MODULE 1 UNIT 2
Behavioural biases and their effects

IN COLLABORATION WITH getsmarter™

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Learning outcome:

LO3: Discuss how behavioural biases impact the market.

1. Introduction

Traditional finance theory assumes that investors make decisions rationally, without any prejudice or bias based on personal experience or other confounding factors. Behavioural finance, on the other hand, recognises that individuals may act irrationally, basing decisions on information they have misinterpreted or misjudged for whatever reason. Behavioural finance endeavours to explain anomalies in market behaviour that cannot be accounted for by traditional models.

This unit explores behavioural finance, its importance, and its forms. It is vital to understand behavioural finance, as it helps you understand why people invest the way they do. It can give you a broad understanding of why people act irrationally in the market, and how these irrationalities manifest in the form of exploitable patterns or trends. A key component of behavioural finance is using the insights from psychological research by applying them to financial decision-making (Byrne & Utkus, 2013).

It may not be intuitive to think of behaviour as a set of statistical indicators, but that is essentially what behavioural finance aims to achieve. You cannot ask a trading algorithm to recognise “fear” or “overconfidence”, but you can ask it to recognise the statistical indicators that arise from these forms of behaviour. By the end of this set of notes, you will be able to recognise the causal relationship between behaviour and asset prices.

Behavioural finance has two primary pillars. The first is cognitive psychology, and the second is the ability to predict under which conditions arbitrage is effective (Ritter, 2003). Arbitrage refers to the process of profiting from differences in prices or yields in different markets. The idea is to buy a financial instrument in one market and immediately sell it in another for a higher price. Arbitrage in practice can take on many forms, and is discussed further in this set of notes.

2. The basis of behavioural finance

First, you need to know how people think, what sort of irrationalities are present in their thinking, and how these irrationalities create distortions in the decisions they make. After this, you need to know when these behaviours can be capitalised on. The combination of these two bodies of knowledge creates behavioural finance.

People’s minds work in unpredictable ways. They may make decisions based on what initially occurs to them, and some thoughts and preferences arise quicker and more naturally than others do. What comes to mind is dependent on many factors, such as an individual’s personal experiences and the context of the information. Many behavioural aspects covered in this set of notes are manifestations of these core understandings.

Context is an important part of individual decision-making. How information is presented can alter how it is viewed. In Figure 1, the two red circles are the same size, but due to the surrounding information, they appear to be different sizes. You can think of the two red circles as an investment decision and the yellow circles as information not critical to the decision but still influencing its outcome.

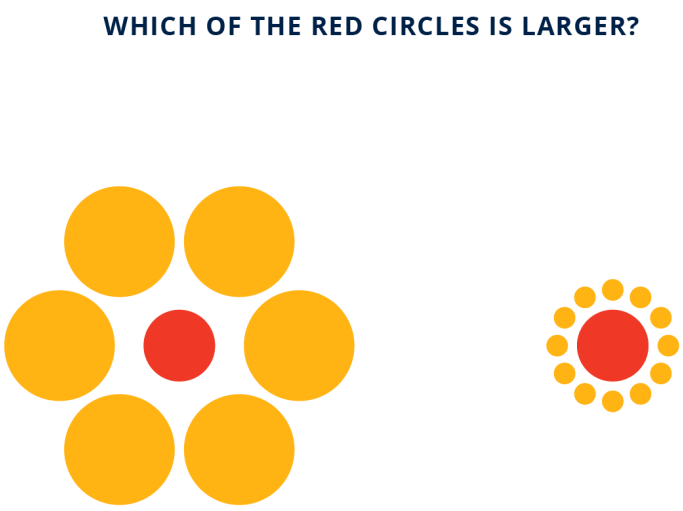

Figure 1: Circle optical illusion.

Figure 2: Logo colour optical illusion.

In Figure 2, a blue University of Oxford logo is shown. The colour tone remains constant for the logo, but the visual context (or noise) surrounding the logo (i.e. a gradient that transitions from dark to light) gives the impression that the colour tone of the logo changes.

As a non-visual example, assume you have a random-number generator that can produce either a 1 or a 0 with a 50% chance of either appearing. If the sequence produced is 0;1;1;1;1, what would you expect the next number to be? What would you consider to be the context in which this information is being presented? How do you think the way the information is being presented would influence your choice?

If you had a choice between buying one ice cream for £1, or two for £1.50, would you buy two? If you found out that the ice cream normally costs £0.80 (i.e. with no promotion), would you buy it then? What is the context here? Think about how the presentation of information can alter how you view choices.

By now, you should have some understanding of how the way people perceive information can alter the decisions they make. Can you think of instances where the way information was presented to you could have altered the way you made a decision?

The optical illusions explored previously work because your perception is dependent on the context in which the information is presented. You need context to be able to make an informed decision about the information you see. However, if that context is presented in a misleading manner, people may interpret the information incorrectly. While the intention is not always to mislead, there are instances in which context can be purposefully manipulated to encourage a certain type of response.

For example, a country might decide to have an opt-out, rather than an opt-in, policy for organ donation (this implies that the norm is being an organ donor). The overall rate of organ donors will be much higher than if individuals have to purposefully opt in. A 2004 study showed that when subjects had to opt in to be an organ donor, the percentage of donors was 42%, but when they had to opt out, the percentage was 82% (Johnson & Goldstein, 2004). In Germany, which has an opt-in policy, 12% of citizens are organ donors, while in Austria, which has an opt-out policy, 99% are (Damani, 2015). This is generally referred to as the default effect, and illustrates how the context in which information is presented has a strong impact on subsequent decisions.

3. Prospect theory

A key concept in behavioural finance is prospect theory, developed by Daniel Kahneman and Amos Tversky, which states that investors make decisions based not on specific outcomes, but rather on perceived gains and losses. Furthermore, individuals place greater weight on the potential losses – they feel the pain from the loss much more acutely than the joy from the gain (Tversky & Kahneman, 1981). The following is an illustration of prospect theory, given in Tversky and Kahneman's 1981 paper:

> Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

> If Program A is adopted, 200 people will be saved. [72 percent]
>
> If Program B is adopted, there is ⅓ probability that 600 people will be saved, and ⅔ probability that no people will be saved. [28 percent]
>
> Which of the two programs would you favour?

In the study, 72% of the subjects chose Program A, the risk-averse option. The idea of definitely saving 200 lives is perceived to be more attractive than the alternative, even though the alternative has the same value (expected value is a ⅓ chance of 600, which is equal to 200).

Another group of subjects was given an alternate framing of this decision:

> If Program C is adopted 400 people will die. [22 per cent]
>
> If Program D is adopted there is ⅓ probability that nobody will die, and ⅔ probability that 600 people will die. [78 per cent]
>
> (Tversky & Kahneman, 1981)

In this scenario, 78% of the subjects chose Program D, the risk-taking option. The certainty of 400 people dying is less acceptable than a ⅔ chance of 600 people dying, even though ⅔ of 600 is equal to 400. The key takeaway from this example is that, when presented with a decision involving gains, people are often risk averse, but when presented with a decision involving losses, they are often risk-taking.

The example provides a good illustration of the effect of framing. Framing refers to the way you define the context in which you are making a decision, and how you perceive alternatives to the choice you need to make. How you frame the issue determines how you understand the problem, what solutions are available, and how it connects with other situations. When presenting a problem or decision, it is often possible to frame or present it in more than one way (Tversky & Kahneman, 1981).

Another important concept here is loss aversion, which is the notion that individuals take more solace in avoiding a loss (for example, not losing a £10 note) than enjoyment in realising the equivalent gain (for example, finding a £10 note on the side of the road). Naturally, any rational entity would seek to avoid a loss. However, loss aversion refers to the idea that people dislike realising a loss enough that they avoid it, despite the fact that a superior option is available.

It may seem impossible for a loss to be a better option, but consider the following example:

If you buy a security for £400, and then its value decreases by £235 after three months, you might hold on, so as to not realise the loss. Now say there is another asset that has a higher potential rate of return: your decision to hold the original security creates an opportunity cost. You are not choosing the option with the highest potential rate of return, but instead seeking to regain the value from the first security. The loss in potential value will exceed the benefit of holding the original security, but you want to avoid realising that loss.

Loss aversion leads to a situation where bias makes you underestimate the real cost of a decision. This makes you choose the option with less potential value – in this case, deciding to hold the stock instead of selling it and purchasing one with higher potential earnings.

Finally, it is important to recognise that how a decision is framed can significantly influence the impact of loss aversion. Words such as “discount”, “saving”, “penalty”, and “windfall” evoke emotions and affect how an individual perceives potential gains and losses. For example, people may be more willing to buy a £700 jacket on sale for £500 than buy it for £500 when it is not on sale.

The next section explores some of the most common biases that people hold and how these manifest in financial markets.

4. Bias

Bias is essentially a disconnect between what is true and what is believed to be true. This does not refer to one person acting irrationally; rather, these biases result in many people acting in the same irrational way. So, what would cause people to believe things that are not true? This is an important question, because – if you understand how biases are formed – you will have a better understanding of how information should be presented.

How are statistical concepts linked to behaviour? The concept itself can seem immensely complicated, but, when it is broken down and the base components understood, it is often very intuitive. One of the key statistical concepts in behavioural finance is Bayesian updating (also known as Bayesian inference). Bayesian updating is a method of inference that involves updating the probability of an event when new information is received.

Consider the following example: There are two people, Tarryn and Jonathan. You think there is a good chance they will end up getting married, as they get along well, like the same food, and have several shared interests. These observations are examples of information that is used to formulate a level of belief that an event will occur. In your mind, the probability of Tarryn marrying Jonathan is x%. If you then find out that Tarryn has actually started dating someone else, this will most likely cause you to adjust your level of certainty that Tarryn will marry Jonathan. This new level of certainty can be defined as y%. The “prior probability” of the event is defined as x%, and the “posterior probability” is y%, with (in this case) y% < x%, or prob(y) < prob(x).

This process of applying new information is something people do automatically. In mathematics, Bayesian updating is used to make more accurate predictions.

Pause and reflect:

Can you think of examples where you have applied Bayesian updating in your life?

The next step is to relate Bayesian updating to market behaviour. A good example of this is one of the most common biases in the market: over- and underreaction to information.

Consider this example: Following the unexpected release of negative information about a company, the future earnings of that company are negatively impacted, reducing the "fair" price of the stock from £100 to £75 for each share. Some investors are likely to overreact to the news and sell their shares for less than £75 (e.g. for £50). Similarly, some investors may underreact and value their shares at £90.

In relation to Bayesian updating, overreaction means the individual has given too much weight to the new data compared to prior beliefs (overstated its significance), while underreaction means the individual has not given enough weight to the new data (understated its significance). Both situations would lead to forecasting errors in financial markets.

This example of over- and underreaction relates to the first pillar of behavioural finance: how people think. You have looked at people's thought processes, the sorts of biases present in their decision-making, the way these biases create distortions in decisions they make, and the way this could manifest practically in the market. Now you can focus on the second pillar of behavioural finance: arbitrage (i.e. identifying whether or not you can capitalise on the situation). In the over- and underreaction example, there is clearly an arbitrage opportunity, as you could buy shares from the overreactors and sell them to the underreactors (or those trading at fair value). But, remember that this simplified example is purely a thought exercise – it is not meant to reflect real-world market conditions.

You have learnt about the basic principles of behavioural finance and biases, so this set of notes now move on to some of the other forms of bias that arise in behavioural finance. As you work through the following sections, try to recall instances where you demonstrated any of these biases.

4.1 Representativeness

People use information to update their beliefs, but do not always update them correctly. Representativeness is a form of bias where individuals make decisions about the "frequency of an attribute based off its similarity to, or representativeness for, the parent population" (Tversky & Kahneman, 1972). The sections that follow provide several examples of this phenomenon to aid your understanding.

4.1.1 Gambler's fallacy

Gamblers continue to gamble when they are losing, based on the belief that their luck is about to turn. The gambler's fallacy is the belief that, when an event occurs more frequently than normal over a given period, it is less likely to appear in the future. Think back to the random-number generator, mentioned in Section 2 of this set of notes: it can produce either a 1 or a 0, with a 50% chance of either appearing (prob(1) = 50%; and prob(0) = 50%), and it produces the sequence 0;1;1;1;1.

People are tempted to believe that the probability of a 0 occurring is greater than the probability of a 1 occurring (prob(0) > prob(1), or prob(0) > 50%). In this case, the previous results would have no impact on the probability of a 0 occurring, but they shape your beliefs on the matter. People expect the sequence produced to be representative of the underlying random process, even if that sequence is short.

To understand how this manifests in stock market selection, think of the 1s and 0s as representing either upward or downward movements of a stock's price, respectively. You own Stock X, which is worth £100. A 0 causes a downward movement of £10 over one day and a 1 causes a corresponding increase in the stock's price of £10 over one day.

In Figure 3, Point A is the start, B is the stock's position after one day of trading, and C is the stock's current position, trading at £130 on Day 5. It can move to either D (rolling a 1) or E (rolling a 0). If the gambler's fallacy holds, some people would incorrectly assume E is more likely to occur than D. If you think the stock's price is going to fall, it makes sense to sell it, but if you think it is going to rise, it makes sense to hold it. More people may be inclined to sell than hold in this case, even though, strictly speaking, neither is more likely to happen than the other.

Figure 3: Historical and forecasted price movements of Stock X.

With the gambler's fallacy, the fundamentals that the sequence is based on are known – namely that a 1 or a 0 has an equal chance of occurring. It is a "fair coin toss".

The "representativeness" here is that they expect the sequence to mirror the underlying fundamentals, even in a short sequence. In other words, they expect the sequence to be representative of the underlying fundamentals.

4.1.2 Hot-hand fallacy

The hot-hand fallacy is the belief that if someone has previously been successful in a random event, they have a greater probability of success in future attempts. Consider the 1985 study by Gilovich, Vallone, and Tversky that investigates the hot-hand fallacy in relation to basketball. They set out to determine whether, if a player has scored three shots

in a row, they are more likely to make their fourth shot. The following table is a simplified version of the table that appeared in the study. It was ultimately shown that there is “no evidence for a positive correlation between the outcomes of successive shots” (Gilovich, Vallone & Tversky, 1985).

Table 1: Basketball example. (Adapted from: Gilovich, Vallone & Tversky, 1985)

Player	Probability of a hit after three misses	Probability of a hit after three baskets
Clint Richardson	0.50	0.48
Julius Erving	0.52	0.48
Lionel Hollins	0.50	0.32
Maurice Cheeks	0.77	0.59
Caldwell Jones	0.50	0.27
Andrew Toney	0.52	0.34
Bobby Jones	0.61	0.53
Steve Mix	0.70	0.36
Darryl Dawkins	0.88	0.51

You could think of this as the inverse of the gambler’s fallacy. In other words, if you think of a miss as a 0 and a hit as a 1, the sequence 0;1;1;1;1 might lead you to think that the next shot is more likely to be a 1 than a 0. A key difference between the two fallacies relates to the underlying probabilities. For the gambler’s fallacy, the underlying random sequence (50% chance of each event occurring) is known, but for the hot-hand fallacy, it is not – the produced sequence is used to infer information about the underlying process.

So, with the hot-hand fallacy, people do not have a known probability to attach to each event, and instead guess at the fundamentals based on past performance. Here, the "representativeness" is that, if the performance is good, the fundamentals are assumed to be good. The thought is that, since someone is successful several times in a row, the probability of them continuing to be successful is increased.

Think about how these last two fallacies could manifest in the stock market. The gambler's fallacy is essentially saying that what goes up must come down, while the hot-hand fallacy is saying that what goes up will keep going up. These are related to two intuitive concepts mentioned in Unit 1's lesson, namely mean reversion and momentum.

It is difficult to imagine a genuinely random sequence (Gilovich, Vallone & Tversky, 1985). Representativeness is essentially a model of overreaction to a limited depiction of the known fundamental sequence (gambler's fallacy) and to observed data linking back to the unknown fundamental sequence (hot-hand fallacy).

4.2 Overconfidence bias

Another form of bias found in investment decisions is overconfidence bias – that is, "a condition in which investors believe and consider their abilities are above the average of other investors and have an unrealistic level of self-evaluation" (Kartini & Nahda, 2021). This is particularly dangerous given that, irrespective of the information available and their level of experience in interpreting that information, overly confident investors tend to exaggerate their analytical skills as well as their understanding of the markets (Kartini & Nahda, 2021).

The cause of overconfidence has been debated by experts, but the consensus indicates that it is rooted in positive self-judgement and people's need to control their surroundings. These psychological influences can lead to several investment mistakes:

- Due to unacknowledged shortcomings in analysing and interpreting market information, overconfident investors tend to execute incorrect buying and selling positions.
- Overconfident investors tend to trade more often, which increases their transaction costs.
- Overconfident investors tend to limit their prediction intervals, thus disregarding some of the uncertainty in their decision-making.
- Overconfident investors tend to overestimate returns and underestimate risk.

(Kartini & Nahda, 2021)

In a study conducted by behavioural finance expert and author James Montier, 75% of the 300 fund managers surveyed believed their investment skills and abilities were above average – a statistical improbability. In contrast, the remaining 25% believed they were relatively the same as others, while none considered themselves below average (Montier, 2006). These results support the idea that this form of bias is prevalent in the investment industry.

Further reading:

Montier's article on the study offers some interesting insights into overconfidence bias, as well as other forms of biases that surface among investors.

4.3 Availability

Availability, as defined in a 1974 paper by Tversky and Kahneman, is that "[t]here are situations in which people assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind". For example, people might assess the likelihood of heart attacks occurring in middle-aged men based on how often people they know in those demographics have experienced them (Tversky & Kahneman, 1974). Similarly, if, on your daily walk to work, you see accidents at one particular intersection multiple times throughout a year, you might believe that there is a higher chance of an accident occurring there than at other intersections. This issue with availability bias is that it can be influenced not only by frequency, but also by the ease with which certain information can be recalled. Relying too heavily on availability can lead to certain biases in human decision-making processes.

Within the stock market, availability bias can manifest in many ways. For example, an investor who has recently lost money by investing in one sector is likely to view shares in this sector with heightened caution in future, potentially missing out on good opportunities as a result. Another example could be an investor reluctant to sell a particular share, as they have recently had many positive conversations about the particular company and industry, even though the financial analysis indicates they should sell.

Some key aspects in the establishment of availability bias are recency, repetition, and vividness. These are logical: the more recent an event, the easier it comes to mind; if an event occurs frequently, it is easy to remember; and if an experience was particularly memorable, it is easily recalled. However, the availability of these events is not necessarily an indicator of likelihood.

4.4 Anchoring

Anchoring is when "people make estimates by starting from an initial value that is adjusted to yield the final answer" (Tversky & Kahneman, 1974). In other words, anchoring captures the bias of relying or focusing too much on the initial information that was received. The first piece of information acts as a reference point for the individual, and thereby influences future decisions.

In their 1974 study, Tversky and Kahneman showed that different initial values produce different estimates that are biased towards the initial value. Even if people know the initial number is random, their estimates are still influenced by this number.

In this study, subjects were asked to estimate the probability of different events – in this case, the percentage of African countries in the United Nations. Each time, a wheel was spun in the presence of the subject, yielding a result between 1 and 100 (though it was rigged to only land on 10 or 65). Subjects were then asked to estimate a value and indicate whether it was above or below the initial value, causing them to at least partially base their

answers on this initial value. These arbitrary initial numbers given to subjects had a significant impact on their estimates: a higher initial value led to a higher estimate and vice versa for low initial values.

Researchers who examined the popular game show Jeopardy! (US edition) found that "contestants anchor heavily on the initial dollar value of a clue in their wagering decision, even though there exists no rational reason to do so" (Jetter & Walker, 2017). More than half the wagers were within US$500 of the clue's initial value, even though the average highest possible value that could be wagered was US$5,914. This study's findings are interesting, since anchoring is rarely studied outside laboratory settings, and the game show was a good approximation of real-world circumstances. Their results of the contestants are still significant at the 1% level (meaning they are at least 99% certain of their results), and interestingly, it was found that children younger than 13 did not have anchoring bias in the same circumstances (Jetter & Walker, 2017).

In financial markets, investors are anchored to historical events and stock price data. These act as preconceived notions about the fair value of a stock, and can create a situation where investors are unwilling to sell the stock if its price falls, even if there are better options. You can think of historical events and price data as the initial value given to participants in the first example, and the investment decision to buy, sell, or hold as their estimate (Wattle Partners, 2016).

4.5 Confirmation bias

Confirmation bias is the notion that once a person holds a belief, they seek evidence that supports that belief and reject evidence that contradicts it. When given information that supports their belief, they are likely to think, "Can I believe this?", but when they are faced with information that goes against their beliefs, they respond by thinking, "Must I believe this?"

The English philosopher Francis Bacon (1620, quoted by Levine, 2014), described the concept as such:

> The human understanding when it has once adopted an opinion…draws all things else to support and agree with it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects; in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate.

Consider the following example of confirmation bias in action:

There are two groups of subjects: one in favour of capital punishment and the other against. They are each given two studies, one seeming to confirm their beliefs, and the other seeming to disprove them. As predicted, the subjects rated the results and procedures of the study confirming their beliefs to be more convincing and astute than the study opposing their beliefs (Lord, Ross & Lepper, 1979).

There are many instances in which this bias impacts behaviour in financial markets. For example, a strong supporter of AI will be quick to support tech start-ups making use of AI, whereas someone more sceptical of AI will need a lot of convincing to invest. If you have

a preconceived notion of a company's stock, you will gladly accept information that supports that belief and be less willing to accept information that opposes it.

Further reading:

Confirmation bias presents itself in financial markets in many different ways, and it is helpful for you to be able to identify examples of it. Additionally, an Indonesian case study showcases the impact that various biases have on investment decisions.

Based on what you have learnt, try to guess which human bias is at play in each of the following investment scenarios.

Test yourself:

Scenario 1: As a fund manager, you have made a series of profitable investments over the last two years. You identify another investment opportunity in the same sector and, while your colleagues find it too risky, you decide to invest and expect to make a good return.

Scenario 2: Due to increasing global distrust in governments and central banks, you favour decentralised cryptocurrencies over centralised fiat money. You join a cryptocurrency social media community that actively shares articles that support cryptocurrency's mainstream adoption in the future. Consequently, you decide to allocate a portion of your investments to cryptoassets.

Scenario 3: You decide to hold off on selling your property stocks, even though the real estate market remains muted and there is little indication of a bull market in the future. Rather, you hope to realise the same high returns that were experienced a decade ago during a real estate boom.

Note: Refer to the end of this set of notes to view the answers.

5. Mean reversion vs momentum

Mean reversion is the theory that stock prices and returns will, at some stage, move back (or revert) to their mean or average. This mean can be calculated in a number of ways (using moving average, for example), but the concept remains the same. A mean-reversion trader looks for unsustainable trends. You can think of the mean as an accumulation of market insight on the fair value of the company's stock, and of the day-to-day fluctuations as the changes in market sentiment, which is more susceptible to whims. So, when the daily sentiment is too far above or below the mean, and with markets being at least somewhat efficient, the price is driven back to its mean (Carr, 2015). In essence, mean-reversion exploits abnormal market activity to buy low and sell high, with the expectation that prices will revert to a normal pattern.

Momentum trading seeks to take advantage of trends in the market, and typically targets accelerations in prices in a trending market. In physics, momentum is described as mass

multiplied by velocity. Think of a large boulder rolling down a hill, picking up speed. A good momentum trader would, in the figurative sense, always be looking for a boulder that is going to start rolling. They want to take advantage of this motion at the stage when the boulder will take them down the fastest in the shortest amount of time. A good momentum strategy would be one that allows the trader to enter the required position before the event occurs.

Both the mean-reversion theory and momentum trends are used as components in market analysis, and can form a component of an investor's overall trading strategy.

6. Arbitrage

Having investigated some of the psychology behind investor decision-making, you can now turn your focus to the second pillar of behavioural finance: identifying when these biases will yield arbitrage opportunities.

Arbitrage is a fundamental concept in the field of finance. It is when you buy an asset in one market and sell the same or very similar asset in another market to take advantage of a pricing discrepancy (Shleifer & Vishny, 1997). This is a core concept in the analysis of securities, as its effect causes securities to tend towards their fundamental values, helping to keep markets efficient. But how closely does this textbook definition reflect true arbitrage? This is a key question you need to ask yourself. Even the simplest arbitrage strategy is significantly more complicated in practice than the definition implies (Shleifer & Vishny, 1997).

Further reading:

Reflect on the conditions that can limit your ability to implement an effective arbitrage strategy.

7. Conclusion

This set of notes has demonstrated how people can act irrationally, and how many people acting irrationally together can manifest in various ways in daily life and within financial markets. It is crucial to understand that these are fundamental concepts that highly technical and in-depth trading strategies are built on. The practical quantitative modelling of these traits is exceedingly complicated and not covered here, but in the video that follows, you will have the opportunity to see how a momentum trend is used to model a trade strategy.

Behavioural finance should not be seen as a separate subject to financial analysis, but rather as a way to identify patterns in behaviour, as an essential tool for understanding financial markets, and as part of mainstream financial analysis.

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9. Answers

Scenario 1: Overconfidence bias. You feel your skill as a fund manager is well above average and you expect to continue making good returns. Your overconfidence leads you to downplay the risks involved.

Scenario 2: Confirmation bias. You have actively sought out information that supports or confirms your positive beliefs about cryptocurrencies (or, alternatively, supports your negative beliefs about centralised fiat currency).

Scenario 3: Anchoring bias. You base your investment decision on past returns or performance, rather than the intrinsic value of the stocks.