rose.com by any other name”. In: *The Journal of Finance* 56.6, pp. 2371–2388.