

## 4 Order Books

No matter what strategy or time frames you're using, as long as you're trading on a centralized exchange (or on some decentralized exchanges such as Serum on Solana), your trades will go through an order book. The only exception to these are DEXes that use AMMs (Automated Market Makers), which we'll cover in the next chapter, but by far the most popular way of trading is through the order book model, whether we're talking about Bitcoin, Tesla, wheat futures, EUR/USD or anything else. Because order books are the way that trades are actually defined and executed, you need to understand how they work. Apart from just the practical understanding of how trading works, order books can give you a lot of actionable information, especially through specific interfaces that optimize for finding patterns and other forms of alpha in the data. Heatmaps are the most popular tool for this, so a significant part of this chapter will be about how they work and how to use them to find trade opportunities and have a fresh way of looking at price action.

### 4.1 How Order Books Work

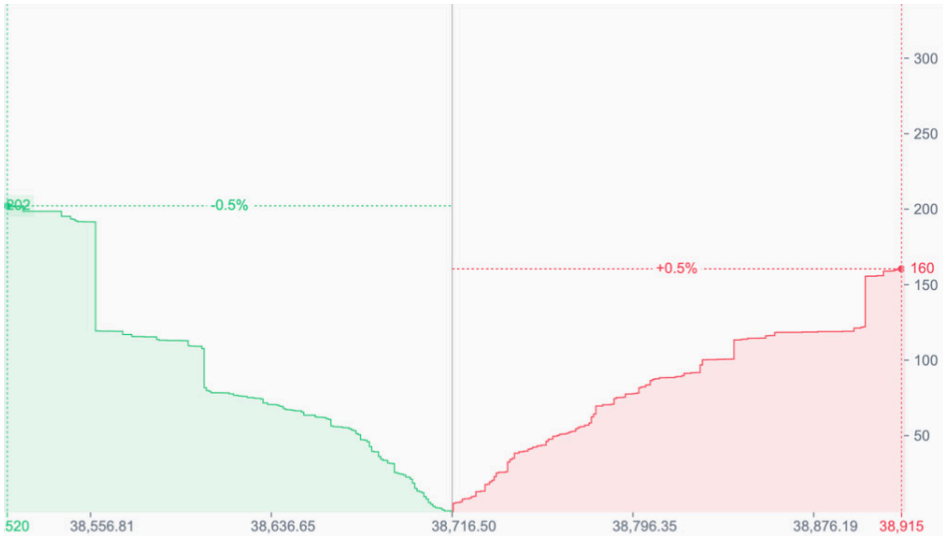
First of all, what even is an order book? Simply put, it's the list of currently active limit buy and sell orders. Limit orders are those that are set at a specific price, rather than being executed instantly. For example, if BTC is trading at \$40,100, you can set a limit buy order with a limit price of \$40,050, and your order will be filled (that is, you'll actually buy the BTC) only when the price drops to \$40,050 and someone decides to sell BTC at that level. On the other hand, a market order is one that's executed instantly: creating a market buy order when BTC is at \$40,100 means that you'll buy BTC at that price (or slightly higher, you'll soon see why).

Limit and market orders are complementary: a limit order can only be filled when a market order in the opposite direction is executed. In the example above, your \$40,050 limit buy order (which is called a bid) will be filled only when the price is at \$40,050 and someone else executes a market sell order at that level. The thing is, orders don't just have a price associated with them, but also a specific size: when you create a limit order, you also specify how much BTC you want to buy at your desired level. The result of all this is what you can see on the order book, typically shown on the trading interface on exchanges:

Orderbook		Grouping None ▾	
↑ 39,349		39,325	
Bid Size (BTC)	Bid Price (USD)	Ask Price (USD)	Ask Size (BTC)
14.3954	39,348	39,349	0.0100
2.4109	39,347	39,350	0.2518
6.6782	39,346	39,352	0.0025
0.7000	39,345	39,353	0.1500
0.0586	39,344	39,356	0.6925
0.5445	39,343	39,357	1.5249
1.4089	39,342	39,358	0.8514
0.0226	39,341	39,359	3.3632
0.5186	39,340	39,360	1.4185
1.5274	39,339	39,361	4.2533
0.0410	39,337	39,362	1.4241

Here we can see what it looks like on Binance, with the BTC/USDT order book: the left side lists buy orders (bids) and the right side shows sell orders (asks). The bids and asks are shown in order of the bid/ask price, with the order size also displayed for each individual level. So, in this example we can see that there is a total of 0.01 BTC in sell orders at 39,349 USDT, and 0.2518 BTC at 39,350 USDT. Let's say that you want to market buy 0.1 BTC in this situation: what will happen is that you'll buy 0.01 BTC at 39,349 and, since that ask has now been filled completely, the remaining 0.09 BTC at 39,350. Even though the first limit sell order was at 39,349, the average price at which your order will be executed will end up being 90 cents higher (with 10% executed at 39,350 and 90% at 39,350, leading to an average of 39,349.9).

As you can see, the order book determines how much you can buy and sell without moving the price significantly (this is a measure of liquidity), and the more orders there are at a particular level, the harder it will be for the price to break through that level. There are several ways to make use of this, the simplest being the depth chart, which you can see in the image below (also from the BTC/USDT pair on Binance, but taken at a different time).



The depth chart is basically just a more intuitive graphical representation of the order book: the current price is shown in the middle, with the buy side to the left and the sell side to the right. The scale on the right side shows cumulative order size: for example, we can see that there is a total of 160 BTC of sell orders that would need to be filled for the price to move up by 0.5% to 38,915 USDT, while 202 BTC of buy orders would need to be filled for the price to drop by 0.5%. Since there is more liquidity on the buy side than the sell side, this can be a signal that it's easier for the price to move up than down.

What's more, you've probably noticed that the chart contains many sharp increases of liquidity on both sides, such as the large amount of bids around 38,560. These are referred to as buy walls (on the buy side) and sell walls (on the sell side, logically enough). The presence of such walls can make it more difficult for the price to break past them, while areas that are fairly flat on the order book can make it easier for the price to traverse those levels.

If you open a real-time example of a depth chart on an exchange, however, one thing you're bound to notice is how quickly it changes: orders are constantly being added, cancelled and moved, especially on a trading pair like BTC/USDT on Binance. This – along with the fact that you always need to consider how liquidity is distributed on multiple exchanges and how it changes through time – makes the depth chart a very rudimentary tool. In order to really get into analyzing the info that order

books can give you, you need something that shows you a representation of how liquidity changes through time as well, and that's where heatmaps come in.

## 4.2 Heatmaps



Rather than showing you just one snapshot of the order book, a heatmap shows the current as well as all the historical snapshots of buy and sell orders. For example, here we can see what a heatmap (in this case XBTUSD on BitMex, so Bitcoin for those of you unfamiliar with this alternative ticker) looks like on TradingLite. Apart from the price and volume, which you'll see on pretty much any chart, the most striking feature – and also the thing that makes it a heatmap – are the horizontal lines you can see in different colors on the chart. These lines represent buy or sell orders (depending on whether they're above or below the price) present in the order book at a specific time. The chart above is fairly simple: the only order that really stands out is the huge buy on 38k, which eventually got filled right before the price reversed.

This sort of thing tends to happen more often than not: when there's a huge order (or a bunch of smaller orders set close together and at the same time, which typically means they were set by the same enti-

ty), odds are that whoever placed it had a very good reason to lay down millions in a bid, which is why that level can be a good point at which to look for a reversal. If the order is extremely large, it can also stop the price right in its tracks and cause a reversal simply because there wasn't enough pressure to fill the order completely.

Situations like that, when the price is very close to a huge order, can offer good risk/reward opportunities for quick scalps. For example, if ETH is at 3,558 and there's a ridiculously large buy order at 3,555, you can open a long with a stop at 3,554. If the order isn't filled, you might catch a quick bounce, but in any case you should be ready to take profits quickly if the only rationale behind the trade is the buy wall. Luckily that shouldn't be a problem, since the extremely tight stop loss will allow you to increase the leverage quite a bit without risking losing too much.

Just like any other datapoint that offers actionable trading opportunities, orderbooks and heatmaps can also be manipulated by those with big enough portfolios to do so. This is called spoofing, and it involves placing orders with no intention to have them filled, but using them only to deceive traders that are looking at the heatmap. The thing is, whenever a whale places huge orders on the book, they know that everyone else can see them, and this can easily be used for some more deceptive strategies.

Let's take one simple example: imagine a whale that's got a big enough portfolio to post huge orders, especially on an otherwise uninteresting low-volume day. The whale can place a large buy wall slightly below the current price and, as everyone notices these orders, people try to front-run the bid by buying above it, causing the price to bounce. Now, at this time our hypothetical whale is filling a huge short position, using the liquidity of the would-be front-runners. Then, with the short filled and price starting to approach it again, he pulls (cancels) the buy orders. All the traders that bought now have to sell, whether voluntarily – seeing that the order is gone – or by force, with their tight stop losses being hit one by one. The price drops sharply and the whale makes a decent profit on his short.

If your first thought is that this kind of a practice sounds very shady and should be illegal, you'd be right: spoofing is against the law as a form of market manipulation in traditional finance, and the regulators there mean business when it comes to enforcement and penalties. In crypto however, the regulatory waters are much murkier, which is why

spoofing is still a very common practice. Besides, it's always fairly difficult to prove: traders can, of course, cancel their orders whenever they want, and even in traditional markets, a charge of market manipulation would have to be backed up with more concrete evidence (such as simultaneously opening a position on the opposite side, like the example above).

In any case, spoofing is very much real, not to mention the fact that even the largest orders can be cancelled in the blink of an eye regardless of whether there are any shady intentions involved or not. What this means for you is that you should never rely solely on the order book to justify trades: while a short-term scalp with a ridiculously good risk/reward can sometimes be worth it, risking more capital based on what whales want you to think is never a good idea.

Instead, it's best to mainly use heatmaps in confluence with other data. Some of the extra data is available right on the heatmap interface, and this has to do with the current positioning of the market. For example, it's easy to see why it would be extremely helpful to know when traders are getting too aggressive with shorts, since that opens up the possibility of a short squeeze that could push the price higher very quickly. By adding a few more indicators to a heatmap, you can do just that.



Looking at the example above (BTC perpetual futures on FTX, 5 min chart), we can see a sharp drop in price around 18:00 on May 3rd. What's interesting is that this is accompanied by predicted funding (the white line in the Funding section) going steeply into negative territory, open interest increasing, and CVD moving down.

This means that traders are opening aggressive short positions. More specifically: an increase in open interest just means there are more positions being opened, but the thing that can tell you that this is dominated by aggressive shorts is funding and CVD. There are more market sells than buys (CVD) and predicted funding is becoming more negative since the price is being driven below the spot price of BTC. As you can see, this did in fact cause the shorts to be rinsed: starting at 6:00 the following day, price went up along with the CVD and funding, while open interest dropped. This is how a short squeeze works: first, the price just needs to reverse a bit, which will be enough to trigger the first short posi

The same thing also applies in the other direction: if open interest, CVD and funding are all going up quickly, that's a sign that traders are aggressively long, with any drop in price potentially leading to a cascade of long liquidations. These kinds of data can be very actionable for trading: while an overleveraged market doesn't necessarily mean that a short or long squeeze is imminent, it does mean that you should favor trades that would profit from a reversal like that.