

Chapter 5: Fundamentals of trading in financial markets

Reading this chapter you will be introduced to the following key concepts:

- Margin trading: initial margin, minimum margin, margin calls, and leverage
- Short selling: initial margin, minimum margin, margin calls, and how to use leverage
- Mark-to-market: exchange trade futures, OTC contracts, and accounting standards

Introduction

So what is all the fuzz about? Profitable trading is after all simply a matter of buying low and selling high. In doing so one is ensured a profit - right? Well, while that is correct there is more to trading than just long positions, which is trader talk for having bought an asset. In real life traders take short positions, that is selling assets they do not own, and they use leverage, that is invest for more money than they have. To navigate safely a potential trader needs to know all the terms related to this and other types of trades and to trade profitable one might actually have to use all of these ways of trading.

However, financial markets are special and distinct from many other types of markets for several reasons. First of all, oftentimes trading happens at centralized places, like for example on stock exchanges. This in general means that these markets are very liquid and that there are many market participants. Secondly, most of the instruments which are traded are standardized. For instance exchange traded stocks of IBM and GM are similar in terms of the rights they carry although they are issued by different companies. Thirdly, in some cases it is possible to trade several types of instruments issued by the same entity. This is e.g. the case in the fixed income market.

In this chapter we will go through all of these types of trades in detail. Specifically, we will cover margin trading and the issue of leverage, short selling, and the effects of mark-to-market.

Trading on exchanges

When an investor instructs a broker to buy or sell securities, although this may be done by placing a phone call, a complicated system is at work. It involves many players, may take several forms and may actually be executed in a number of different ways. In general the flow of an order to an exchange may be:

Investor -> Broker -> Brokerage Firm (a commission broker) -> Floor Traders

Floor traders entrusted with market making are called registered traders, or previously specialist at the NYSE, and these are responsible for maintaining a “fair and orderly market”. In return for this exclusive right to make the market the registered trader may be required to deal personally in the stock. Registered traders maintain bid and ask prices at which they are obligated to meet at least a limited amount of market orders.

Registered traders make money from multiple sources:

1. They make commissions when acting as brokers.
2. They also make money from executing trades at their bid and ask prices.
3. They have unique knowledge about the market from their “book” of limit orders.

Unlike the actual exchange trades OTC trading is negotiated directly through dealers. Each dealer maintains an inventory of securities and sells from this at asked prices and buys for this at bid prices. An investor engages a broker who searches for the dealer offering the best deal on the particular security. In this market there is no guarantee that the best price for the investor is obtained.

Margin trading

Buying on Margin refers to the purchase of stocks for borrowed money. This means that the investor only commits a portion of the funds needed for investment and borrows the rest from the broker. Securities bought on margin have to be left with the broker in a margin account as security.

When buying on the margin the overall investment has to satisfy a margin ratio in terms of how much of the purchase may be for borrowed money. The margin ratio is defined as the ratio of the net worth of the margin account to the market value of the securities. This margin ratio is referred to as the initial margin.

Example: Suppose an investor has \$5,000 dollar in a margin account with a broker who requires an initial margin of 50%. How many shares of ABC, currently trading at \$50, can the investor buy? With a 50% initial margin the investor can borrow an additional \$5,000 dollar and buy stocks for \$10,000 in total which corresponds to 200 shares.

With margin trading it is important to always keep track of what the exposure is. A “trick” for doing this is to consider the account as a fictitious “company” with asset and liabilities, and where the equity as always correspond to the difference between the two. Exposure, or the margin ratio, is then the equity divided by the asset value. That is:

$$\text{MarginRatio} = \frac{\text{Equity}}{\text{AssetValue}} = \frac{(\text{AssetValue} - \text{Debt})}{\text{AssetValue}}$$

When buying on the margin the asset value depends at any time on the price of the asset according to the following equation:

$$AssetValue = P * N,$$

where P is the price and N is the number of asset in the portfolio.

Example: If the investor buys 200 shares of ABC at \$50 the asset value is \$10,000, and the equity corresponds to the \$5,000 the investor had in the margin account. Thus the margin ratio is:

$$MarginRatio = \frac{\$5,000}{\$10,000} = 50\%.$$

Since this corresponds to the initial margin, 200 shares is the maximum the investor can buy.

Why would you buy on the margin?

So why would investors buy securities on the margin? The answer is to obtain leverage in a bullish market. In fact the leverage is calculated as the inverse of the margin ratio. Assume that the investor knows that the stock of ABC will be worth \$70 in one year and that the investor holds \$5,000. Buying for \$5,000 would give you 100 shares and the profit from this investment would be equal to $100 * (\$70 - \$50) = \$2,000$. That is the return on this investment is 40%.

However, if instead the investor borrows \$5,000 from a broker 200 shares could be bought now as we saw above. This in terms would lead to a profit of $\$14,000 - \$5,000 - \$5,000 = \$4,000$. With an initial investment of \$5,000 the return is 80%. That is twice the return the investor would have without leverage. Note that the leverage is 2 in this case – that exactly the multiplier on the return. Thus, with leverage you can increase your return dramatically on margin purchases. The “new” leveraged return is easy to calculate. It is simple the initial return times the leverage. In the example above the return is 40%, $(70-50)/50$, and the leveraged return is $40% * 2 = 80%$.

So why would you not use leverage all the time? The answer is that with the added return comes added risk. This is always the case in financial markets! To see the risk, let us suppose that the investor was mistaken and instead ABC drops 30%. With leverage the return is $-30% * 2 = -60%$. This corresponds to a loss of \$3,000, leaving him only with \$2,000 dollar in the margin account.

The minimum margin

The example above shows that as the price drops the equity quickly vanishes. For the broker it thus makes sense to require a minimum margin which should be maintained on the account.¹ This ensures that the broker will be able to recover the money originally borrowed by the investor.

The minimum margin on a margin account is the level below which the account cannot fall. Suppose that the minimum margin is 30% on the margin account from the example above. This means that

¹ Note that the minimum margin is called the maintenance margin in the USA.

$$\text{MarginRatio} = \frac{\text{Equity}}{\text{AssetValue}} = \frac{(\text{AssetValue} - \text{Debt})}{\text{AssetValue}} \geq 30\%,$$

at any time.

Suppose that the stock of ABC drops from \$50 to \$40 in the example from above. Then the margin ratio is

$$\text{MarginRatio} = \frac{(\$40 * 200 \text{ share} - \$5,000)}{\$40 * 200 \text{ shares}} = \frac{(\$8,000 - \$5,000)}{\$8,000} = 37.5\%.$$

Thus, since the margin ratio is above the minimum margin the investment still satisfies the margin requirement and the investor is safe.

However, there is of course a level below which the price cannot fall without violating the minimum margin, and knowing this level is of interest to not only the investor but also the broker. We can calculate this price by reorganizing the margin ratio in terms of P to give

$$\text{MarginRatio} = \frac{(P * N - \text{Debt})}{P * N} \Leftrightarrow P = \frac{\text{Debt}}{(1 - \text{MarginRatio}) * N}.$$

Example: Consider the example from above again with a minimum margin of 30%. At which price is this minimum margin attained? To calculate this we use the formula above to get

$$P = \frac{\$5,000}{(1 - 30\%) * 200} = \$35.71.$$

This means that should the price fall below this value the margin requirements are no longer respected. However, as long as the price stays above this value the margin requirement is met, and the investor is in good standing with the broker.

Margin calls

Whenever the margin ratio drops below the minimum margin, the broker issues a margin call. In doing so, the investor will be required to either add cash or securities to the account with the broker, or to sell part of the assets and pay off the loan. If the investor does not act, the broker may himself sell part of the assets to pay off part of the loan to restore the balance of the margin account.

Adding cash to the account increases the equity and hence lowers the debt. It is obvious that this will increase the margin ratio. But how can adding assets to the account help? This increases the exposure so you might think that it increases the risk. However, since no money is borrowed to buy these assets it essentially corresponds to adding equity. To see this explicitly note that we can rewrite the definition of the margin ratio to be

$$\text{MarginRatio} = \frac{(P * N - \text{Debt})}{P * N} = 1 - \frac{\text{Debt}}{P * N}.$$

Thus, as N is increased so is the margin ratio. The important element here is that the debt does not increase also, though.

Finally, what about selling assets and paying off the loan, the important constraints being that the money is used to pay off the loan? Well, according to the above equation this is also sure to increase the margin ratio. The reason is that debt is already a fraction of the exposure, that is $P * N$. Hence, if you lower both debt and exposure with \$100 this ratio decreases, which in terms increases the margin ratio.

Acting on a margin call

So suppose that the price of ABC drops to \$30 which means that you get a margin call – what then? Well any of the three actions above could be considered. The million dollar question is how much money to add, how many securities to add, or how many securities to sell and pay of the loan.

Adding cash

Suppose you decide to add cash to the account. How much is needed? To figure that out we use the margin ratio definition and solve for X, the unknown amount of cash, such that the following holds

$$\text{MarginRatio} = \frac{(P * N + X - \text{Debt})}{P * N} \geq 30\%.$$

This yields the following:

$$X \geq \text{Debt} - (1 - 30\%) * P * N.$$

Substituting the values for P and N we arrive at $X \geq \$800$. That is, adding \$800 or more ensures that the margin requirements of the account are satisfied. You can easily check this - try!

Adding or buying additional securities

Next, suppose you decide to add securities. How many are needed? Let Y be the number of securities you add. We then use the margin ratio definition and solve for Y such that the following holds

$$\text{MarginRatio} = \frac{(P * N + P * Y - \text{Debt})}{P * N + P * Y} \geq 30\%.$$

This yields the following:

$$Y \geq \frac{\text{Debt} - (1 - 30\%) * P * N}{(1 - 30\%) * P}.$$

Substituting the values for P and N we arrive at $Y \geq 38.10$. That is, in order to make sure the margin requirements are satisfied the investor needs to add 39 securities or more. If you add 39 securities the combined holding is 239 and the new margin ratio is

$$\text{MarginRatio} = \frac{(P * N - Debt)}{P * N} = \frac{\$30 * 239 - \$5,000}{\$30 * 239} = 30.26\%.$$

While the minimum margin requirement is satisfied, it should be noted that doing so would cost the investor \$1,170. Thus, this strategy is more expensive than adding cash directly. The reason is that adding securities also increases the exposure!

Selling securities

Finally, suppose that you decide to sell some of the securities and use the money to pay off the debt. How many securities do you need to sell? Let Z be the number of securities you sell. We then use the margin ratio definition and solve for Z such that the following holds

$$\text{MarginRatio} = \frac{(P * N - P * Z - Debt + P * Z)}{P * N - P * Z} \geq 30\%.$$

This yields the following:

$$Z \geq \frac{Debt - (1 - 30\%) * P * N}{30\% * P}.$$

Substituting the values for P and N we arrive at $Z \geq 88.89$. That is, in order to make sure the margin requirements are satisfied the investor needs to sell 89 securities or more. If you sell 89 securities it would bring in \$2,670 which reduces the debt to \$2,330. You now have 111 securities and the margin ratio is

$$\text{MarginRatio} = \frac{(P * N - Debt)}{P * N} = \frac{\$30 * 111 - \$2,330}{\$30 * 111} = 30.03\%.$$

That is, the minimum margin is just satisfied.

However, while the minimum margin is satisfied, compared to the previous case where additional assets were bought this is achieved by trading a much larger amount of assets; 89 compared to 39. This means that large transaction costs may have to be paid. Much more importantly though is the change of leverage of the position which drops from 2 to 1.11. In the case where assets are bought it only drops to $239/139=1.72$. Thus, this strategy not only involves trading more than double the assets but it also severely reduces the upside potential of the position.

Short selling

The above strategies, and the use of leverage, were all motivated by investor's belief that the asset value was going to increase. However, at times investors may think that the asset is going to fall. How can one profit from this? Well, if the asset is already in your portfolio you can sell it and buy it back once the price drops. This leaves your portfolio unchanged after the trade and yields a profit, which is given by the difference between the price at which the asset was sold and the price at which it was bought back. The problem is that often investors may not already

have the asset in their portfolio. Moreover, they may not want to have it in their portfolio either in the long run.

The solution to this problem is to sell the asset short, or short selling the asset. The mechanics of this operation are the following:

1. Borrow the asset from your broker, and sell it immediately.
2. Once prices have dropped buy back the asset, and give it back to your broker.

The consequence of these transactions is that you make a profit when the price of the asset declines even though you did not have the asset at the outset, while your portfolio stays unchanged.

All short sales happen on margin accounts and require some initial deposit from the investor. This happens for the very simple reason that if prices increase, there may not be enough money in the account to buy back the asset which is owed. Because of this the trade involves an initial margin and minimum margin requirements. In addition, note that the proceeds from the short sale generally have to be kept in the margin account also.

Initial margins in short selling

The initial margin in a short selling transaction is calculated in the exact same way as above. That is, it is defined as the ratio of the net worth of the margin account to the market value of the securities.

Example: Suppose that an investor believes that XYZ, which is currently trading at \$100, will fall 20% and assume that the investor borrows 100 shares from the broker. Selling these shares yield \$10,000. However, the margin ratio of this transaction is zero, since the net worth in the account is zero! This is not good, and hence the broker will require the investor to add cash to the account. If the initial margin is 50% the investor is required to deposit \$5,000.

More generally, the margin ratio can be calculated using the same type of formula as above. Specifically, for a short position this is given by

$$\text{MarginRatio} = \frac{\text{Equity}}{\text{AssetValue}} = \frac{(\text{AssetValue}(\text{Sale}) + \text{deposit} - \text{Debt})}{\text{AssetValue}}$$

However, note that the debt in this equation is the value of the assets sold, which is what is required to buy them back. Substituting this into the equation the ratio becomes

$$\text{MarginRatio} = \frac{(\text{AssetValue}(\text{Sale}) + \text{deposit} - \text{Debt})}{\text{AssetValue}} = \frac{(\text{Cash} - P * N)}{P * N}$$

From this equation we clearly see that if no deposits are made the margin ratio is zero at beginning.

Minimum margins and short selling

A short position is making money when the asset falls in value. Hence it is only in case the price increases that the position is problematic. However, in this case the problem is that the losses are unlimited since there is no upper bound on many assets.² This of course means that short selling is potentially very risky. To manage this risk the broker uses minimum margins.

Example: Suppose that the price of XYZ increases with 30% to \$130 instead of it falling as predicted. Then the margin ratio can be calculated to be

$$\text{MarginRatio} = \frac{(\$15,000 - \$130 * 100)}{\$130 * 100} = 15.38\%.$$

So this would lead to a margin call if the minimum margin is 30%.

As it was the case when buying on the margin it is possible to calculate the maximum price the asset can have before a margin call is received. This can be done by rearranging the formula for the margin ratio as follows

$$\text{MarginRatio} = \frac{(\text{Cash} - P * N)}{P * N} \Leftrightarrow P = \frac{\text{Cash}}{(1 + \text{MarginRatio}) * N}$$

Example: With the values for XYZ we can calculate the maximum price to be

$$P = \frac{\$15,000}{(1 + 30\%) * 100} = \$115.38.$$

So if the price remains below this value the investor is ok. If it increases above and beyond this, a margin call is issued by the broker.

The result from the above examples are interesting as it shows that the movements allowed on a short sale before a margin call is issued are smaller than on the long positions. In particular, ABC was allowed to fall from \$50 to \$35.71, a drop of 28.6%, but for the short position the maximum movement is 15.4% as the above example shows. However, notice that the possible returns are still of the same magnitude when factoring in the leverage. That is, a 20% drop in the price still leads to a 40% profit on the initial investment of \$5,000. To see this notice that with a 20% drop the 100 stock can be bought back at \$80 for a total price of \$8000 which would yield a profit of \$2,000.

² For a leveraged long position the maximum loss is the initial investment since the minimum value of an asset is zero.

Mark-to-market

In real life the margin accounts are not monitored continuously. Instead at the end of the day the value of the account is calculated. This is called to mark to market the position.³

Definition of mark-to-market: The recording of the price or value of a security, portfolio, or account on a daily basis, to calculate profits and losses and to confirm that margin requirements are being met.

If at the time of the mark to market the account value falls below the minimum margin, the broker issues a margin call that requires the client to deposit more funds or liquidate his account.

Margin accounts are not only used to obtain leverage and to short sell stocks. In fact all derivatives trades happen via margin accounts, and it is in fact from this market that the term mark to market comes from. However, unlike the previous situations when dealing with e.g. futures contracts payments are made automatically to and from this account when prices change at the time of the mark to market.

Futures trading at exchanges

To understand the original practice, consider a futures trader trading at an exchange. Since all trades at exchanges happens through the clearing corporation at the actual exchange, whenever taking a position, the trader need to deposits money with the clearing corporation at the exchange. This is what we have been calling a margin, and it is intended to protect the exchange clearing corporation against losses.

The calculation of the margin ratio follows exactly the same procedure as above; it is the ratio of the equity to the exposure. However, it is important to know that at the time when you enter into a futures contract no money is paid. Thus the only equity which is in the margin account is what has been deposited by the investor. In this way, the transaction resembles that of buying on the margin even if the investor takes a short position in the markets for futures.

The actual mark to market generally happens at the end of every trading day, where the contract is marked to its present market value.⁴ If the investor is on the winning side of a deal his contract has increased in value that day. Then the exchange pays this profit into his account. On the other hand, if the market price of his contract has declined, the exchange charges his account the losses. This procedure thus results in a sequence of small payments to and from the margin account throughout the life of the futures contract.

³ Mark to market or fair value accounting also refers to the accounting standards of assigning a value to a position held in a financial instrument based on the current fair market price for the instrument or similar instruments.

⁴ In some markets the mark to market is done more than once a day. The Chicago Mercantile Exchange, for example, does it twice a day.

Finally, if the balance of the account falls below the value required to maintain the position, the exchange issues a margin call. The trader must then immediately pay additional margin into the account to maintain his position. It is possible to calculate the exact price at which a margin call is issued. However, the exact calculations will depend on whether the position is long or short the futures contract. For a long position the “equity” in the margin account drops when the price of the futures contract falls. This drop, though, also decreases the exposure, and therefore in general the prices can vary more for long positions than for short positions.

Mark to market of other types of contracts

The mark to market is relatively straightforward when fair price exist for the assets. This is for instance the case for the exchange traded futures contracts where a market price exists. However, when dealing with over the counter, or OTC, contracts on the other hand this is not as easy. In particular, many OTC contracts are tailored specifically to a buyer and these contracts are not traded on exchanges. Thus, the price of the contract may not be the result of active and regulated market trading. Market values are, therefore, not objectively determined or readily available which makes the actual mark to market difficult.

The practice of marking to market has caught on in corporations and banks. And unfortunately some of them seem to have discovered that this is a tempting way to commit accounting fraud. This is especially the case when the market price cannot be objectively determined. In such cases the concept of **marking to model** is used instead. This means that the value assigned to an asset is that given by a financial pricing model and not by an actual market. Because this is a hypothetical price and in principle only an estimated value it can potentially be manipulated in order to achieve spurious valuations. The appendix explains how this procedure was used and especially misused by Enron, previously one of the world’s largest energy companies.

Margin trading in real life

In real life dealing on a margin account is more complicated than the little toy examples we have used above. First of all the actual margin may depend on the market at which trading happens. Thus, while 50% initial margin and 30% minimum margin is used in the stock market with various brokers; at exchanges when futures are traded the margin may be more like 20%/10%. This, of course, just means that in this market more leverage can be used.

Secondly, depending on the broker investors may have to pay interest rate on the loans in the accounts. This means that if the investor borrows \$5,000 to leverage up a long position interest may have to be paid on this value. What about for short positions? Well technically, no money is borrowed just an asset. However, if this is a stock which pays dividends the investor will have to pay this to the broker out of his own pocket.

Thirdly, if investors have several positions some of these may be offset against each other and as such the margin requirements are reduced for such positions. For instance spread traders who have offsetting futures contracts do not have to deposit collateral both for their short

position and their long position. The exchange calculates the loss in a worst case scenario of the total position. However, if trading stocks and bonds with your broker it is rarely the case that margin requirements offset each other since no payments are made at the mark to market.

Summary

This note explains the basics of trading in financial markets. In particular, it explains the basis of buying on the margin, short selling, and the mark to market. All of these concepts are important to understand for traders. Buying on the margin allows a trader to obtain leverage, which is investing for more and having more in exposure than one has money. This allows investors to increase the return on investments. But it comes with a higher risk. Short selling is the basic strategy to use when one has a bullish, or downward, view of the market. It essentially involves selling assets one has borrowed from a broker. A short position is in principle even riskier – the maximum losses are unlimited as the price of the asset increases. Marking to market a position essentially means to calculate and record its value. This allows the broker and investor to monitor the relative exposure of a position. The mark to market is used on a daily basis in the market for derivatives.

References:

Bodie, Kane, Marcus, Perrakis & Ryan: “Investments”, 5th Canadian Edition, 2005.

Appendix: Enron and mark to market accounting

The Enron scandal involved the energy company Enron and the accounting, auditing, and consultancy partnership of Arthur Andersen, and was revealed in October 2001. The corporate scandal eventually led to Enron's downfall, resulting in the largest bankruptcy in American history at the time. Arthur Andersen, which was one of the five largest accounting firms in the world, was dissolved.

Prologue

Enron was founded in 1985 by Kenneth Lay through the merger of Houston Natural Gas and InterNorth, two natural gas pipeline companies. In the early 1990s, Lay helped to initiate the selling of electricity at market prices and, soon after, the United States Congress passed legislation deregulating the sale of natural gas. The resulting markets made it possible for traders such as Enron to sell energy at higher prices, allowing them to thrive.

By 1992, Enron was the largest trader of natural gas in North America, and the gas trading business became the second largest contributor to Enron's net income, with earnings before interest and taxes of \$122 million. The creation of the online trading model, EnronOnline, in November 1999 enabled the company to further develop and extend its abilities to negotiate and manage its trading business.

In an attempt to achieve further growth, Enron pursued a diversification strategy. By 2001, Enron had become a conglomerate that both owned and operated gas pipelines, pulp and paper plants, broadband assets, electricity plants, and water plants internationally. The corporation also traded in financial markets for the same types of products and services.

Mark to market accounting used by Enron

In Enron's original natural gas business, the accounting had been fairly straightforward: in each time period, the company listed actual costs of supplying the gas and actual revenues received from selling it. However, when Skilling joined the company, he demanded that the trading business adopts mark-to-market accounting, citing that it would reflect "... true economic value." Enron became the first non-financial company to use the method to account for its complex long-term contracts. Mark-to-market accounting requires that once a long-term contract was signed, income was estimated as the present value of net future cash flows. Often, the viability of these contracts and their related costs were difficult to judge. Due to the large discrepancies of attempting to match profits and cash, investors were typically given false or misleading reports.

For one contract, in July 2000, Enron and Blockbuster Video signed a 20-year agreement to introduce on-demand entertainment to various U.S. cities by year-end. After several pilot projects, Enron recognized estimated profits of more than \$110 million from the deal, even though analysts questioned the technical viability and market demand of the service. When the network failed to work, Blockbuster pulled out of the contract. Enron continued to recognize future profits, even though the deal resulted in a loss.

While using the method, income from projects could be recorded which increased financial earnings. However, in future years, the profits could not be included, so new and additional income had to be included from more projects to develop additional growth to appease investors. As one Enron competitor pointed out, "If you accelerate your income, then you have to keep doing more and more deals to show the same or rising income." Despite potential pitfalls, the U.S. Securities and Exchange Commission (SEC) approved the accounting method for Enron in its trading of natural gas futures contracts on January 30, 1992. However, Enron later expanded its use to other areas in the company to help it meet Wall Street projections.

Epilogue

Although the mark to market accounting standard was only one of several problems facing Enron, it was one of the major contributing factors to the company's bankruptcy. Enron's stock price, which hit a high of US\$90 per share in mid-2000, caused shareholders to lose nearly \$11 billion when it plummeted to less than a \$1 by the end of November 2001. When Enron filed for bankruptcy on December 2, 2001 under Chapter 11 of the United States Bankruptcy Code with assets of \$63.4 billion, it was the largest corporate bankruptcy in U.S. history until WorldCom's 2002 bankruptcy.

(Source: Wikipedia)